"WHERE IS EVERYBODY?"

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WHERE IS EVERYBODY?

Sebastian von Hoerner

How much "life in space" should we expect, how frequently may intelligence and technology have developed on the planets of far-away stars? On a small scale, we have already started SETI, the Search for Extraterrestrial Intelligence, and very large future SETI projects could be undertaken; but what are our chances of detecting any radio signals from the other and mostly much older races in the universe? If we ever establish contact and interstellar communication with them, this would certainly mean the largest step in the evolution of mankind since our development of speech about a million years ago. But what chances do we have? Previous estimates have mostly given rather optimistic results, but during the last years some more pessimistic arguments have turned up, which are quite puzzling and hard to beat. In the following, I will emphasize the pessimistic puzzle, hoping that someone else will come up with a convincing optimistic solution.

First, I will give a short summary of the previous estimates for SETI. The only thing we can go by, the only case of life we know, is our own life here on Earth. We should not assume to be anything special. Our Sun is just an average star, one out of 200 billion which make up our stellar system, the Galaxy. And from our theories of star formation we think that planets are quite common, formed together with their central star from a contracting cloud of gas and dust. Sun and Earth are about five billion years old, while most of the other stars are about twice that old.

Regarding life, we should assume similar developments under similar conditions. Which means that life and intelligence have developed wherever a planet similar enough to our Earth was going in the right orbit at the proper distance around a star, similar to our Sun and old enough. Many scientists have estimated how frequently it happens that all conditions for life are fulfilled. Within a factor of ten, say, the results mostly state that about ½ percent of all stars should have a planet where life similar to our own could be expected. Our Galaxy then would have about one billion of such habitable planets, and

our nearest neighbors would be about 20 lightyears away. If our estimate of the percentage is wrong by a factor of ten, then the number of planets is wrong by a factor of ten, but the distance is only wrong by a factor of two. This then would be the distance we had to travel in future spaceships, in search for habitable planets and for higher life.

If we want to communicate by some technical means, however, for example by radio waves, then our partners must be in a comparable state of mind, in order to use similar means and understand each other. We should not assume that our present state of mind is the final goal of all evolution; it will be surpassed by completely different interests and activities which we cannot guess at our present state. Unfortunately, we have nothing to go by for estimating the duration of a "comparable technical state", because we are mere beginners. Using a wild guess of a 100,000 years, say, this would yield about 10,000 such civilizations in our Galaxy, and the nearest partners would be almost 1000 lightyears away from us. If our guess is wrong by a factor of ten, then the distance is only wrong by a factor of two.

What do these distances practically mean? Regarding radio contact, we could assume, for example, the same technical effort on both sides. If we as well as our partner would use equipment like our largest existing telescope at Arecibo in Puerto Rico, with its present best transmitter and receiver, we could already talk to a partner 40 lightyears away (provided we had agreed, before that, on the exact frequency and bandwidth, and knowing already exactly at which star to point the telescope and when). And even a distance of 1000 lightyears could be bridged if we design a transmitter and receiver for this very purpose, which might take about three years and a million dollars.

Of course, guessing the right frequency channel, being lucky with the right time and finding a partner is a lot more difficult and time-consuming. Either we must assume that strong radio beacons are aimed at us, or we must build a large array of many big telescopes.

The distances also mean a very long

waiting time for answers. No signal can go faster than light, and if our partner is 1000 lightyears away, then the answer to any question will take 2000 years. Not individuals, only whole civilizations can talk to each other. A two-way communication, with questions and answers, is only possible if the general time-scale of development is longer than the waiting time, so that there still is interest in the answer to a question asked so long ago. Our own hectic development is a lot faster than that, which would leave only a one-way communication (being given a wealth of general information without having asked for it). But this should never be underestimated: our whole western culture has been strongly influenced by the ancient Greeks from whom we got nothing but a few books and pieces of art in a one-way communication. Actually, all the traditions and cultural values we inherit from our ancestors are one-way communications. And our interstellar partners will be tremendously far ahead of us since we are mere beginners, and most stars are older than our Sun.

Regarding space travel, nothing can move faster than light (except in science fiction). From basic physical considerations one can show that space travel will probably be limited to 1/10 the speed of light, $v \leq c/10$. Relativistic time effects then play no role. With our present known technology and a good financial effort we could already achieve $v = c/100$ or maybe $c/30$. Thus, even a trip to the nearest habitable planets would take at least 200 years, with $v = c/10$ and a distance of 20 lightyears, much longer than the life-time of a crew. Signals then look a lot more promising than travel, and radio waves between 1 cm and 30 cm wavelength seem most economical because there the background noise is smallest.

These promising estimates have led to several SETI searches for radio signals from outer space, beginning with Frank Drake's "Project Ozma" in 1960 at Green Bank. Meanwhile, about a dozen of searches have been done, with better equipment and new techniques, but all with existing equipment and no extra cost except the telescope time. Some hundred nearby solar-type stars have been occasionally searched, some star clusters and even a few other galaxies. So far, without any success.

The opposite SETI approach has been taken since 1972 by a group at Ames Research Center of NASA (and at JPL at Pasadena), called "Project Cyclops": to find out what kind of equipment we should develop and build in order to have a really good chance of success within, say, 20 years of a dedicated search. The answer is a growing array of up to 1500 telescopes, 300 feet diameter each, with special receivers and correlators (doing normal radio astronomy about 1/10 of the time). One would start with one such telescope and gradually build up more, searching all the time, and would stop building up whenever success is achieved. The total cost of all 1500 telescopes and receivers would be about 10 billion dollars. This sounds ridiculously expensive; on the other side, this is just three months of what we actually did pay for the war in Vietnam.

Second, I will describe a puzzling line of thought. The basic assumption of our previous estimates, that we on Earth are about average and nothing special, seems to lead to a serious contradiction. So far, we have considered and generalized only our previous and present activities. But what about our future ones? What will we probably be doing in the next few hundred years? And to what consequences does it lead if we generalize that again, assuming a similar development for other civilizations in space?

We have good reasons to believe that our space exploration will continue and expand. There is our great general curiosity, the drive to explore and to use our near and far surroundings. In addition, our planet Earth is getting unpleasantly crowded, and we are using up many of our limited natural resources at an alarming speed. Within the next few generations we must develop complete recycling systems for many metals and rare elements, and we must develop new energy sources. The next logical step then is to set up space colonies for mining, in large shelters or underground, on Moon and Mars and even on the many thousands of asteroids (little planets, big chunks of minerals and metals, orbiting around our Sun between Mars and Jupiter). These colonies will become self-supporting and multiplying, they will grow with their own babies

and grandchildren. In September I was at the 28th International Astronautical Congress at Prague, where many such plans were presented and discussed. A wealth of general problems, and even a lot of solid engineering tasks, have already been worked out in an amazing detail. We actually could start all this activity right now, if we wanted it and if we would be willing to spend the money. Sure, mining the asteroids is at present not economical, but that will change when our resources on Earth are getting used up.

Another future aspect must be mentioned. At present we live with a frightening arms race which has completely gotten out of hand, and which cannot continue for too long. Either we learn to be more reasonable, or we will blow each other to pieces. All the big nations spend 1/10 of their gross national product on the development and manufacture of more and more powerful weapons, which was a world-wide total of 334 billion dollars per year in 1976. And nobody wants to be left behind: in 1976, the underdeveloped countries received 13 billion dollars for economical help, but bought weapons for 18 billion dollars, from the industrialized countries. And the total destructive power of all nuclear bombs was, in 1972, about 40,000 Megatons of TNT, which is the same as 10 tons of dynamite for each living person on Earth. Just try to imagine a solid round ball of dynamite with 7 feet diameter, one for each person.

Our chances for blowing up are really quite large. But in case we don't, if we somehow manage to stop the arms race, then a very large amount of money, a large work force of labor and engineering, must be redirected to other activities, and space engineering may come in quite handy and naturally. But especially if we do not stop the arms race, we should very soon build large space colonies: for the survival of the human race and culture in case of severe catastrophies on Earth.

Let us assume that after a hundred years or so, if we survive, we have many large self-supporting colonies in space, with people living there for generations, in shelters or underground; maintaining large-scale industries of mining, manufacturing, engineering, and exploration. After a few generations the cultural and emotional ties to the home planet will become less important. It seems to be the next logical step to send out large colonies (in mobile homes) on interstellar trips lasting many generations, in order to explore and colonize other planetary systems. If we do not destroy ourselves, we will probably do all this. Life, in whatever form we know it, has a strong tendency to expand and to fill out every possible niche, into all its corners. Plants, animals and man have settled in hot and dry deserts as well as close to the cold ice-covered poles.

Space travel becomes easy (even for our beginner's technology) if we drop the prejudice that it must be finished within an individual's lifetime. After we have colonized the nearby planetary systems, these settlements will grow, and after a while some of them will send out their own colonies in mobile homes to the next systems, and so on (just as hundreds of islands spread out over thousands of miles of the Pacific Ocean have been colonized long ago by Polynesians in their small primitive boats). We will have started a continuous wave of growing colonization, spreading out with about 1/100 the speed of light. And in this way we can colonize our whole Galaxy, from one end to the other, in less than ten million years. This is only a very short time in astronomical terms. Even in biological terms it is not too long. The higher mammals are about 20 million years old; and 400 million years ago the first plants and animals moved out of the oceans and started conquering the continents of our Earth which took about 200 million years. Furthermore, ten million years would be needed for our present technology, and it might be reasonable to expect that a further-developed future technology could colonize the whole Galaxy within one million years, going with 1/10 the speed of light.

Now let us generalize again; let us assume that we on Earth are about average and that similar developments are to be expected on similar planets, and that such planets are provided by ½ percent of all stars which means there are one billion such planets in our Galaxy (these are the basic

assumptions for our previous and future SETI projects). We know that our Sun is not an old star, and that most stars are about five billion years older because star formation was about 30 times more productive at the beginning than it is now. The very first stars will have had no solid Earth-like planets, because the original big-bang of the universe provided only hydrogen and helium, while all the heavy elements needed for solid planets are produced by stellar evolution and supernova explosions. But still we expect about one billion habitable planets similar to Earth, most of them being about four billion years older than Earth.

Assuming similar developments on these planets then leads to the following conclusion. All what we just have described as our own probable future, large-scale space exploration and colonization, all this should have happened long ago. It could have been started by anyone out of one billion planetary civilizations four billion years ago, and it would have been finished only 1 - 10 million years after it started, colonizing the whole Galaxy with everyone of its habitable planets. The whole Galaxy should be teaming with life, so obvious that there is no question about it. And, first of all: we humans should be the descendants of long-ago settlers from somewhere else. Which we certainly are not.

Furthermore it seems clear, from all we know, that all life on Earth had a common origin, and has developed here without any outside interference. All humans, animals and plants use the same basic organic chemistry, the same amino acids and even the same complicated genetic code. And the long chain of development from simple life forms to highly organized ones seems well enough described by mutations and natural selection. As to the origin of life, we know from lab experiments that many large organic molecules, even amino acids and nucleotide bases and sugars (the most important building blocks of living matter), are formed abundantly from water and the gases of the original Earth's atmosphere, if energy is provided by ultraviolet radiation of the Sun or by electric discharges of lightnings. We still do not know how the first self-reproducing organisms formed, or

the genetic code, but the further development seems more or less clear. Also the development of human intelligence seems to follow quite naturally, since it provides such a wonderfully large and manyfold niche.

Not only our Earth, our whole planetary system appears uninhabited by any outside settlers. Otherwise, their large-scale mining industry or active radio communication would have been very obvious to us, the moment we invented optical and radio telescopes, since all this would be so nearby. There just are no extraterrestrials here.

We then are forced to the sad conclusion that our basic assumption was wrong, the assumption that we are not unique but are typical for the general development, and that life, intelligence and technology have developed in a similar way at a very large number of similar planets. But if all that is wrong, how can we ever expect to detect radio signals from other beings in space? If life is not abundant, and if we are not typical, then there is no chance of success for any SETI project.

We have shown that if our own development and attitude were typical, then the Earth should have been colonized long ago, there should be outside settlers here instead of us homegrown humans. With other words: "If we were typical, we should not exist". Which is such a revolting contradiction that we just cannot be typical. But then SETI has no chance.

How could we explain the absence of extraterrestrials in our system, or in general the absence of any obvious evidence of higher technology in our Galaxy? Because if even our beginner's technology is able to travel large distances and to send out strong radio signals, then the technology on old planets, after billions of years of further development, should surely be able to do all kinds of "astroengineering" plainly visible and obvious, none of which we observe.

Where is everybody? This question has puzzled many scientists. Maybe the origin of self-reproducing life is so improbable that it almost never occurs. Maybe intelligence is so dangerous that it always ends up in self-destruction. Or, if this and other

crises are to be mastered, any surviving civilization must be so highly regimented and stabilized that complete stagnation excludes any further technical progress. Maybe not a single one of a billion old civilizations felt the desire to colonize the Galaxy. Or, first attempts of space colonization and astroengineering have always met disastrous failures and have since been given up. Another nice thought is the "Zoo Hypothesis": that we live in a region of the Galaxy which has been declared a zoo or wildlife area, and a perfect zoo is one in which the animals don't see their waiters and spectators. Maybe the answer is "change of interest", meaning that science and technology are only a very short-lived phase of any long developement, to be surpassed by completely different future activities, which we cannot guess and which do not produce any obvious evidence. Well, most of these explanations would not give SETI much chance, and, anyway, none of them sounds very convincing and plausible.

The main difficulty is what I like to call the "Large Number Problem". We should expect one billion habitable planets, with higher life four billion years old, and both are very large numbers. In order to explain the absence of extraterrestrial evidence, either habitable planets must occur only once in a billion of cases, or life originates only once on a billion of planets within four billion years; or intelligence destroys itself or stagnates without any exception in a billion of cases, or poachers in wildlife areas are less frequent than one in a billion over four billion years, or not one in a billion of governments granted funds for space mining, and so on. Any one of these explanations would sound much more acceptable if we had to consider only a small number of cases, but not so for a billion of them.

One way of avoiding the large number problem would be to assume that during these billions of years, with lots of interstellar communications between the old civilizations, all these many original cultures have completely merged into one single galactic superculture which now acts as a whole (ant hill or bee hive), or at least with only a small number of subcultures. This would make several explanations possible, and it

might give us some chances for SETI. But it works only if the galactic travel time of communication, 30,000 years from one half to the other for radio signals, were always much shorter than the timescale of individual planetary development, which does not sound plausible. It also leaves an unpleasant afterthought: what about all these newcomers, like us, about one per 100 years in the Galaxy? Those of the old establishment would have to investigate them, early enough and carefully, for finding out whether they can be educated into useful future members, or whether they are to be treated as dangerous violent bacteria. Hard luck for us, probably.

In summary: the absence of extraterrestrials in our solar system seems to show that there are none anywhere else in the Galaxy either (at least no "technical" ones). Even if we have no explanation for our amazing uniqueness, it still would follow that our searches for signals cannot have success.

If we want to continue our searches, and especially if we want to invest large sums, we should try to find a scenario which favors interstellar communication but prevents interstellar travel and colonization. Some suggestions have been made, but none so far looks plausible. In the absence of such a plausible scenario, it might be suggested to continue our searches with moderate means, in case the argument given above is wrong or incomplete, but to postpone any great expenditure until we can justify it again. Any suggestions?

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VLA GOLF

Tom Cote

This has been a big year for golf in
Socorro, and many VLA staff members and
their families participated in a variety of
golf activities all summer long. The
year started with the opening of a new Pro
Shop and Clubhouse, which was very badly
needed. Socorro now boasts a beautiful 18
hole public golf course located on the New
Mexico Tech campus. The par 72 course is
some 6,500 yards in length and is very de-
manding. The main obstacles to be faced
on the course are some strategically
placed water hazards, severe dog legs,
Ernie Caloccia, trees, wind and sheer
length. Oddly enough, sand traps are not
common here and are found on fewer than
half of the 18 holes. The "snake pit"
draws a lot of attention though and playing
out of this 3rd hold monster is nearly
impossible. Playing into it is easy.

This past April, I "volunteered" to
organize a weekly golf league for the VLA,
and, admittedly, we got off to a shaky
start. We tried to form organized teams,
but matches were difficult to schedule.
So, we started individual competition with
matches played Tuesday evenings after our
return from the site. Points were won
weekly and accumulated all summer. Keith
Cottom helped me set up individual handi-
caps, and by late June we were on our way!

Regular members of our VLA Twilite
League included: Larry and Dottie Carlisle,
myself, Kerry Hilldrup, Bill Horne, Al and
Audrey Miller, Bob and Norma Mitchell,
Jim and Alice Oty, Bob Schweigert, and
Gene and Bobbie Spaulding. Others who
joined us occasionally included Barry
Blaisdell, Keith and Sue Cottom, Ernie and
Helen Caloccia, Don and Carolyn Krieger,

Jack and Phyllis Lancaster, Ramon Molina,
and Jon and Dora Spargo.

In September we had what was scheduled
to be the final golf gathering of the
summer. On Sunday, September 18, the First
Annual VLA Putt 'n' Gut Tournament was
staged and was followed by a pot luck supper
at the home of Bob and Norma Mitchell. The
tournament was a 4 person scramble and was
a lot of fun and a huge success. The
winning foursome consisted of Keith Cottom,
Bill Horne, Audrey Miller, and Jim Oty.
They turned in a round of even par 72 for
18 holes. Awards for our regular Twilite
League members were presented at the pot
luck and went to 1st and 2nd place men's,
and 1st and 2nd place women's finishers.
The winners were:

> 1st place, men - Kerry Hilldrup
> 2nd place, men - Al Miller
>
> 1st place, women - Dottie Carlisle
> 2nd place, women - Norma Mitchell

Trophies went to first place finishers,
consolation awards went to 2nd place
finishers. Awards were funded by the VLAPRA.

During the pot luck we decided to have
another scramble tournament, and on October
9, the second First Annual VLA Putt 'n' Gut
Tournament was held. The pot luck supper
this time was hosted by Jack and Phyllis
Lancaster at their home. The winning
threesome of this event consisted of Bill
Horne (again?), Ernie Caloccia (hit the
ball and drag Ernie), and Florence Foster.
They turned in a 4 over par 76 for the win.
Congratulations to all!

I'd like to thank Mal Sinclair and John
Archer, newcomers to the VLA, for joining
our tournaments and hope they can play
regularly with us next season. Thanks also
to Dave Gibson for joining us. Finally,
I'd like to acknowledge the fine work the
staff of the Pro Shop did to help us set
up our tournaments. They were very help-
ful. Unitl next spring....happy bowling!

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Blessed is the season which engages the
whole world in a conspiracy of love.

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LAST THOUGHTS

John Brooks

As you read this article my family and I will probably be lying in the sun on Waikiki Beach, Hawaii. We will be staying there for two weeks, on our way home to Sydney, Australia after spending a most enjoyable year in Green Bank.

Whilst we won't spend too much time fretting about Green Bank winters, we will no doubt miss many of the more pleasant aspects of life in Green Bank, particularly the many people who made our stay there so enjoyable and whose friendship we will always cherish.

In many ways life in Australia and America are very similar. Wages, cost of living, and lifestyles are almost identical. Most of my friends in Green Bank have always expressed a great deal of interest in some of our observations on aspects of American life which differ, and so I thought I might write about a few of these areas in the rest of this contribution.

Education: Firstly, our school year runs from February to December, with the major school break of six weeks starting mid-December to the end of January. This, of course, is the hottest part of our summer. The school year is broken up into three terms with a two week vacation between terms.

A major difference in education systems is that ours is run on a State basis; that is, the Education Department is a State Government Department, and the teachers are trained and paid by the State. There are many privately run schools but I would guess that these would handle only 15% - 20% of the student population. The State lays down the work programme for each grade and thereby establishes a fair degree of uniformity among all schools. This is further reinforced by the fact that all students at ages 16 and 18 years must sit for an exam set down by the Education Department. These exam papers are called the "School Certificate" at age 16 years, and the "Higher School Certificate" at age 18 years, and are used by the Education Department as a basis for University entrance.

Another major difference in school systems (as far as my children are concerned) is that American students are not required to wear school uniforms, whereas in Australia they are.

At the present time in Australia all education is free, including University.

Taxation: My first impression was that the American taxation burden was lighter than that encountered in Australia; on reflection, however, once again the taxes in both countries are fairly even. The sorts of things that tend to balance out the apparent discrepancies in the taxation rates are:

1. Free Education.
2. No State Taxes: In Australia the Federal Government alone has taxation rights. Part of this taxation money so collected is distributed among the States according to a formula based on population and geographic factors.
3. Child Endowment: Another area where taxation money is returned to the taxpayer is a scheme called "Child Endowment" whereby the mother receives a weekly income for each child (the rates are currently $3 per week for the first child and $5 per week for each child thereafter. The scheme is principally intended to give the mother an income (obviously at a fairly frugal level) which she can use to provide clothing, etc. for her children without being solely dependent on her spouse.
4. Medical Care: Australia has a system of compulsory medical insurance. The insurance may be taken out with the Federal Government or with a private company. It costs me approximately $400 per year for this insurance for myself, wife, and two children, and covers about 80% - 85% of both doctors' and hospitals' standard fees.

Sports: Rugby, soccer, and cricket are the sports which I am most familiar with, but I've really enjoyed watching baseball, American football, and basketball on T.V. this year. Many of the skills necessary for American sports are also required for the Australian variety, so a sports fan from one country would soon find himself enjoying a sport played by the other country.

These are some of the differences, but as I have mentioned before, we have more in

common than could be said of most nations. In fact, apart from their funny accents, most of my Green Bank friends would find themselves quite at home in Australia.

I have really appreciated having had the opportunity to work in America this year and the experience has been tremendous for myself and family. If any of you find yourselves in Sydney at any time I would really enjoy having the opportunity to return some of the wonderful hospitality which has been showered upon us during the year.

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TIPS ON BEEF FOR YOUNG HOUSEWIVES,
NEW HOUSEWIVES, RECONVERTED HOUSEWIVES

Rufus Chappell

Have you ever been to the supermarket and watched how carefully most customers shop for meat. Generally they will scoot up and down the aisles of canned goods, pickles, specialties, and produce filling their carts without too much hesitation or study. Not so when they turn the corner at the end of the last row of shelving and begin the journey down the storewide display of meat, where more than likely the most economically important item on their grocery list will be purchased. Here we will find the highest single item of food cost with which we have to deal.

In this article I will show why this is true and offer some suggestions as to how we can improve our meat budget by using different cuts of meat and by using different methods of preparation.

There are two basic methods of cooking meat. These are by dry heat and by moist heat. Each of these methods has modifications that offer a variety of cooking procedures. The procedure that you select should be determined by the kind of meat being used, the quality or grade, and the cut.

Under the moist heat method are (1) steaming, and (2) boiling or poaching. The dry heat method includes (1) roasting or baking, (2) broiling and grilling, (3) sautéing, and (4) pan frying.

In general the moist heat methods or combinations are applied to the more economical cuts of meat. These meats are tougher and require moist heat to break down the connective tissues and make them tender.

Dry heat methods are intended for the better cuts of meat that have little connective tissue and become more readily tender when cooked. The two methods are not interchangeable as the more economical cuts of meat are never at their best when cooked by dry heat. On the other hand, it is a waste of money to cook any tender cuts by moist heat. The exception to this rule would be the less tender cuts such as chuck or bottom round which are often ground into hamburger and cooked by the dry heat method.

There are two terms used in the meat industry that should be explained. These words are "inspected" and "graded". The grading stamp found on most meat products designates quality as specified by the U. S. Department of Agriculture and is put there at the request of the packer. It is a voluntary request, not a required step. The inspection stamp shows that the animal has been inspected and passed as wholesome and is required of all packers.
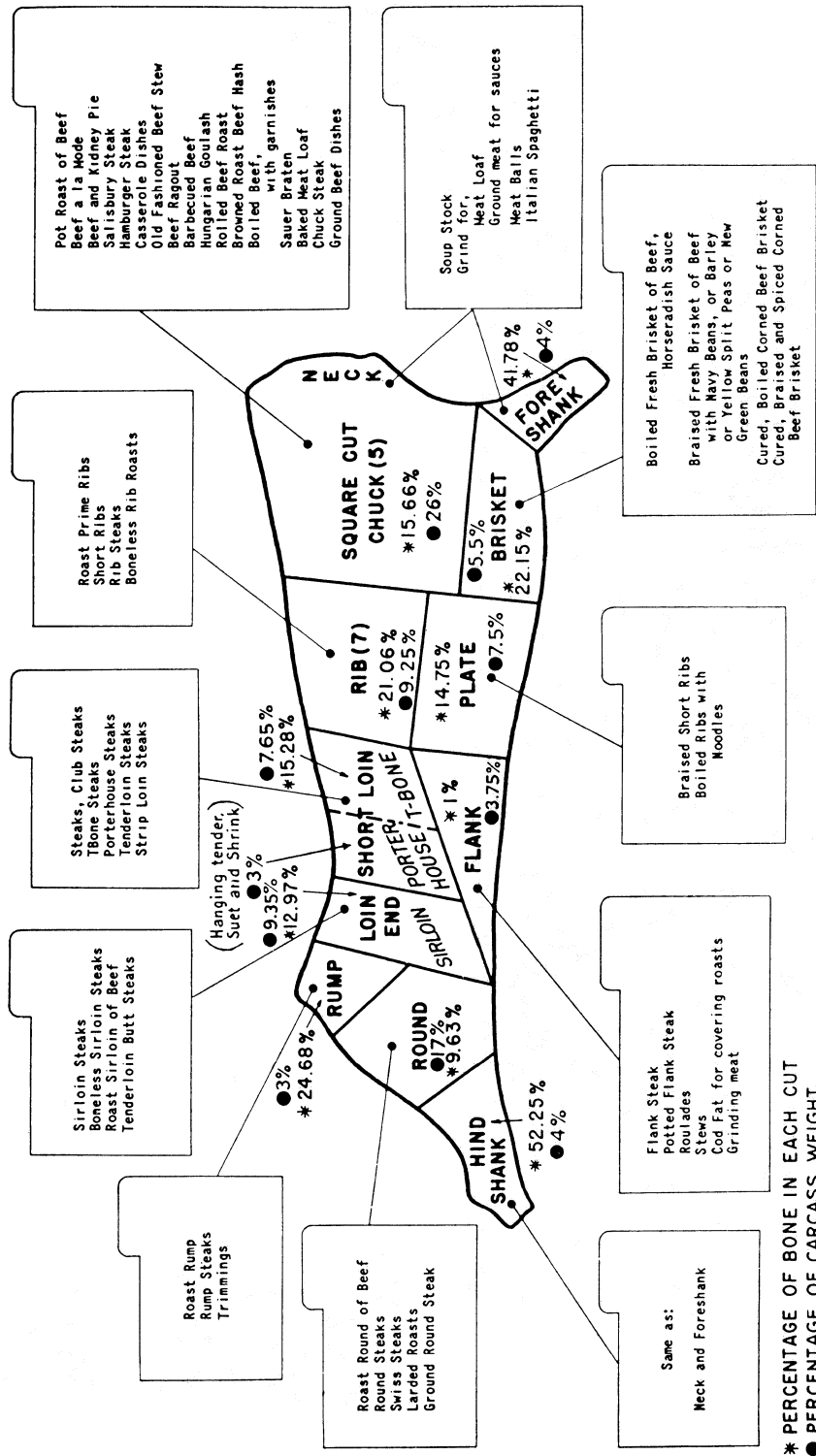
The higher grades of meat are more tender and usually have a better flavor than the lower grades. The most popular cuts, such as tenderloin and sirloin, usually make up a small percentage of the total carcass weight. The law of supply and demand makes higher grades and popular cuts more expensive; grades and cuts less in demand, less expensive.

The chart on the following page is one developed by the Armour Company and gives the percentage of carcass weight of each cut and the percentage of bone in each cut. As you can readily see, the more popular cuts make up a surprisingly small percentage of the total carcass.

From the loin end, short loin, and rib come your more expensive cuts of meat. These cuts, when taken from the higher graded carcasses, are always at their best when prepared by the dry heat method.

By utilizing some of the less expensive cuts from the other parts of the carcass and

Pot Roast of Beef
Beef a la Mode
Beef and Kidney Pie
Salisbury Steak
Hamburger Steak
Casserole Dishes
Old Fashioned Beef Stew
Beef Ragout
Barbecued Beef
Hungarian Goulash
Rolled Beef Roast
Browned Roast Beef Hash
Boiled Beef,
    with garnishes
Sauer Braten
Baked Meat Loaf
Chuck Steak
Ground Beef Dishes

Soup Stock
Grind for,
    Meat Loaf
    Ground meat for sauces
    Meat Balls
    Italian Spaghetti

Boiled Fresh Brisket of Beef,
    Horseradish Sauce
Braised Fresh Brisket of Beef
    with Navy Beans, or Barley
    or Yellow Split Peas or New
    Green Beans
Cured, Boiled Corned Beef Brisket
Cured, Braised and Spiced Corned
    Beef Brisket

Roast Prime Ribs
Short Ribs
Rib Steaks
Boneless Rib Roasts

Steaks, Club Steaks
TBone Steaks
Porterhouse Steaks
Tenderloin Steaks
Strip Loin Steaks

Sirloin Steaks
Boneless Sirloin Steaks
Roast Sirloin of Beef
Tenderloin Butt Steaks

Braised Short Ribs
Boiled Ribs with
    Noodles

Flank Steak
Potted Flank Steak
Roulades
Stews
Cod Fat for covering roasts
Grinding meat

Roast Rump
Rump Steaks
Trimmings

Roast Round of Beef
Round Steaks
Swiss Steaks
Larded Roasts
Ground Round Steak

Same as:

Neck and Foreshank

NECK
SQUARE CUT CHUCK (5)   *15.66% ●26%
FORE SHANK   41.78% * ●4%
BRISKET   ●5.5% *22.15%
RIB (7)   *21.06% ●9.25%
PLATE   *14.75% ●7.5%
SHORT LOIN   ●7.65% *15.28%
LOIN END   ●9.35% *12.97%
(Hanging tender, Suet and Shrink)   ●3%
PORTER HOUSE/T-BONE   *1%
SIRLOIN
FLANK   ●3.75%
RUMP   ●3% *24.68%
ROUND   ●17% *9.63%
HIND SHANK   *52.25% ●4%

* PERCENTAGE OF BONE IN EACH CUT
● PERCENTAGE OF CARCASS WEIGHT

by preparing them by one of the moist heat methods one can expect to enjoy a variety of deli-
cious dishes at a considerable saving.

* * * * *
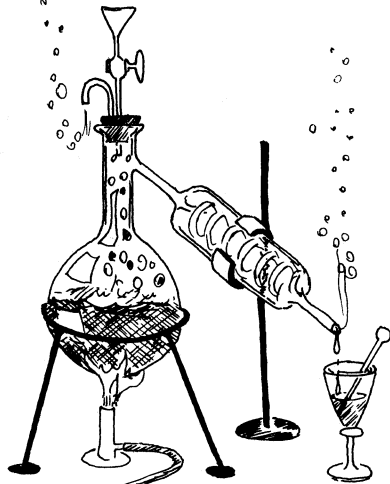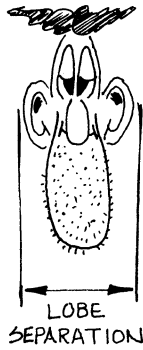
The VLA

ASTRONOMICAL
ILLUSTRATED
DICTIONARY

SUPPLEMENT TO THE
VLA USERS GUIDE
for visiting scientists
as an aid to recognition
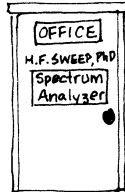of various cellestial objects

Drawn by: Paul Harden
Based on Graffitti of numerous
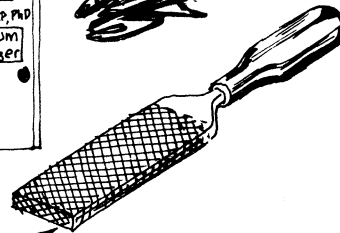authors as found on the
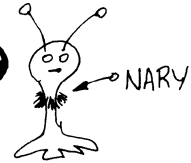VLA premesis. Circa 1977

ANTENNA SOLUTION
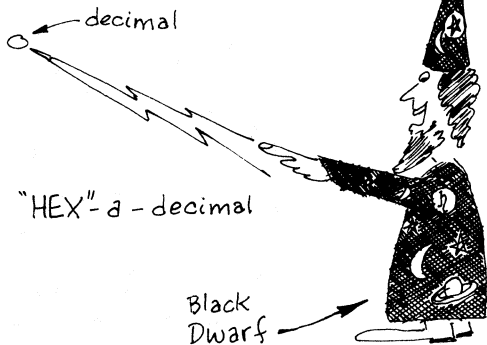
LOBE SEPARATION

OFFICE
H.F. SWEEP, PhD
Spectrum Analyzer

GIANT STARS
Starring
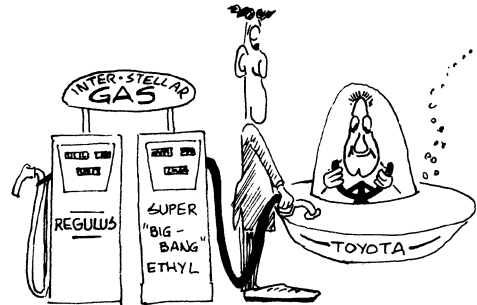John Wayne
Rachael Welch
Elvis Presley

NARY

END OF FILE

decimal

"HEX"-a-decimal

Black Dwarf

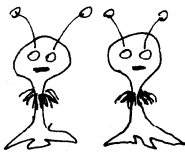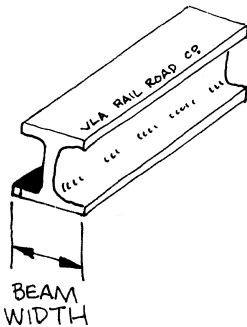INTER-STELLAR GAS
REGULUS
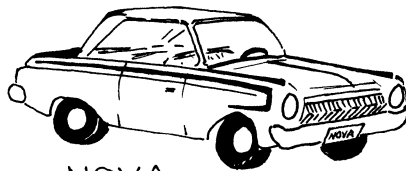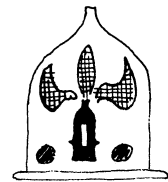SUPER "BIG-BANG" ETHYL
TOYOTA

BI-NARY

FLOATING POINT

BEAM WIDTH

NOVA

RADIO STARS:
FIBBER MCGEE -3GC421
JACK BENNY - M13
ORSON WELLS-NG547

To be continued next issue.

SOLAR HEAT THE GREEN BANK POOL?

Buck Peery

Pool Statistics:

Size	22.87 m x 10.67 m	(75 ft. x 35 ft)
Area	244 m^2	(2,625 ft.^{2})
Volume – Water	386.4 m^3 386,364 liters 386,364 kg	(13,640 ft.^{3}) (102,000 gal.) (850,000 lbs.)
Estimated temperature (April and May)	5° C	(41° F)
Energy required to heat pool 1° C assuming no losses	386,364,000 calories 449.3 kWh	(1,533,191 BTU) 449.3 kWh

The radiant energy available from the sun, in this area, from April through September on a completely sunny day, approximates the following:

06:00	27,115 calories/hr/m^2	(10 BTU/hr/ft^2)
09:00	406,728 calories/hr/m^2	(150 BTU/hr/ft^2)
12:00	840,571 calories/hr/m^2	(310 BTU/hr/ft^2)
15:00	406,728 calories/hr/m^2	(150 BRU/hr/ft^2)
18:00	27,115 calories/hr/m^2	(10 BRU/hr/ft^2)

A rough rule of thumb, sometimes used, is an optimistic average for the 12 hour period of:

338,940 calories/hr/m^2 (125 BTU/hr/ft^2)

If we chose to raise the temperature of the water in the pool 1° C each sunny day, and assumed we could capture 100% of the energy and transfer all of that energy to the pool we would need 386,364,000/338,940 x 12 or 95 m^2 (1,022 ft.^{2}) of collecting surface. 10 m x 9.5 m (32.8 ft. x 31.2 ft.).

Most collectors are constructed of rows of copper pipe spaced close together. If we assume the collectors used 5 cm (1.97 in.) diameter pipe spaced on 6 cm (2.36 in.) centers we would need approximately 16 m (52.5 ft.) per square meter. This means a total length of approximately 1,520 meters (5,000 ft.). The estimated cost of the copper pipe, without fittings, any special treatment, or installation, is $17,250.00. Enclosing the pipe, covering the enclosure with glass or some similar material, assembling, fittings and controls, could easily triple this figure.

If we chose to raise the temperature of the pool water to a temperature acceptable for swimming, 24° C (75° F) in five days we would multiply all of the above figures by four. This would require 380 m^2 (4,100 ft.^{2}) of collecting surface.

The above calculations do not allow for any losses. The losses are difficult to assign values to but they include such things as inefficiency of collector surfaces, radiation from the collectors, conduction to the surrounding air, limited transfer from the conductor surface to the water inside, cloud coverage, losses to earth from pool and piping system, losses to the air from the pool, evaporation of water from the pool, and radiation from the pool. These losses could more than double the collecting area required in both of the above cases.

This little exercise points out that while solar energy is cheap, in raw form, and plentiful, when not cloudy, it has two basic limitations which make it difficult and expensive to harness and utilize. These

basic limitations are

1. Low concentration per unit area -
840,571 calories/m^2 (977.5 watts/m^2)
(90.8 watts/ft^2) maximum for a short period
in the middle of the day. This requires
large collecting areas and concentrating
devices if high temperatures are required.
The maximum useful average operating temp-
erature obtainable from flat collectors is
approximately 38° C (100° F). It is true,
for a very short time around noon, tempera-
tures of 75° C (167° F) can be reached in
flat collectors with very limited water
flow. 38° C is a very optimistic figure
for a full 12 hours of operation.

2. Cyclic and varying quantities of
energy - The quantity of energy available
per unit area is continually changing and
cycling from zero early in the morning to
a maximum around noon back to zero in the
evening with a 10 to 12 hour period of
zero during the night. This cycle varies
in time and quantity with the time of year.
This requires large, well insulated stor-
age facilities to provide a continuous
source of the needed energy during the
night and over periods of cloudy skies.

*****

1978 HOLIDAY CALENDAR

|	
January 2	For New Year's Day
February 20	For Washington's Birthday
March 24	Holiday*
May 29	For Memorial Day
July 3	Holiday*
July 4	Independence Day
September 4	Labor Day
November 10	For Veteran's Day
November 23	Thanksgiving Day
November 24	Holiday
December 22	½ Holiday
December 25	Christmas

* Additional Holiday

*****

TRUSTEES MEET

Richard Fleming

The semi-annual meeting of the AUI
Board of Trustees was held in Green Bank
on October 19 and 20. There were also
members of the AUI Corporate Staff, Brook-
haven National Labs, and NRAO in attendance
which brought the total number of partici-
pants to almost 50. The accompanying photo
shows part of the transportation require-
ments and helps illustrate the extra activ-
ity in Green Bank that week.
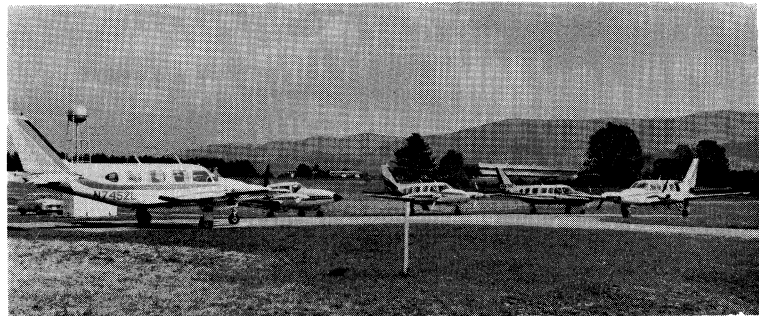
The official business meetings were
accompanied by technical briefings from
NRAO staff members. Ken Kellermann pre-
sented a brief on "VLBI"; Lee J Rickard on
"Molecules in External Galaxies"; Larry
Rudnick on "Where are all Those Electrons
in Clusters of Galaxies"; and Craig Moore
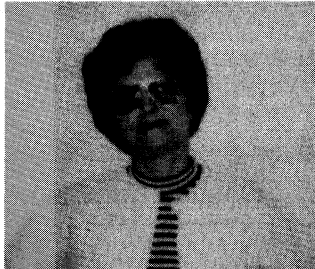presented a brief on "Next Generation of
Maser-based Receivers".

*****

After the verb "to love", "to help" is
the most beautiful verb in the world.
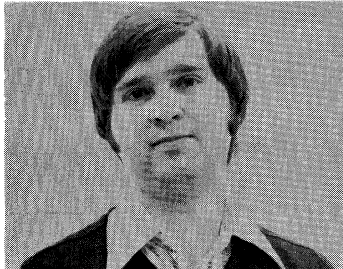
—Baroness von Suttner

PERSONNEL UPDATE

New Employees

Sylvia M. Bennetts
Technical Trainee
VLA - New Mexico

William R. Bond, III
Electronic Draftsman
VLA - CV

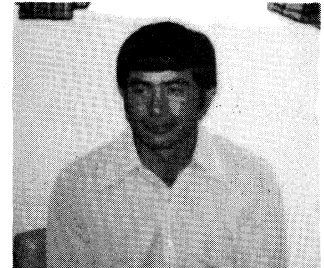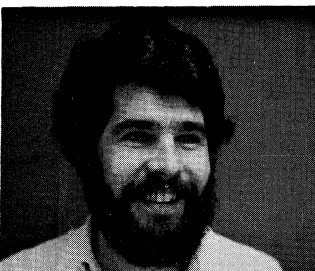Phillip F. Bowers
Research Associate
Basic Research - CV

Jean A. Eilek
Research Associate
Basic Research - CV
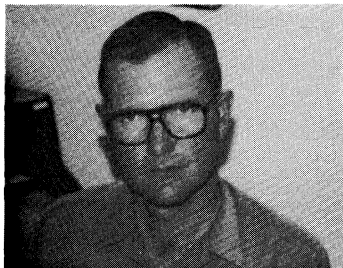
Robert J. Greiner
Telescope Mechanic
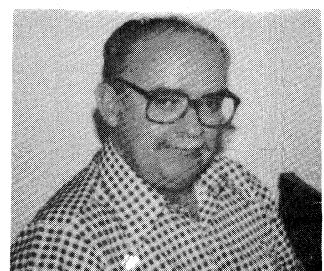VLA - New Mexico

Ramon Gutierrez
Telescope Mechanic
VLA - New Mexico

Jan M. van der Hulst
Research Associate
Basic Research - CV

Photo Not
Available

Faye M. Lewis
Technical Trainee
Electronics - Tucson

Doyle R. Marshall
Senior Buyer
VLA - New Mexico

NEW EMPLOYEES (continued)

Photo Not
Available
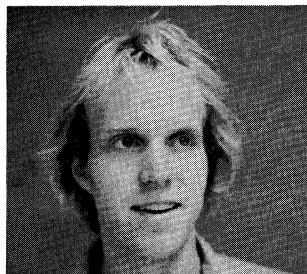
Manuel D. Montoya
Maintenance Trainee
VLA - New Mexico

Edward E. Mullen, Jr.
Computer Operator
Computer Division - CV

Kathleen Y. McConnell
Secretary
VLA - New Mexico
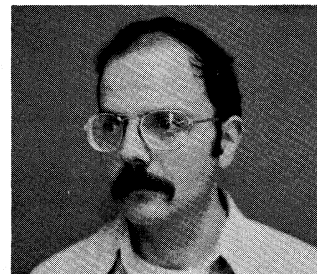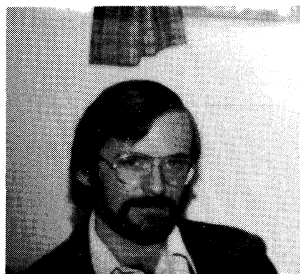
R. A. Perley
Research Associate
Basic Research - NM

Richard A. White
Research Associate
Basic Research - CV

REHIRES

Luis R. Cassiano	Junior Technician	VLA - New Mexico
Feliz M. Landavazo	Assistant Cook	VLA - New Mexico
James M. Manning	Junior Technician	VLA - New Mexico
James J. Osborne	Junior Technician	VLA - New Mexico
Charles Puffenbarger	Heavy Equipment Operator	Plant Maintenance - GB
D. Dawn Reiche	Junior Technician	VLA - New Mexico
Robert L. Stevens	Engineer	Tucson Operations

RETURN FROM LEAVE OF ABSENCE

James L. Dolan

LEAVES OF ABSENCE

Thomas R. Cram   Kenneth I. Kellermann
Judith S. Kampf   Benno Rayhrer

RETIREE

J. Marvin Wimer   Staff Shop Technician   Central Shop - GB

TERMINATIONS

Rick A. Beverage   Patricia J. Crowley   Jerry W. Kaber
Barry F. Blaisdell   Bernard J. Geldzahler   Joseph O. Lee
John W. Brooks   Kathy L. Harper   Charles R. Lipscomb
Barbara A. Coerper   Thomas W. Jones   Robert S. Pariseau

* * * * *

SNOWSHOE

The Snowshoe people have been busy this past year on top of Back Allegheny. They have completed three new buildings, added four new trails, beefed up their skiing instruction, and added more races to their program.

Two of the three new buildings at Snowshoe are lodges. Spruce Lodge will offer budget rooms and economy bunks, while the new Timberline Lodge will feature deluxe rooms. The addition of the two lodges and the completion of additional condominiums and private residences for rent, enables Snowshoe to accommodate 1000 people slopeside.

Since people must eat and Snowshoe knows they must, they have provided a variety of eating accommodations. The new Alfredo's Restaurant and Lounge offers top-of-the-line gourmet food (drinks like Café Mephisto are available in the lounge). The budget minded can lunch at the Burger Shack or cafeteria. Snacks are available at the Snack Bar. Somewhere in between (cost wise, that is) is Skidder Skeller, under Alfredo's, where you can ski up and have pizza, sandwiches, and a hot beverage.

This year Snowshoe adds four more new trails. New Whistle Punk, a 2400-foot low, intermediate slope, threads through the beauty of the basin to yet another addition .....3000-foot Powder Monkey Lift (triple chair, of course). Up on Cup Run Slope you'll find new Cup Cake, a 4200-foot adventurous, intermediate trail, and for the experts new Mephisto, a 1000-foot devil near the bottom of Cup's 7500-foot challenge.

Need skiing instructions? With this year's added lessons, courses, and clinics, Snowshoe can probably fulfill your needs. There's a clinic for would-be racers, a four day freestyle skiing course, lessons in ski touring, a ski academy for older students, Brr Rabbit Ski School for 6-12 year olds, special learn-to-ski days for ladies, men and students, and of course, private lessons for anyone.

Snowshoe has a lot going for the competitive skiers too. New this year is the Equitable Family Skiing Challenge (a parent may team up with one or more children and compete for individual and team prizes). All age skiers can compete regularly in the NASTAR races throughout the season. Seasoned skiers can compete in the Killy Cup Challenge. Both amateurs and pros can com-

pete for cash and trophies in the Pro-Am Race. College students can enter the College Invitational, and cross country ski enthusiasts will be able to compete in several cross country races.

*****

CREF UNIT VALUES - 1977	
January	$40.28
February	39.30
March	38.73
April	38.73
May	37.96
June	39.91
July	39.34
August	38.56
September	38.65
October	39.91
November	38.01

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GREEN BANK BOWLING

Richard Hiner

3 January 1978 will end the first half of the 1977-78 bowling season. Our standing as of 13 December 1977 (was it a Friday the 13th?) is 17 wins and 39 losses. High series from scratch was 567 on 8 November and high game from scratch was 220 on 15 November. This was accomplished by that Cabin Creek boy, Larry Miller, with an average of 162 per game.

Starting the new season, Jim Gibb was stuck on the first two nights of bowling; and a few others contributed later. Being stuck means that every bowler but one strikes in a frame of bowling; the penalty is to buy the drinks (Coke, coffee, or beer) for the other team members.

The following completed the first half of the season: Howard Brown, Edward Burke, Harold Crist, Jim Gibb, Bruce McKean, Larry Miller, Ron Monk, and Bob Vance.

The following will start the second half of the season: Cliff Barkley, Harold Crist, Richard Hiner, Don Hovatter, Tony Miano, Wendell Monk, Russ Poling, and Bill Vrable.

We need more bowlers. If you are interested in bowling during the second half of the season, please contact Dick Hiner, extension GB-309.

*****

Once there was an antelope
    Who said: "I'll write to Santa Clope!"

"You mean, my Son, to Santa Claus,"
    His Mother told the antelaus.

"I know! But Mom, it never rhymes,
    I've tried it half a dozen times."

And so he wrote "Dear Santa Climes,
    Do you have skates for Antelimes?"

The outcome was that Santa Claus,
    Not hearing from the Antelaus

Forgot to think of sleds and skates
    And just brought flannel underwates.

Sometimes it's best to stick to prose,
    When writing notes to Santa Close.

*****

GREEN BANK TOURS

In 1977 a shade over 25,000 people toured NRAO-GB. 43% of the visitors came from West Virginia, and 44% came from West Virginia's four neighboring states. All the rest of the states and 28 foreign countries were represented in the remaining 13%. The 1977 total is about average for the last five years. Barring floods, gas restrictions,

or too many rainy days, NRAO-GB can expect that many or slightly more next year.

NRAO-GB offers eight daily tours during the summer from mid-June through Labor Day and on weekends in September and October. Special group tours for students are also given (there were 51 special group tours in 1977).

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VACATION ACCRUAL TO CHANGE
FOR 15 YEAR WAGE EMPLOYEES
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Beginning January 1, 1978, the vacation accrual rate for weekly wage employees with 15 to 19 years of service will be increased from 1-3/4 to 2 days per month of full-time service. Vacation accrual rates for all other employees will remain unchanged.

Employees affected by this change will begin accruing 2 days of vacation credit as of their first monthly anniversary date of service which occurs on or after January 1, 1978.

Any questions relating to this change should be directed to M. E. Petty, Personnel Manager.

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THE 1978 NRAO PROGRAM PLAN
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R. L. Brown

Each year we provide the National Science Foundation with a synopsis of what we imagine will be the scientific thrust of the research conducted with NRAO facilities in the next 12 months along with a summary of our plans for instrumentation and development in the coming year. This document we call the Program Plan. I would like to take this opportunity to abstract briefly those parts of the Program Plan that may be of interest throughout the Observatory.

I. The Scientific Program

In 1978 we expect that an increasing number of programs will study various aspects of clusters of galaxies. For example, the properties of the intra-cluster medium may be

deduced directly from the observations of the scattering of the microwave background and indirectly from the structure of radio sources in the cluster. Studies of individual galaxies, both in clusters and in the field, will continue, with a view towards obtaining further information on the galaxies themselves and on the presence of satellite hydrogen clouds. Measurement of absorption features in galaxy-quasar pairs will be of help in estimating the extent of the hydrogen envelope around galaxies.

Our understanding of the structure of radio galaxies and of the incidence of compact active components in radio sources will be advanced by the availability of high-resolution, high-sensitivity maps made with the completed portion of the VLA. The VLBI technique will be used to monitor sources showing apparent super-luminal velocities, in an investigation of the dynamics of individual components and of their relative motion. There is renewed interest in the statistical properties of sources at very low flux densities; such sources are probably sufficiently distant that they reflect conditions at an early stage of the universe.

Programs on the single dishes will be primarily concerned with problems of the Galaxy and of galactic sources. Galactic structure studies will concentrate on the physical characteristics and kinematic behavior of the inner region of the Galaxy, and will include a search for the fundamental plane of symmetry within 2 kpc of the center. A number of proposals have been received relating to dark dust clouds and Bok globules; briefly, it is hoped that observations of continuum, recombination lines, and lines of certain key molecules will enable a picture of the density and temperature structure in these objects to be developed. Other molecular line studies will continue the investigation of the manner in which molecules are formed and of certain isotopes such as deuterium. Continuum observations of x-ray stars, radio stars, and novae will be continued.

II. New Observing Equipment

One of the principal strengths of the NRAO has long been recognized to be its

"state-of-the-art" currency in instrumentation and peripheral computer hardware. We expect that the new observing equipment being planned or developed (as summarized below) will further perpetuate this reputation.

A. Items to be Completed in 1978

1. Correctable Subreflector - The 140-foot telescope will be improved in the 1 to 3-cm wavelength range by the development and installation of a subreflector which is dynamically programmed to correct astigmatism.

2. 1024-Channel Autocorrelator - The present 413-channel autocorrelator at the 140-foot telescope is one of the most heavily used instruments at NRAO. It will be replaced with a unit providing 20 percent more sensitivity (through three-level quantization), 2.5 times more channels, and a larger bandwidth. This autocorrelator will be available for use by the end of 1978.

3. 130-170 GHz Receiver - This receiver will be completed in 1978 and give a single channel capability in the 130-170 GHz frequency range.

B. New Development Items in 1978

1. 300-Foot Low-Noise Systems - A dual-channel upconverter-maser system giving low-noise performance in the frequency range 1000-5000 MHz will be started. A second up-converter-FET system will give low-noise coverage at 300-1000 MHz.

2. Traveling Feed - An improved traveling feed assembly for the 300-foot telescope will be installed which will be capable of supporting the new cryogenic cooled receivers.

C. Continuing Development Items

1. Maser, Upconverter System for the 140-Foot Telescope - There will be continued development of a dual-channel upconverter-maser system giving very low noise temperature covering the frequency range 5-25 GHz.

2. 200-250 GHz Receiver - A dual-channel cooled mixer receiver for the 200-250 GHz frequency range will be started.

3. Varactor Downconverter - Tests will be made on a varactor down-converter from 80-120 GHz frequency range to 25 GHz, which will give considerable improvement in noise temperature for millimeter wavelength observations at the 36-foot telescope.

4. VLA Post Processor - Further work will be done on a VLA post-processor to enable observers to process raw VLA data.

5. VLBI - The plans include the develop-

ment of a Mark III VLBI recording terminal and the start of the development of a processor. The system will be compatible with the VLBI system being developed at Haystack.

6. Diode and Josephson Junction - Development work on Schottky diodes and Josephson junctions will continue. Both these developments are important for further improvements of millimeter receivers.

III. Operations and Maintenance

Because the NRAO now has significant operations at four sites we have found it desirable to organize the principal activities at the Observatory into six operational units arranged by activity rather than exclusively by site. These six are as follows.

1. Research Support - This group is composed of the scientific research staff and the students (summer, co-operative, and Ph.D.). As well as undertaking research, the staff assists visiting observers in gaining familiarity with the NRAO telescopes, advises the technical divisions about modifications to equipment or the design of new equipment, and participates in the checkout and calibration of instrumentation.

2. Technical Support and Development - This unit has the general responsibility for the observatory-wide technical and instrumentation programs. The Central Development Laboratory explores new concepts in radiometers, and has provided design support for very long baseline and correlator development. The Computer Division operates the central computer and the VLB MK II processor, and assists in the development of programs for computers at the telescopes. The Engineering Division provides engineering assistance to the operating sites, and undertakes the design of new facilities and telescopes. The Scientific Services Group maintains the central and branch libraries, and provides technical illustration and drafting.

3. Green Bank Operations - There are five divisions with the responsibility of maintaining and operating the 300-foot telescope, the 140-foot telescope, and the four-element interferometer, with developing new instrumentation and with maintaining the Green Bank site. These divisions are: Telescope Operations, Electronics, Shops,

Plant Maintenance, and Administrative Services.

4. <u>Tucson Operations</u> - This group maintains and operates the 36-foot millimeter wavelength telescope at Kitt Peak and develops new instrumentation for this telescope. An important aspect of recent work is the effort to obtain state-of-the-art radiometers at 1.3 and 2 mm.

5. <u>VLA Operations</u> - This group will be expanded significantly as the number of antennas and the complexity of the data handling will both increase over 1977 levels. For example, the number of antennas which are operational will grow from 10 in January 1978 to 15 by the end of the year. The pressure on available observing time will become heavy, both because of the intrinsic power of the completed portion of the VLA and because of the removal of the interferometer from service. There are four divisions: Antenna Maintenance, Scientific Services, Array Operations, and Electronics.

6. <u>General and Administrative</u> - Included in this unit are the Director's Office, the Fiscal Office, and the Business Office.

Next issue we will explore the nature and scope of the science that is currently being done with the NRAO facilities.

* * * * *

NOW IS THE TIME TO:

Bed stock

Sleep later

Wish for spring

Thaw water pipes

Read seed catalogs

Watch the Superbowl

Try out a snowmobile

Keep barn doors closed

Grease the silo unloader

Roll another log on the fire

Serve cabbage and ham for
new year luck

Tell Aunt Jenny what you got
for Christmas

Remind the kids how bad the blizzards
used to be

Put a pole light up at the pond so the
boys can play hockey in the evening

* * * * *

EXPLODING MAISE AS A CULINARY POSSIBILITY

P. F. and K. L. Bowers[1]

Submitted to

THE JOURNAL OF PERSONAL COMMUNICATION

Abstract

The physical properties and culinary characteristics of zea mays everta (popcorn) have been briefly explored. This report substantiates earlier findings that this type of corn can be quite sumptuous if prepared and consumed within a specified, though not severely constrained, set of environmental conditions.

Introduction

While it is well-known that the effect of heating Indian (pop) corn is an explosive reaction in which the mass of the grain is approximately conserved though its density is drastically decreased, it is not widely appreciated that the resultant low density kernel can be a pleasant and rewarding source of delight when orally consumed. We have therefore decided to investigate several types of this substance to determine the general quality of taste and the convenience of preparation in an environment that can be easily duplicated by most users.

The Experiment

The experiment was made at the authors' kitchen[2] at 2/50 Chester Street, Epping, N.S.W., 2121, Australia. The raw material was obtained from a container of "Gourmet Popcorn Mix" manufactured by J. Zachary, Rollingstone, Minnesota, U.S.A., and kindly supplied by Mrs. G. C. Woolley of St. Paul, Minnesota.

The uncooked corn consisted of a mixture of a) black seeds, b) white seeds, c) maroon seeds, and d) yellow seeds, thereby avoiding selection effects involving the type of popcorn investigated.

The corn was cooked in a deep, covered pan over a medium to medium high gas flame. It should be noted that the type of heat is not critical. However, care must be taken to ensure that the degree of heat is not too low or too high (using standard calibration units found on most cooking devices), else the final product can be either insufficiently cooked with an overabundance of seeds or scorched to the bottom of the pan. Similarly one should preclude the possibility that the pan is too shallow, or provide large lips around the perimeter to catch flying kernels.

Before the corn was added to the pan, a thin layer ($< \frac{1}{4}$ cm) of polyunsaturated vegetable oil was slightly preheated. Some authors suggest placing a few seeds in the oil and waiting for them to burst before adding the bulk of the corn. We have found that this technique is not critical, however, and that the corn can, in fact, be added to cold oil. The important point is that the corn layer should generally not exceed one seed in depth so that all the corn may have sufficient access to the heated oil. Polyunsaturated oil is recommended inasmuch as to

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avoid the "greasy" taste of which some users have complained.

Explosive activity in the pan was observed approximately two minutes after the heating process was instigated. The pan was thereafter subjected to sundry vigorous vibrations to ensure an even distribution of the kernel layer over the heat. The agitation was periodically repeated every 20-30 seconds until the last seed had burst. The shake trajectory varied between an oscillatory linear translation and a circular or elliptical path. The plane of vibration was always horizontal, however. Upon completion of the popping, the corn was immediately transferred to a large unheated bowl. Finishing salt supplied with the corn was discreetly applied.

Results and Discussion

Table I summarizes the results of the experiment, where columns 1 - 4 are respectively the initial and final kernel colors, the relative size, and the taste quality rating (TQR). Though the kernels showed considerable variation in their colors and sizes, Table I shows that the TQR (on a scale of 0 - 10) was systematically and consistently high with an average value of 9.6 ± 0.1. This value was only slightly lower when no salt was added.

The results of this experiment substantiate previous findings by Bowers and Bowers (unpublished) and Gilmore (private communication) that this type of corn can be quite palatable though prepared within a widely-varying set of physical conditions. This does not imply, however, that the popcorn itself is always palatable under all circumstances. For example, the user must be careful not to add too much salt or butter (if preferred) since the corn may lose much of its essential crispness. Similarly, though some afficionados have been known to eat it cold for breakfast, it is recommended that most people will enjoy it best when it is fresh and hot. It is also quite acceptable to serve it with chocolate or vanilla fudge, though the rich texture of the latter quantity will necessitate a marked decrease in consumption of the former quantity.

Finally, there are a vast number of beverages which we have found to enhance the enjoyment of _zea mays everta_. These range from alcoholic beverages such as beer or malt liquor to many of the fashionable colas. White wines, slightly chilled, are also acceptable, though not as popular.

TABLE I

Initial kernel color	Final kernel color	Relative size	TQR
Black	Bright white	Large	9.8
White	Off-white	Medium	9.5
Maroon	Soft-white	Small	9.5
Yellow	Haze-white	Large	9.6

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A promise is as good as the one who makes it.

* * * * *

<div style="text-align:center">

OLD PICTURES COLUMN

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1908 Photo of Green Bank

This photo, contributed by a local resident who wishes to remain anonymous, shows part of Green Bank back in 1908. Where would you say the photographer was standing when he or she took the picture? Definitely it's looking northeast up route 28, and we think it was taken from about in front of Merritt Gum's house.

* * * * *

After an interview with the <u>New York Times Magazine</u> about "Life in Space", Sebastian von Hoerner got the following nice letter:

Do you do Astronomy?

I would like to have my done.

My birthday is Oct. 16, 1923.

* * * * *

God so loved the world, that he gave his only begotten Son, that whosoever believeth in him should not perish, but have everlasting life.

--John 3:16

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VARIATIONS IN ANTENNA IMPEDANCE AS A FUNCTION OF COW DUNG

Paul Harden

"*If a massive star collapsed to a sufficiently small volume, it is guessed that light would not escape. A rotating black hole could account for the tremendous gravitational radiation from our universe.*"[1]

One of the more significant considerations to be given in the design of any antenna system is to properly measure the "resistance" of the antenna, which is referred to as the CHARACTERISTIC IMPEDANCE, "Z_0". Of course, this Z_0 has many variables that must be known; to name a few: frequency of operation, size and material of the antenna, type of soil, and the Dow Jones average...all must be added together, divided by 12.3 and converted to rodchains before the signal gathering capabilities can be properly consummated.

Of particular interest recently to VLA engineers in evaluating recent observing runs is "type of soil" in addition to our environment, two factors that have a smashing influence on this magic Z_0. Unlike most other installations of huge antenna arrays, the VLA has experienced some huge shifts in antenna impedance, typically from 15 milli-ohms to several giga-ohms in less than a second (12.7mSec.) at random intervals. This has brought a little bit of attention to improving the VLA antenna impedance. After considerable effort using the latest in applied theoretical research, we have finally discovered the cause of this unique Z_0 excursion: Southern New Mexico Cow Dung.

The VLA, located in one of the country's most productive cattle areas, is frequented often by huge herds of cattle, naturally leaving evidence that their biological processes are far from the ordinary. In many cases, this evidence has been found in very close proximity to the antennas (I discovered some one night myself while walking out to antenna #7--ed.) Since this part of the country experiences a humid earth in the mornings, scorching sun in the afternoon, and small to drenching rains in early evening, the impedance of the soil changes considerably. The impedance of cow dung (Z_{doo}), on the other hand, changes considerably, in fact logarithmically, per unit of water. When the soil has an impedance of 12.7 ohms (73 drops of water), the corresponding amount of dung will have an impedance of several giga-ohms plus a capacitance of 1000mF (while the earth only a few micro-farads). Since the dung normally rests upon the ground (thus, parallel to ground), we have both resistance and capacitance in parallel to the soil. Since capacitances are additive in this situation, we have a total antenna-ground capacitance of 1000mF and a resultant Z_0 of 7.5 giga-ohms. This yields a time constant of 0.0127 seconds, EXACTLY the periods of the Z_0 excursions experienced (where TC=RC, R=12.7 ohms, ground resistance and C=1000mF).

EFFECTS ON THE RADIO ASTRONOMY COMMUNITY.

Basically, we theorize that radio emissions from celestial sources travel through space in straight lines, that is from point A to point B, as shown in Figure 1.

FIG. 1

These radio waves bend slightly in their transverse through our upper atmosphere, though this is electrically corrected with the Upper Atmosphere Radio Wave Bender-Outer Compensator Module, F33 in each antenna. As the antenna has a capacitance and Z_{doo} of 1000mF and 7.5Gohms, this will cause an apparent dwarfing to the energy velocity by K=0.3 when measured at 21 cm. This yields in an erroneous frequency of the received signal causing subsequent errors in the determination of the gravitational red shift (GRS). Remembering that the Z_0 is shifting every 12 mSec means that the GRS error is therefore modulating at this rate, precisely the rate of many a popular pulsar. This is not to infer that many pulsars also have cow dung impedance problems. This modulating error,

--continued, next page--

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[1] Black holes have absolutely nothing to do with this article.

speeding up then slowing down the incoming radio waves, will produce "bunches" of celestial electrons where the speeded up waves run into the slowed down waves. This bunching effect, of considerable mass, is evidenced by the numerous bulges, gouges and dents in the waveguide system; gouges as deep as one inch have been reported every 2 feet (every 3rd cycle at 21 cm)! Since the GRS is in error by 180 MHz, then the measured speed of celestial objects will be in error by the minute quantity of 4.9 Km x 10^{10}/second. This modulating error will also produce an apparent position off-set in declination by a mere -23 degrees, which when processed by the computers will generate a corresponding pointing command to cause the entire 85-foot VLA dish to oscillate about both drive axes in a huge 37 degree ellipsoidal pattern every 7 seconds, yielding of course a slight additional error to the astronomical data.

The exact effects of this have not been fully analyzed, but rather left to the discretion of the visiting scientist as to whether or not these small abberations can be tolerated in his specific program.

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│      NRAO ROUNDUP       │
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Reprinted from the NRAO Quarterly Report for July 1, 1977 - September 30, 1977

ELECTRONICS DIVISION

Green Bank Electronics

The 18.5-36.5 GHz maser system is being installed on the 140-foot telescope at the close of this quarter. System tests and first observations are scheduled for the first two weeks in October. In addition to the 140-foot telescope system, there are three masers in various stages of test and construction. Three 1-watt 4.2 K refrigerators have been delivered by the cryogenics group, and they have developed a higher capacity system which has dissipated about 2½ watts in the lab. Work continues on the high capacity refrigerator with the anticipation that all future maser systems

will need the higher dissipation capability.

An off-line ModComp computer has been installed at the 300-foot telescope, and the data interface to the DDP-116 computer is complete.

Design work has begun on a 300 to 1000 MHz receiver primarily for use on the 300-foot telescope. It will be based on upconverters ahead of 5 GHz cooled FET amplifiers. System temperatures below 50 K are anticipated. Design work has also begun on the IF and clipper section of the Model IV autocorrelator.

The baseline ripple causing reflection from the top of the 140-foot telescope Cassegrain house was reduced by more than 20 dB at 9-cm with a permanently installed tilted reflector. Tests on additional tuning plates are continuing into next quarter.

Tucson Electronics

During this quarter tests have been made on the new varactor down-converter receiver at 115 GHz. This receiver uses a maser, built in Green Bank, as the IF amplifier, a varactor down-converter developed by S. Weinreb and a quasi-optical LO injection system designed by J. Payne. The first tests yielded a SSB receiver temperature of 275 K, a factor of 2.4 improvement over our present cooled mixer receivers. This noise temperature is higher than expected, and the excess noise is currently being investigated.

The 130-170 GHz receiver is nearing completion and will be tested on the antenna in late October.

We have experienced trouble with diode reliability on the new 33-50 GHz receiver. Work is continuing on this problem, and telescope tests of the receiver will take place in October.

During this quarter we have developed the capability for producing the very fine grids and meshes required for high-frequency quasi-optical components.

The design of a polarization splitter and lens-corrected feed horn for the new 230 GHz receiver has been completed.

Charlottesville Electronics

The VLB Mark III recording system has been completed except for a complete set of

IF video converters. A Mark III experiment was run during the latter part of September, recording on six of the 28 tracks. The tapes have not been processed yet; however, it has been confirmed that the data are in the correct format and can be read at Haystack.

Development of Model IV autocorrelator is continuing.

During this quarter the group in Charlottesville has continued to supply Tucson with diodes for 33-50, 80-120, and 130-170 GHz mixers.

The 1-mm mixer has been successfully whiskered and has proven to be very reliable. Room temperature and 20 K measurements have been made with no diode failures. The mixer SSB noise temperature of $\sim$ 3000 K (measured at room temperature) and $\sim$ 1500 K (measured at 20 K) at 210 GHz is reasonable since the choke structure was designed for an alternative diode mounting arrangement. This will be corrected in the later versions that are currently being manufactured for a cooled, dual-channel 1-mm receiver for Tucson.

ENGINEERING DIVISION

The Engineering Division supervised the fabrication of a deformable subreflector, its mounting frame, and prototype components of the deforming mechanism. Drawings and supervision of shop fabrication for a jig to measure the subreflector were completed. Designs of structure modifications for the 140-foot telescope were completed and shop fabrication started for the September shutdown. Engineering assistance was provided the 36-foot telescope for modifications to the telescope and dome. Drawings were completed and quotations received for modifications to the center polar brake on the 140-foot telescope. Drawings were completed for modifications to a section of the warehouse for a cryogenics laboratory. Research and conceptual design continued for a future 25-meter millimeter wavelength telescope and its associated astrodome. Routine inspection and engineering assistance was provided operations and maintenance in Tucson and Green Bank.

COMPUTER DIVISION

140-Foot Telescope

Development work continued between observing runs on the new control system. New features, such as automatic pointing, have been added.

300-Foot Telescope
A ModComp II computer has been installed for off-line data analysis. The computer and programming are essentially identical to the 140-foot telescope spectral-line analysis system as described in the NRAO User's Manual Report No. 28.

360 System
The disc capacity has been increased on the IBM 360 system. The new system is more favorably priced as well as more technically attractive than the older system.

VLBI
Several on-line (processor) program improvements have been made. The noise tube may now be used to determine an indication of system temperature. Fringe rates may be altered on the CRT display, and the amplitude is now independent of the selected time constant. Certain additional information is printed on the teletype during processing.

VERY LARGE ARRAY PROGRAM

Observations with the array were scheduled for 831 hours during the third quarter. During August the array was increased to eight antennas and extended to a 7.66 km baseline. Antenna No. 12 was accepted on July 12, 1977, and Antenna No. 13 was accepted on September 2, 1977.

A new, antenna based, empirical calibration system has been implemented in the DEC-10 computer. This new map-making program is now in operation. The PDP 11/70 host for the array processing system was received, installed, and accepted.

The design phase of the electronics modification, which is largely in the local oscillator area, has been essentially completed and a program of implementation in the existing electronics has
The custom integrated circuits for the spectral processor have been tested in prototype and found to be well within specifications. An initial production batch of 1400 circuits has been received for the integrating counter,

and the first production batch of the multi-
plier circuits is expected soon.

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SOMETIME
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Sometime when you're feeling important,
Sometime when you ego's in bloom,
Sometime when you take it for granted
You're best qualified in the room,
Sometime when you feel that your going
would leave an unfillable hole,
Just follow the simple instruction
and see how it humbles your soul.
Take a bucket and fill it with water,
Put your hand in it up to the wrist,
Pull it out, and the hole that's remaining
Is a measure of how you'll be missed.
You may splash all you please when you
enter.
You can stir up the water galore,
But stop, and you'll find in a minute,
That it looks quite the same as before.
The moral in this quaint example,
Is do just the best that you can,
Be proud of yourself, but remember,
There's no indispensable man.

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REFLECTIONS
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Mamie Ortiz

Ghost towns always fascinate me, but I
think that perhaps my favorite ghost town
is Kelly, New Mexico. No matter how many
times I go there, I never get tired of going
yet another time.

There is something about old founda-
tions and ruins that captures my imagina-
tion. As I climb the steps and walk
through the rubble, I can almost feel the
presence of those inhabitants no longer
there. Everywhere I turn, there are re-
minders that real people once lived and
worked here: tin cans scattered around;
bottles and bits of broken pottery; some-
thing that looks as if it might once have
been a child's toy; and abandoned wash tubs,
rusty, full of holes, all bent out of shape.

Somehow the wash tubs always disturb me.
Why would people move away and leave a wash
tub? Was it not a necessary item in those
days?

As I continue to walk, I see the place
where the old school house once stood. It
is on a little hill with a big shade tree,
just as I would expect it to be. My hus-
band went to school there, and his mother
before him. It conjures up a vision in my
mind of Spanish-speaking children dashing
around playing, or sitting orderly in the
classroom, trying to figure out this strange
lady from the East who happens to be their
teacher.

As I raise my eyes and look toward the
mountains, I see rockpiles on the mountain-
sides, and tall iron structures, serving
as reminders of the wealth and labor, and
also the dreams, of days gone by. But to
me these things do not detract from the
beauty of the mountains; they only add to
the strange magnetism that they always seem
to possess.

And as I turn away and look to the
west, there she is, looking down at me --
the strange lady on the mountainside, Mary
Magdalene. For years I searched in vain as
I tried to discern her face among the rocks
and brushes, but to no avail. But then one
evening I looked again and there she was, as
plain as day. How could I have missed her
all those years? I have never been able to
figure out her mood; she is just there,
looking at me.

I turn from her steady gaze and bring
my attention to the Catholic Church, the
only building still standing. It is very
old, even though it is not the original
church that was built at Kelly. The bell is
no longer in the tower because it was
stolen. The church has been newly white-
washed and is carefully maintained by the
people of Magdalena. Once a year in the
month of June they celebrate the Kelly
Fiesta, and the ghost town comes to life
once again.

Across the road from the church,
nestled quietly on the rolling hillside, is
the cemetery. A modern flagpole is there,
standing guard as a lonely sentinel. The
tombstones, faded and cracked, many stand-
ing awry, some not standing at all, amid

the weeds and cacti, bring visions of rattle-
snakes to mind.

As I wander along, a frightened jack-
rabbit darts out in front of me and speeds
through the brush, ears standing erect.
After a rain, the air smells as fresh and
fragrant as Springtime itself. The cacti are
in bloom, showing off their elegant blossoms
with great pride. The most beautiful of all
is the prickly pear, with raindrops glisten-
ing on petals that look like the king's
velvet.

The clouds have thinned out just enough
to show the beauty and grandeur of the match-
less sunset; the distant mountains outlined
against the sky that is splashed with purple
and magenta, slowly fading to a softer hue,
and finally sinking out of sight, reminding
me of the power and greatness of God.

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THE WHITE-WINGED GUAN IS ALIVE AND WELL AND LIVING IN SOUTH AMERICA

Lee J Rickard

Extinction can be embarrassing. Of
course, it's no fun for the unhappy species
being pitched, appendages sprawling, into
oblivion. But neither is it pleasant for
the biologist who has to explain why it
happens. One generally invokes some change
in the environment to which the wretched
beast could not adapt: the disappearance
of needed food supplies, the appearance of
efficient predators, or the appearance of
more efficient rivals competing for the
available food.

But there are some large-scale extinc-
tions whose causes are poorly understood.
For example, a wide variety of animals died
out within a span of a few million years at
the end of the Cretaceous Period (about 70
million years ago). Included in this group
were the dinosaurs, a very successful group
of reptiles who had dominated the land for
more than 100 million years. It has turned
out to be very difficult to reconstruct the
events surrounding this dramatic extinction.
Similarly, it's difficult to understand why
the horse became extinct in the Americas,
but not in Asia, about 10,000 years ago. The

horse thrived when reintroduced by the
Spaniards in the 16th century, although
neither the animal nor the environment had
changed much since the time of the original
extinction.

Even more embarrassing, there are some
species that refuse to stay dead. Of course,
true extinction is forever, as the Sierra
Club keeps reminding us. But labelling a
species extinct depends on observing that it
has vanished from all possible habitats.
A number of supposedly extinct species have
turned up in habitats that nobody thought
to check. The first such incident histori-
cally, and also the most embarrassing, in
several respects, was the case of the
crinoid.

The principal source of embarrassment
here is in the timing. The idea of extinc-
tion didn't really exist until the 19th
century. Before then, most fossil studies
were based on invertebrates (animals with-
out backbones), and usually on marine
varieties. The absence of a particular
fossil form from recent rocks was generally
interpreted as representing a move to
another, as yet unknown, habitat. But in
1824, Baron Cuvier finished the first care-
ful study of large fossil animals. It was
clear that there weren't enough unexplored
places left in the world to hide such
beasts; it had to be that most of them no
longer existed. And if true for the ver-
tebrates, it was logical to assume that the
previously known discontinuities in the
fossil record for invertebrates also repre-
sented extinctions.

One of the most obvious extinctions was
that of the crinoids. The crinoids were
spiny-shelled animals, cousins to the star-
fishes and sea urchins, that were once one
of the major lifeforms on Earth. The
fossil evidence available in 1824 showed
that they had been extinct for a consider-
able span of time (200 million years, as we
now date it). But in 1850, a Norwegian
zoologist, Pastor Michael Sars, did some
dredging near the Lofoten Islands, at a
depth of 450 fathoms. He dug up, amongst
other things, scads of live crinoids. One
must assume that Cuvier was nonplussed.

Alas, no one had thought to investigate
the marine habitat beyond the continental

shelves, for reasons that made Pastor Sars' discovery even more embarrassing. Obviously, animals depend on plants at the bottom of the food chain, and plants need sunlight. But at a depth of about 200 fathoms, the light that does filter down cannot support active plant life. No plants, no animals - no life below this region. This was called the abyssus theory, published by Edward Forbes in 1843, obsolete seven years later. We now know that, while photosynthetic plants do not live below 75 fathoms, the animals that feed on them do drift lower, and are themselves eaten by animals that live even lower. The food chain extends down to the deepest regions sampled.

The subsequent history of deep-sea dredging has been dotted with discoveries of animals previously believed to be extinct. The first true deep-sea studies were actually made during repair work on the transatlantic cable, and showed that animal life existed in regions as abysmal as one could imagine. The British government then financed several exploratory voyages, the most extensive being that of H. M. S. Challenger in the 1870's. Among other bizarre creatures, the Challenger turned up some eryonids off the coast of Africa. The eryonid is a variety of crab that vanished from the near-shore fossil record during the adolescence of the dinosaurs. These British voyages naturally stimulated similar expeditions by American, German, Norwegian, French, and Austrian scientists, and even a brief study by the Prince of Monaco - trying, I suppose, to close the gap in the Abyss Race. Modern deep-sea searches continue to uncover new cases of "extinct" animals. Last year's Woods Hole Notes reported the discovery of a shrimp-like beast (called a syncarid), thought to have disappeared 300 million years ago.

When animals are resurrected from extinction, the press generally blazons them as "living fossils", as if they were freaks plucked by time machines from ancient seas. Certainly, that was how the coelecanth was publicized. The coelecanth was a type of fish that appeared about 350 million years ago, and apparently disappeared some 290 million years later. Or so it was thought until a live one was caught in a

trawl net, off the coast of South Africa, in 1938. Unfortunately, the museum curator to whom it was delivered had no facilities for preserving the carcass, and the taxidermist didn't leave much for paleontologists to handle. J. L. B. Smith, who made the first analysis of what little remained, circulated leaflets among all the coastal fishing villages, offering a reward for other specimens. He had to wait 14 years before a colony of coelecanths was discovered in the Comoro Islands off Madagascar. (Of course, I refer here to scientific discovery; the local fishermen had known about the fish for generations.) The South African government got very excited - they flew Smith out to the islands in a special military plane, and he, in gratitude, named the fish after the Prime Minister.

The coelecanth became the zoological superstar of the modern world. Not that it didn't deserve it, mind you. The ancestors of the coelecanths were related to the earliest amphibians, so the fish has considerable scientific interest. But it's no more a living fossil than the shark or the horseshoe crab. Rather, it is a viable lifeform that simply has not had to change much over hundreds of millions of years - except for a move from near-shore to deep marine reefs, which was why it had seemed to vanish from the fossil record.

Of course, a large part of its attraction was that the coelecanth was the biggest "extinct" animal ever found (about 5 feet long, and usually over 150 pounds). It probably tweaked everybody's favorite fantasy - that of finding a live dinosaur. The very possibility has an awesome attraction for some naturalists. Just this summer, several Japanese scientists gleefully announced that a decomposing monster dredged up near New Zealand was a plesiosaur. (The plesiosaur was a bulky marine reptile with paddle-like fins and a long sinuous neck; it's supposed to have died out with the dinosaurs.) Most paleontologists, though, believe that the beast was just the remains of a basking shark. Such sharks can easily be 30 feet long; and when they rot, the gill structures slough away, along with the lower jaw, leaving a long thin "neck" like that of a plesiosaur. While more likely,

this interpretation cannot be confirmed; the corpse was so vile that the fishermen who found it threw it right back, for fear of spoiling the rest of their cargo.

There is now considerable sentiment favoring the identification of the Loch Ness monster as an extant plesiosaur - at least among people who believe there is a Loch Ness monster. Nessie, unfortunately, is rather like a UFO, in that she resists the temptation to leave physical evidence of her existence. Since 1933, there have been thousands of reports of sightings in or about the loch, but only a few photographs, mostly indistinct, and no bones or half-eaten fish. Before 1975, most monster buffs claimed identifications with unknown giant mammals, of the otter or sea cow variety. The plesiosaur hypothesis was out of favor because it was difficult to understand how a cold-blooded reptile could get in a decent amount of sun-basking time without having been more visible over the 12,000 years that the loch has been landlocked. But a recent photograph - which, although computer enhanced, is still pretty indistinct - looks more like a plesiosaur than anything else. The researchers involved, Robert Rines and Sir Peter Scott, have not actually made this identification, although they do assert that it is a fish-eating reptile. (Thus reviving the problems of sun-basking and the absence of half-eaten fish.) They have named it, though, in order to get it protected by British law as an endangered species: Nessiteras rhombopteryx, literally "monstrous Nessie with the rhomboidal fins". A catchy name for an uncatchable beast.

Actually, there are more known "living fossils" on land than in the seas, although they are generally small and not of great antiquity. This fact has prompted some people to assert, Baron Cuvier to the contrary, that such creatures may account for the occasional reports of fantastic land animals. In modern times, these reports usually refer to the man-like beasts that are believed to live in mysterious, inaccessible places like Tibet and Northern California, where they lead lives of gentle vegetarianism, disturbed only by clumsy backpackers.

Unfortunately, most of the evidence for the existence of either the Yeti or the Sasquatch (the two major Bigfoot beasts) is anecdotal, reminiscences of close encounters of the furred kind. Neither beast seems to leave a spoor, with the exception of their footprints. (I ignore "Yeti scalps" and putative Sasquatch films - all apparently hoaxes.) In the case of the Yeti, these prints are mainly those of bears, apes, and pilgrims, often distorted by the melting and refreezing of the snow. Sasquatch prints are not as easily explained; but if real, they would imply two different zoological families of Bigfoot (Bigfeet?). It is very hard to imagine how two viable populations of large beasts can support themselves on the impoverished low-energy foods typical of the coastal evergreen forests of the Pacific Northwest.

Baron Cuvier probably guessed right about the problems of hiding large undiscovered land mammals. The number of new large mammals discovered since his time is less than a dozen; only three have been found in this century. The "living fossils" found on land today are more likely to be birds than Neanderthals, and probably not of great age at all. Indeed, I was started on this article by reading about the rediscovery of such a bird: the white-winged guan, whose "extinction" lasted only a hundred years. At some point in the 1870's, the guan retreated from the Peruvian acacia flats, a temporary nesting place, to what turns out to have been its traditional home in the foothills of the Andes. It took a century for science to find it again - a few miles from the Pan-American Highway. The discoverer, John O'Neill of L.S.U., admits that it was a bit of an embarrassment.

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NOTICE

Ping-pong balls are available at the Green Bank Cafeteria. See cafeteria personnel about obtaining them.

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WHAT'S COOKING?

Sweet and Sour Pork
from the kitchen of
Stella Wu

1 pound cubed pork tenderloin	Sauce:
2 tablespoons soy sauce	½ cup catsup
1 teaspoon sherry wine	4 tablespoons sugar
½ teaspoon salt	1 tablespoon soy sauce
1 green pepper, cubed	½ teaspoon salt
1 carrot, sliced	1 small can cubed pineapple
2 tablespoons cornstarch mixed	and juice
with lightly beaten egg	1 cup water
1 cup flour	2 tablespoons cornstarch mixed
oil for frying	with 2 tablespoons water

Marinate pork with salt, soy sauce, and wine for 10 minutes. Dip pork in corn-starch mixture. Coat pork with flour, then fry in oil until crisp. Drain.

Sauté carrot and green pepper until half done. Add salt, soy sauce, juice, water, sugar, and catsup. Thicken with diluted cornstarch. Add fried pork and pineapple. Mix well. Serve with rice.

Savory Beef and Onion Stew
from the kitchen of
Henny Kellermann

2 large thinly sliced onions
¼ cup flour
¼ cup butter or margarine
2 cups stock or stock of
    meatcubes
3 bay leaves
5 cloves
1 tablespoon vinegar
½ pound sliced cold or
    leftover meat (beef)
2 tablespoons cornflour
pepper
Worcestershire sauce

Brown the onions and the flour in the butter in a saucepan. Add stock gradually, stirring all the time. Add bay leaves and cloves and simmer for five minutes in covered saucepan. Add the vinegar and the diced meat; simmer for another hour. Mix the cornflour with a little water; add this to the stew to thicken the sauce. Simmer for five minutes, stirring continuously. Make it to taste with a little pepper and Worces-tershire sauce. Serve with mashed or boiled potatoes and red cabbage.

Marshmallow Pavlova

*from the kitchen of
Beth Brooks*

     4 egg whites
     1 cup castor sugar
     ½ teaspoon vanilla
     3/4 teaspoon white sugar

Beat egg whites until soft peaks form. Add
sugar, 1/3 cup at a time. Beat. When
dissolved, add vanilla and vinegar. Beat
one minute only.

Mark 7-inch circle on aluminum foil. Spoon
meringue into circle and level it on top.
Carefully smooth sides and top of pavlova,
then, with a knife blade, mark grooves
around sides; smooth over top again.

Bake in a slow oven approximately 1½ hours.
Cool in oven.

When pavlova is cold cut around top edge.

Fill with fresh whipped cream and top with
strawberries, sliced bananas, or any fresh
fruit in season.

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AS THE OLD YEAR ENDS,
LET ME REMEMBER...

Let me remember, as the old year ends,
That there has been no year without some new
And unexpected happiness that transcends
The years; let me recall how friendships grew
Through days that I believed so desolate,
That nothing beautiful could ever grow
In them: and let me not forget how great
Successes came, when hope had seemed to go.

Oh, let me not forget, beginning now
A year that seems to promise little good,
How even the darkest years contained somehow
More lovely days than I believed they could,
For so I am assured I shall not miss
Some bright transcendent happiness in this.

                        --Jane Merchant

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WORLD OF WONDROUS BEAUTY

I don't know how to say it,
    but somehow there seems to be
A silence to a snowstorm
    that just grips the soul of me.
The raindrops have a patter
    as they splash against the panes,
And the thunder rolls and rattles
    like a thousand railroad trains;
But a good old-fashioned snowstorm
    has no tumult in its sweep
As it spreads its spotless blanket
    where the roses lie asleep.

There's no herald of its coming,
    no black, angry patch of sky,
No great gust of wind to whistle
    of the storm that's drawing nigh;
But the birds give up their singing,
    and the trees stand straight and still,
And the snow begins to flutter
    round the humblest window sill;
Then the noise of busy traffic
    seems somehow to ebb away
While the world takes on the silence
    of a country Sabbath day.

He who rises with the dawning,
    ere the trade of men begins,
Sees a world of wondrous beauty,
    washed completely of its sins;
And the splendor of the tropics
    and the glory of the palm
Never know such robes of silver
    or such sweet unbroken calm
As the humblest northern lilac,
    or the roughest fence rails know,
As they stand on winter mornings
    in their uniforms of snow.

                        --Edgar A. Guest

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BRAIN TEASER

contributed by Henry Richards

The brain teaser this issue is a final examination prepared by Dr. Tom Tice, Chairman of the EE Department, ASU, Tempe, Arizona, for the Antenna Course.

FINAL EXAM

(OPEN BOOK --- OPEN NOTES)

1. As an approximate analytical model of a turnstile antenna used for TV broadcasting, satellites, and other applications, two short dipoles of equal length are placed at the origin. One coincides with the x-axis, the other with the y-axis. The currents are of equal magnitude, but the current on the x-dipole leads the current on the y-dipole by 90° in phase.

   a. Derive an expression for the far field pattern in the xy plane ($\theta = 90°$).

   b. On a large circle of radius r in the far field, how does the phase of the field at ($\theta = 90°$, $\phi = 135°$) compare with the field at ($\theta = 90°$, $\phi = 60°$)?

   c. In the direction ($\theta = 60°$, $\phi = 90°$), specify the polarization in terms of the parameters:
      (1) Axial ratio
      (2) Orientation of major axis of ellipse
      (3) Direction of rotation

   d. How is the pattern modified if 1/2 wavelength dipoles are used instead of short dipoles? (Answer in a qualitative way.)

2. The aperture of the antenna for the world's largest radio telescope at Arecibo, Puerto Rico, is a circle with a diameter of 1000 feet. It is desired to measure directly the far field pattern at 8000 MHz. The allowable deviation from a plane wave front, across the aperture, is $\lambda/16$.

   a. What is the minimum range to an isotropic source antenna in space above the radio telescope?

   b. What is the approximate half-power beam width? (HINT: This is an open book exam and there is a Chapter 12 in the Textbook.)

3. The National Radio Astronomy Observatory (NRAO), about 50 miles west of Socorro, New Mexico, features a Very Large Array (VLA) which will eventually have 27 antennas. Each antenna is a parabolic reflector with an aperture diameter of 82 feet. The individual parabolic reflectors are connected in interferometer pairs whose outputs will be combined by the computer. As one possible configuration, consider two antennas separated 12 kilometers along the baseline and connected in phase at a wavelength of 6 cm.

   a. Outline a procedure for finding the pattern of the array.

   b. Using equations already derived in the textbook, write an equation for the relative far field pattern.

   c. What is the approximate half-power beamwidth of a single 82 foot parabola?

   d. What is the approximate half-power beamwidth of the array of two parabolas?

BEST WISHES FOR THE FUTURE!

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NOEL
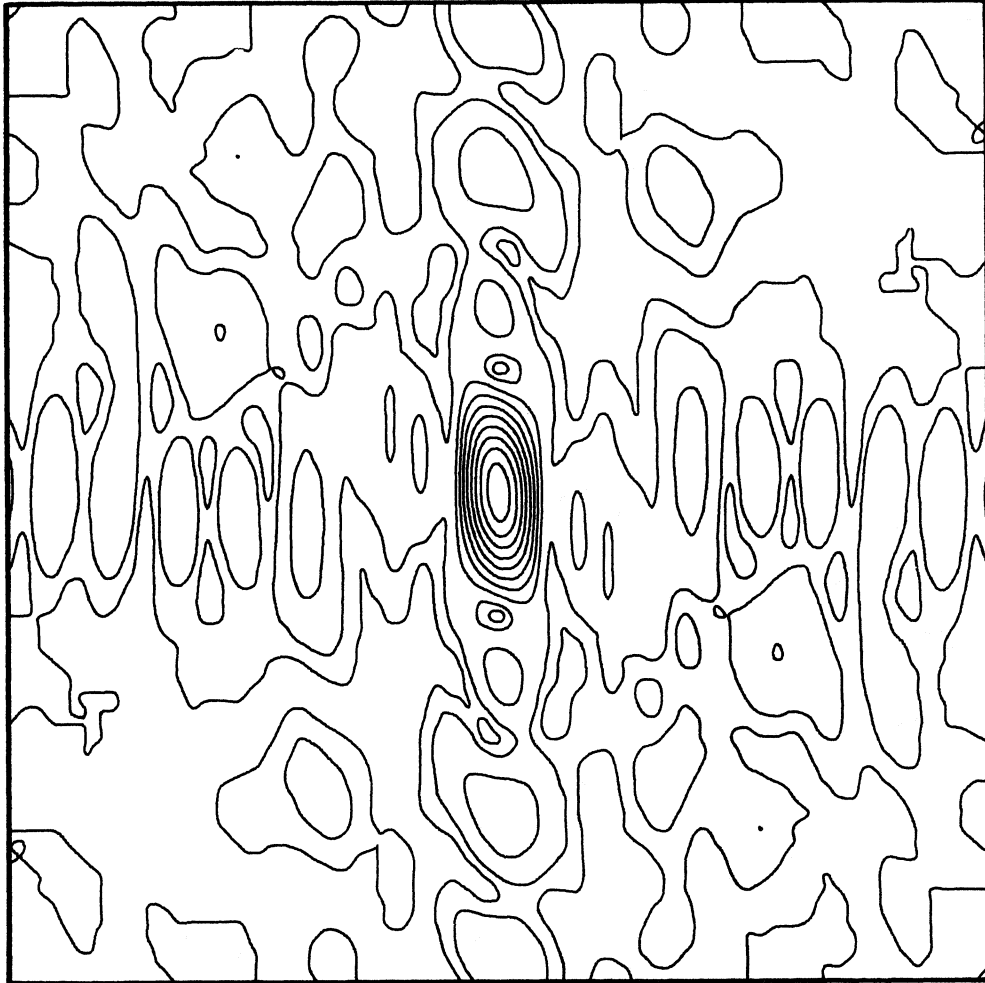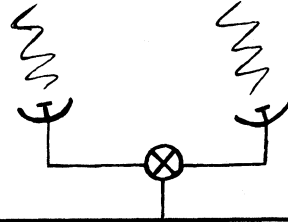
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