

The O B S E R V E R

Vol. 12, No. 5

September 1971

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Future Sprint Stars



Golf Driving Contest



Sack Race



Unexpected Guests



Chow Line



Prize Winners

N R A O R A P I C N I C 1 9 7 1

Story on Page 2

GREEN BANK PICNIC

Richard Fleming

The annual NRAORA summer picnic was held Saturday, August 14, at the Recreation Area in Green Bank. The attendance at this gala affair was something in excess of 300 people and, from what my reporters say, fun was had by all. One roving reporter said that the people he interviewed and observed all enjoyed the games, activities and late pool hours. One person said he had never seen so many prizes as well as happy prize winners. Another person said that the food was great while still another (who still seemed to be chewing something) said the food was the best ever.

All in all, the picnic was a great success and enjoyed by everyone. Many thanks to Bill McLaughlin and the girls at the cafeteria for the great food that was available. Special thanks go to the board members who planned and organized the picnic this year and especially to Dorman Williams, Carl Davis, George Liptak and Dave Williams.

Two special prizes were given this year to lucky number holders. Marilyn Gum won the first prize, a Panasonic AM/FM clock radio. Mrs. High won a Coleman Thermos for second prize.
(For other contest winners see pages 15 and 16).

A special thanks to all of those who helped assemble the OBSERVER.

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INTERSTELLAR MOLECULES

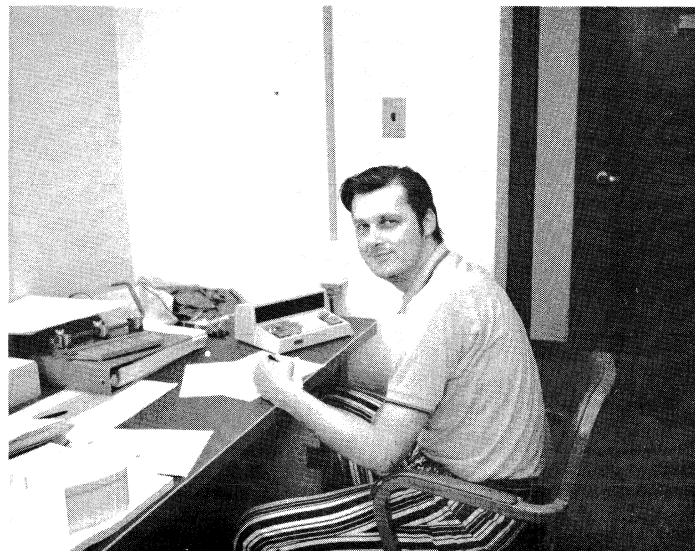
Barry Turner

Two years ago, when Lew Snyder wrote the last Observer article on this subject, there was little to report on outside of the then-recent discovery of interstellar formaldehyde. Only hydroxyl (1963), water and ammonia (1968) were otherwise known at that time at radio frequencies. Over the past two years, the revolution which Snyder predicted has indeed come about - 19 molecules have been definitely identified at radio wavelengths, another 3 or 4 radio lines are known which are still unidentified, and molecular hydrogen, H_2 , was discovered last year in the far-ultraviolet region by means of a WV rocket camera.

Two important directions have been taken in the discovery of all these molecules. The first direction is that of ever-increasing complexity of the organic (carbon-containing) molecules; the heaviest interstellar molecules at present are cyanoacetylene (HCCCN), formamide (NH_2CHO) and methylacetylene (CH_3CCH), and the last one also contains the most atoms - seven. When molecules get this complicated it is quite certain that they must have formed in gas clouds whose densities are much higher than astronomers would have suspected possible until recently; it also means that more complicated species yet must exist. The other important direction is the discovery of molecules containing atoms other than C, N, O, and H, which are the four cosmically most abundant atoms. The first of these, carbon monosulphide (CS) was discovered by the Bell Lab group as recently as February of this year; since then, silicon monoxide (SiO) and carbonyl sulphide (OCS) have been found. When one works out the abundances of these species, the interesting thing is that they are much less (about 10,000 times less) than the corresponding molecules that contain only H, C, N, O. It appears, therefore, that the simple organic molecules like formaldehyde (H_2CO), carbon monoxide (CO), and hydrogen cyanide (HCN) are much more abundant than we would have expected from their constituent atoms alone; some formation process is greatly favoring the simple organic molecules over all other kinds; even such simple non-organic species as hydroxyl (OH) and ammonia (NH_3) appear to be

somewhat underabundant by comparison.

Until recently, a major problem for astronomers engaged in studying interstellar molecules was that very little was known in the laboratory about how these molecules break up under the action of the ultra-violet light that pervades all of interstellar space, except the dense dust clouds. Also, nothing much is known about how these molecules form in the very rarefied gas of the interstellar medium which would not support the type of gaseous chemical reactions that occur in laboratory experiments. It has long been thought that interstellar molecules must form by having their separate parts come together on the surfaces of interstellar grains (solid particles) and stay there long enough to form bonds with each other and produce the molecules. The problem is that one must know what the grains are made of, and what is the physical state of their surfaces (temperature, chemical properties, whether they are smooth or pitted) before one can decide which molecules can be made in this way and how fast they can be made. Unfortunately, almost nothing is known of the nature of interstellar grains.



Barry Turner

Continued, next page--

Luckily for the astronomers working on interstellar molecules, chemists and physicists at several institutions (National Bureau of Standards, NASA, and several universities) have started trying to solve some of the problems in the laboratory. Probably the most important result so far has been the discovery that under radiation fields that simulate the known interstellar environment outside dust clouds, the interstellar molecules break up much faster than was previously believed. This proves that the molecules must exist pretty much only inside these relatively dense clouds, where they are shielded from the damaging radiation. Furthermore, they must have been created inside these clouds, because they could not survive a passage through the space between the clouds. Other important experiments have recently been done on the formation of molecules. Some of these experiments start with the very simplest molecules (H_2O , H_2CO , NH_3 , CH_4) in conditions that attempt to simulate primitive earth conditions. The more complex molecules that are found to form in these gas-phase experiments are in many cases just the molecules that are found in the interstellar medium, even though the environment is drastically different. Other recent experiments have investigated how molecules form on solid surfaces under the action of ultraviolet light. Again it is found that many of the interstellar molecules are the ones that form in greatest quantity. It is a long way from these experiments to a full understanding of just what makes some of these molecules form so readily, but at least we know that in order to explain the interstellar problem we must explain why certain chemical paths dominate others under a wide range of conditions. And we can use the results of these experiments to predict new interstellar molecules.

It is only by studying several different lines from several molecules that astronomers have been able to determine fairly directly some of the physical conditions inside interstellar clouds. Temperatures are found to range from about $3^\circ K$ to nearly $100^\circ K$ ($-450^\circ F$ to $^\circ F$), while particle densities go from about 1,000 to about 10,000,000 particles per cubic centimeter, a density only slightly below that produced terrestrially in high-vacuum equipment. This picture is a long way from the old one in which the space between

the stars was thought to be empty.

What does the future hold for interstellar molecules? For most of the large interstellar molecules we are presently working at the limits of sensitivity for telescopes and receivers. Improvements, particularly in receivers, at wavelengths less than 1 cm will provide the best chance for detecting many more molecules. Only in the last three months has it become clear that the millimeter wave lines of many interstellar molecules are surprisingly strong relative to the centimeter wave lines; this means that they are more highly excited than was expected. For this and other reasons, millimeter wave radio receivers have a potential increase in sensitivity of between 10 and 100 over centimeter wave systems. The next few years should see an enormous increase in the list of interstellar molecules, particularly the millimeter wave lines. In this wavelength region lies the best chance of detecting molecules such as amino acids, long chain sugars, nitriles, and other prebiotic molecules. The most important question to answer in these next few years will be: What is the dominant chemistry and physics of the cool interstellar clouds which contain the molecules? It appears that understanding the cool cloud chemistry is related to understanding the chemistry of the primitive earth experiments; this in turn may be related to understanding the origins of life.

OBSERVATORY TOURS

The number of visitors to NRAO this year is running a little over 5000 ahead of last year. By August 29, 22,288 people took the tour. There is no doubt that 1971 will be our biggest tour year.

Three new records have been set so far and they occurred in the week ending August 15:

Total visitors for one week: 2,731
Average number of tourists per day: 390
Highest one day registration: 626 (8/15)

RECENT CHANGES TO RADIO FREQUENCY
ALLOCATIONS FOR RADIO ASTRONOMY

W. E. Howard III

During June and half of July 1971, there was a World Administrative Radio Conference held in Geneva, Switzerland, sponsored by the International Telecommunication Union for the purpose of reviewing and changing world-wide frequency allocations for all the radio services having to do with space telecommunications. Over 750 delegates from approximately 140 countries met at this conference and a number of changes were made that affect radio astronomy. Large conferences such as this are held every 8 to 10 years, the last two being held in 1959 and 1963. I would like to summarize here the changes that have occurred to the allocation table that affect radio astronomy. Prior to the conference, each nation develops its position and tries at the time of the conference to have that position prevail among the other delegations. I was one of the 46 delegates from the United States and one of two radio astronomers in our group. Let me now summarize some of the changes that will occur, effective January 1, 1973.

First, starting from the low frequencies and working higher, the guard bands at the standard frequencies 2.5, 5, 10, 15, 20 and 25 MHz were allocated in the past to radio astronomy but we have never fully utilized these guard bands and the bands were deleted. In their place a band from 21.850 to 21.870 MHz was exclusively allocated to radio astronomy. In the band 151-153 MHz the radio astronomy service was added as a primary service in Europe, the allocation to be shared with the fixed and mobile services, with meteorological aids as a permitted service.

In 1963 at the time of the last conference, there was a report that the deuterium spectral line of heavy hydrogen had been detected at 327 MHz but in the intervening eight years the line was not confirmed. A 1963 footnote to the allocation table which gave protection to the line in a frequency range 322-329 MHz was reduced slightly to 322-328.6 MHz.

In the old allocation table there were two bands that radio astronomers used near 400 MHz. They were not the same bands, how-

ever, in the western and eastern hemispheres. At the 1971 conference the radio astronomers received better overall protection by deciding on a common frequency interval, 406.1 to 410 MHz. The old footnote was dispensed with and the allocation now shows in the main body of the table with radio astronomy as a primary service sharing the band equally with the fixed and mobile services.

A number of new footnotes will appear in the new table that will give added protection to recently discovered radio spectral lines and will add to the continuum bands already allocated for radio astronomy. I have listed a number of these in the following table.

<u>Frequency Band</u>	<u>Spectral Line or Continuum Band</u>
1350-1400 MHz	Red shifted neutral atomic hydrogen line
1611.5-1612.5 MHz	OH satellite line (1612.231 MHz)
1720-1721 MHz	OH satellite line (1720.533 MHz)
1664.8-1668.4 MHz	OH primary lines (1665.401 and 1667.358 MHz)
2670-2690 MHz	Addition to 11 cm continuum band
4825-4835 MHz	Formaldehyde (4829.649 MHz)
4950-4990 MHz	Addition to 6 cm continuum band
5750-5770 MHz	Hydrogen recombination line (5763 MHz)
14.485-14.515 GHz	Formaldehyde (14.48865 GHz)
22.21-22.26 GHz	Water vapor (22.23508 GHz)
31.2-31.3 GHz	Addition to 1 cm continuum band
36.458-36.488 GHz	Hydrogen recombination line (36.466 GHz)
115.16-115.38 GHz	Carbon monoxide (115.271 GHz)

Continued, next page--

In the 1660-1670 MHz band, the status of the radio astronomy service was increased from secondary in the band 1664.4-1668.4 MHz to primary co-equal with meteorological aids throughout the 10 MHz involved and meteorological satellites were deleted from the entire band. Air to ground transmissions in the meteorological aids service will be removed from the band 1664.4-1668.4 MHz as soon as practicable.

In the band 10.68-10.70 GHz, the radio astronomy service continues to have an exclusive allocation in all regions of the world. In the adjacent band 10.60-10.68 GHz, an allocation for radio astronomy was added throughout the world with co-equal primary status with the fixed and mobile services, the radio location service being secondary.

Before the conference, radio astronomy had an exclusive allocation in the band 19.3-19.4 GHz. This band was deleted but a higher frequency band was exclusively allocated to radio astronomy in the region 23.6-24.0 GHz. This is a better allocation, in that it is broader in frequency and also protects a group of discrete ammonia spectral lines.

For the first time allocations were made for frequencies above 40 GHz. Three new allocations were made for passive use (radio astronomy and passive space research). These new allocations cover the bands 86-92 GHz, 130-140 GHz and 230-240 GHz. These bands will all be most useful for observing millimeter wave spectral lines. They lie in the minima of the atmospheric absorption and will be also the best window for ground-based continuum observations.

Two recommendations were made by the conference. The first, proposed by Canada, dealt with the low frequency region 10-15 MHz looking toward a possible future need to clear a 50 kHz band for exclusive use by radio astronomy. The second draft recommendation sponsored by the United States relates to the protection of radio astronomy observations on the far side of the moon. Specifically, this latter recommendation urges the C.C.I.R., an international committee which provides technical input to the ITU World Conference, to work out recommendations of the bands to be used for this purpose and requests various administrations of

nations throughout the world to protect passive observations made on the far side of the moon and urges them to adopt any recommendations that may be made by C.C.I.R. prior to the next World Administrative Radio Conference.

One of the principal problems that faces radio astronomy in the next decade results from the fact that satellite transmissions may now be used in services such as the fixed and mobile services that have heretofore been allocated bands for ground based transmissions only. Now that all services may use satellite transmissions, we are particularly vulnerable in any instance where allocations are made for satellite-to-ground transmissions in bands that are immediately adjacent to radio astronomy bands. If this should occur, radio astronomers will undoubtedly experience intolerable levels of harmful interference from spurious emissions from these satellites in the bands that are already allocated to the radio astronomy service. For example, an allocation was made at the 1971 Geneva Conference for satellite-to-ground transmissions by the broadcast satellite service in the band from 2500 to 2690 MHz. This band may be used in the future by educational T.V. and, since the signal levels from the satellite must be high enough to be received on the ground by very small dishes located on the roofs of grammar schools, radio astronomers who are observing with very sensitive receivers may be exposed to interference in the 11 cm band caused by spurious emission from these satellites.

In general, radio astronomy still lacks adequate low frequency allocations, particularly in the region between 74 and 406 MHz. The problems of frequency sharing with other services are quite substantial, particularly at frequencies below about 700 MHz where long distance interference problems are most acute. Nevertheless radio astronomers are under great pressure to share their bands at lower frequencies. In summary, while the 1971 conference recognized and was responsive to the requirements of radio astronomy, at a time when competition for spectrum resources is extremely keen among the terrestrial and

Continued, next page--

space telecommunication services, we will still have to be continually on our guard in order to protect the allocations we now have. Fortunately, the National Academy of Sciences is keenly aware of the problem and there are a number of radio astronomers who are involved in committee work designed both to protect existing allocations and to press for increased protection and allocations for radio astronomy. One academy committee, the main one, is CORF (Committee on Radio Frequencies), chaired by John Findlay. CORF has three subcommittees, one for the biological sciences, one for space sciences, and one for radio astronomy, the latter one being chaired by me. Through this committee structure, scientists throughout the United States can make their desires known to the National Academy of Sciences which, in turn, makes these needs known to the Office of Telecommunication Policy in the Executive Office of the President. It is at this level where the United States' position is firmed up during the next decade prior to the next World Administrative Radio Conference.

Fortunately, radio astronomers have a very good working relationship with the Office of Telecommunication Policy, the staffs of FCC and IRAC and we have every reason to believe that the official recognition and responsiveness to the needs of radio astronomy within the United States will continue in the future.

SAFETY

Jim Dolan

As some of you know, Congress has passed a far-reaching law (P.L. 91-569) known as the Occupational Safety and Health Act of 1970. This law became effective April 28, 1971.

Although State and Federal employees are not covered in the law, Federal agencies are directed to establish safety and health programs in accordance with the Act's standards. Presently it is not clear how this law will affect operations at the NRAO, but the NRAO Safety Committee is taking steps to comply

with the new law. As more standards are adopted and placed in effect, you will probably notice some changes in everyday operations.

In an effort to learn more about the new law and safety programs in general, the NRAO Safety Committee invited three safety specialists to visit the NRAO. On June 17, 1971, we were visited by

Col. C. E. Allard (Lt. Col., USAF, Ret.)
Executive Director
West Virginia Safety Council

Mr. Jim Stone
Director of Safety
Union Carbide, South Charleston, W. Va.

Mr. John Ramsberg
Highway Safety Specialist

Mr. Stone is an experienced safety man and he made a cursory inspection of our facilities. Mr. Stone was very polite but he wasted no time in pointing out a few of our short-comings. He also emphasized that off the job safety is as important, if not more so, as on the job safety. Most accidents happen to persons during off the job hours. Therefore, safety must be a 24-hour per day effort.



D. Hogg (left) and T. Williams with membership plaque presented by Col. Allard (right).

Continued, next page--

The new safety law was discussed in some detail and the NRAO Safety Committee profited from the visit. Col. Allard took the opportunity to present the NRAO a plaque marking membership in the West Virginia Safety Council. The photo portrays our illustrious leaders accepting the plaque from Col. Allard.

1971 JANSKY LECTURESHIP
AWARDED TO CHARLES H. TOWNES

The National Radio Astronomy Observatory announces the award of the Sixth Annual Karl G. Jansky Lectureship to Professor Charles H. Townes of the University of California, Berkeley. Professor Townes will deliver the 1971 Jansky Lecture at 8:30 p.m. on Monday, Oct. 4, 1971 in the Chemistry Building Auditorium on the grounds of the University of Virginia. The lecture will be a popular talk entitled "Exploring for The Creation" and will be open to the public.

A University Professor at Berkeley, Professor Townes received the Nobel Prize in 1964 for his role in the invention of the maser and the laser. Internationally known for his research on the interaction of electromagnetic waves and matter, and also as a teacher and government advisor, he is affiliated with the Department of Physics at Berkeley, carrying on research in astrophysics.

In 1968 Townes and his collaborators at Berkeley discovered radiation from interstellar molecules of water vapor and ammonia, an event that heralded a marked increase in the rate of molecular line detections during the past three years. Over twenty different interstellar molecules have now been discovered by radio astronomers and their work is attracting the interests of scientists from other disciplines, notably chemists and biologists. Professor Townes will deliver the Jansky Lecture in the evening of the first day of a three-day Symposium on Interstellar Molecules to be held in Charlottesville October 4-6, 1971 sponsored by the National Radio Astronomy Observatory and the University of Virginia.

The Jansky Lectureship, established by the Trustees of Associated Universities, Inc., and first awarded in 1966, was named in honor of the man who first detected radio waves from the Milky Way in 1931 while investigating atmospheric interference in radio reception at meter wavelengths. Previous recipients of this award have been Dr. J. G. Bolton of the C.S.I.R.O., Sydney, Australia; Professor J. H. Oort of the Leiden Observatory, Netherlands; Professor J. S. Shklovsky of the Sternberg Astronomical Institute, Moscow, U.S.S.R.; Professor F. Hoyle of the Institute of Theoretical Astronomy, Cambridge, England; and Professor R. H. Dicke of Princeton University.

ARCHEOLOGY SITE

Only a few miles from here is an interesting archeology site. Found several summers ago, this site may well be the oldest white settlement in Pocahontas County - predating Marlin's settling in Marlin's Bottom. Stacy Groscup, Methodist minister and amateur archeologist, discovered the site on lands formerly owned by Neil Hevener. Clue to the site discovery was an unnatural arrangement of rocks. Groscup said that excavation of the site indicated it was a group of three cabins occupied by French trappers about 1750. Evidence of French origin is in the form of parts of French-made flintlocks, utensils, and pottery.

Numerous arrowheads found in the old logs and chinking material almost conclusively prove that both trappers and cabins were destroyed by Indians.

NEWS ITEM FROM FISCAL

On July 1, 1971, Don Hovatter, Head, Fiscal Division, announced the promotion of Harry Fox to Chief Accountant. Congratulations, Harry!

STUNG BY A VLB

Paul Hemenway

During a few days in July and maybe one in August, perhaps you have seen the 85-1 and 85-3 antennas of the interferometer looking like a disjoint set of misplaced bird feeders - or perhaps the computer decided to make up its own mind for a change. Meanwhile, back at the Tatel, the zenith is under constant surveillance. Have astronomers lost their baseline? Was the NSF budget cut so badly that we now have to look at as many sources as possible at once? The outcry is heard: "But that's artistically unpleasing." Bear with us for the situation is generally under control and we will elucidate our position in relatively short order.

The solution to the mystery of the misguided telescopes is that the interferometer is still doing interferometry but this time it is doing intracontinental VLB interferometry with the interferometer at Owens Valley in California. The purpose is to determine accurate positions of a few (extragalactic) radio sources so we can study the rotation of the earth more accurately than is presently studied. We need two long baselines to get rid of the clock difference between ends. This is not a technical article so we'll save the details for another time.

Now perhaps you've considered the problems relating to the set up of these experiments too trivial to consider, all things considered; unless, of course, you've had to set up and coordinate two groups simultaneously at a distance, in which case you don't want to consider it... Well, anyway. Consider one of our recent runs. On August 2-3-4 a four-antenna experiment (as these dual interferometer observations are called) was to be run at 21 cm between Green Bank (hereafter GB) and Owens Valley (hereafter OVRO). Until the beginning of this run I had never been involved with the scheduling of an experiment. The events and situations which occurred started about a week before the run (on a Monday) and are outlined as follows: (Before we start, between every continental phone call insert a sentence which reads: "_____ (We or They) called _____ (them or us) but _____ (they or we) were

out to eat because it was _____ (lunch, coffee-break, or dinner) time in _____ (OVRO or GB).")

1) This particular 4-antenna experiment was not in the original schedules for GB or OVRO.

2) Dr. Hogg called Dr. Seielstad and the following was agreed upon:

a) we would start at 8 AM Monday morning OVRO time (11 AM here);

b) we would run for 48 hours with an 8 hour maintenance period starting at 8 AM Tuesday GB time. See Figure 1-A. However, this meant taking the 48 hours from Dr. Muhleman who was scheduled for that time (but who is responsible for at least some of the 4-antenna experiments at the OVRO end).

3) One P. Hemenway composed an observing schedule for those 2 days minus 8 hours and sent it to Dr. Muhleman.

We should note at this point that for an astrometric project of this nature, one should have observations at the beginning and end of the run which duplicate each other, to tell how much things have changed since the beginning, using exactly the same source configuration. We call this overlap "closure". In our case it means we would like at least 25 hours of continuous observation, but in fact we return to some of the same sources, but not in the same configuration, before 24 hours are completed, so we obtain a kind of "weak" closure with only 24 hours observation.

To continue with the events:

4) I received a call from Dr. Muhleman in which he said that my schedule was fine, but he was going to give up only 24 hours from 8 AM Monday to 8 AM Tuesday OVRO time for the project. See Figure 1-B. I asked if we could have an extra hour and he asked how badly we needed closure and I said I wasn't sure and he said he thought it wasn't important we could have only 24 hours, as indicated. I said if that's all he'd give us that's all we could get so thank you, good bye.

5) I consulted Dr. Hogg because that cut into 3 hours of the scheduled

Continued, next page--

maintenance. He said we could have the first hour without difficulty, the second would take some talking, and the third was probably impossible. We decided to try to get the 3 hours (to make a total of 24 - from 8 AM Monday to 8 AM Tuesday GB time - 5 AM to 5 AM OVRO time) so we wouldn't run into the maintenance schedule on Tuesday.

6) Dr. Clark called Dr. Muhleman to see if he would give up 3 hours earlier and take 3 hours later. However, the result of that call was that it wasn't his three hours to give but Dr. Gottesman was scheduled on the OVRO interferometer at that time.

7) I called Dr. Gottesman at OVRO and asked if he would give us the 3 hours so we could get even the "weak" closure, which I think is vital to our project. Now, asking for somebody else's time when they are not connected with your project is a bad thing to do because if they say no they may be mad at you for the rest of your life for just asking, and if they say yes you will be indebted to them for all eternity or at least until you can pay back the favor in kind, which may be never. Well, he didn't want to give it up but he said since he was going to use that time for calibrating and because of the dire nature of our plea he would consent to let us have the last 3 hours of his run.

8) Then I talked to Dr. Heiles who was on the interferometer during those 3 hours (8 AM to 11 AM Monday GB time) and proposed a monstrous trade: if he would give us the 3 hours before our run, we would give him a full 19 hours from 1600 Tuesday to 1100 Wednesday (when the first original schedule ran out, a net gain of 2/3 of day including 3 hours at the same time of day as the 3 hours he would lose. He accepted like a hungry shark.

So Friday I left on the shuttle for a day in Charlottesville with the schedule all arranged. See Figure 1-C.

Meanwhile, back at the ranch (GB), Dr. Matveyenko, a famous Crimean astronomer visiting to reduce a VLB run to the Crimea, heard of the run about to take place. Now Dr. Matveyenko has a passion for the Crab Nebula, so he asked if we could stick in a few minutes (60) to look at it. After a long conference with Dr. Kellermann (just back from CCCP, he didn't know what he had come back to), we convinced Dr.

Matveyenko that all the time was necessary for the positional measurements. However, after pleading, cajoling, and various methods of arm twisting, he talked Dr. Kellermann into calling Dr. Muhleman to ascertain if the Crab could be observed for an hour after the run was over. I said fine, call Dr. Muhleman, but leave my name out of the discussion, and don't jeopardize the time we already had. Dr. Muhleman was called and apparently the result was as before, i.e., we had gotten all the time we were going to get.

9) On arriving in Charlottesville I found I had had an urgent phone call from Dr. Gottesman so I tried to return the call by FTS without success several times. Meanwhile, Dr. Gottesman had called Dr. Howard who subsequently told me that Dr. Gottesman was trying to reach me. I finally "went commercial".

9.5) I reached Dr. Gottesman to find that they had a massive equipment failure and he needed his three hours (8 - 11 Monday morning, GB time) back when they went on the air again. What can you do?

10) Friday afternoon Dr. Clark called Dr. Muhleman and procured 3 hours, 8 - 11 GB time Tuesday, to make a full 24 hours.

11) Then, about 5 PM GB time Friday Dr. Hogg talked to Mr. Howell about maintenance and they decided that maintenance could be split into 2 days, 5 hours Tuesday (1100 - 1600) and 3 hours Wednesday (8 - 11).

12) Dr. Heiles was informed of the revised latest most probable updated schedule See Figure 1-D.

13-naturally) The run was begun at 11 AM EDT Monday, August 2. Observations were begun (because of the almost inevitable equipment problems of setting up) about 2 hours later, which gave us almost a complete 5 minutes of overlap on one source at each end of the run and a 5/1440 probability (24 hours contains 1440 minutes of even "weak" closure.

Thus ended my initiation into the marvelous world of VLB scheduling beyond the

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Official Solidified Schedule, by committee, but one person at a time. Perhaps if I recover from this attack of telephonia, you may read of the results in a future issue.

GREEN BANK OBSERVATORY

Ann Coffman

Green Bank, West Virginia
 home of man-made steel structures
 Used as gigantic ears to
 discover treasures of the sky,
 But to many they appear only
 as one-eyed monsters
 Winking brilliantly at them
 passing by.
 Astonishing sights probing
 into outer space,
 They seem to mutter all
 to themselves
 Will we be the first to win the race?
 To discover what is way
 out yonder
 God has already told us about,
 So!, the labores within
 are always watching
 And listening for a falling out.
 From the sisters of the Milky Way
 A pathway of stars they
 sprinkled there,
 While skipping through the heavens
 Losing their silver slippers in the air,
 Breath-catching hums to a listening ear
 Brings a joyful reunion between
 God and man - for -
 Watching His heavens, He draws us near.

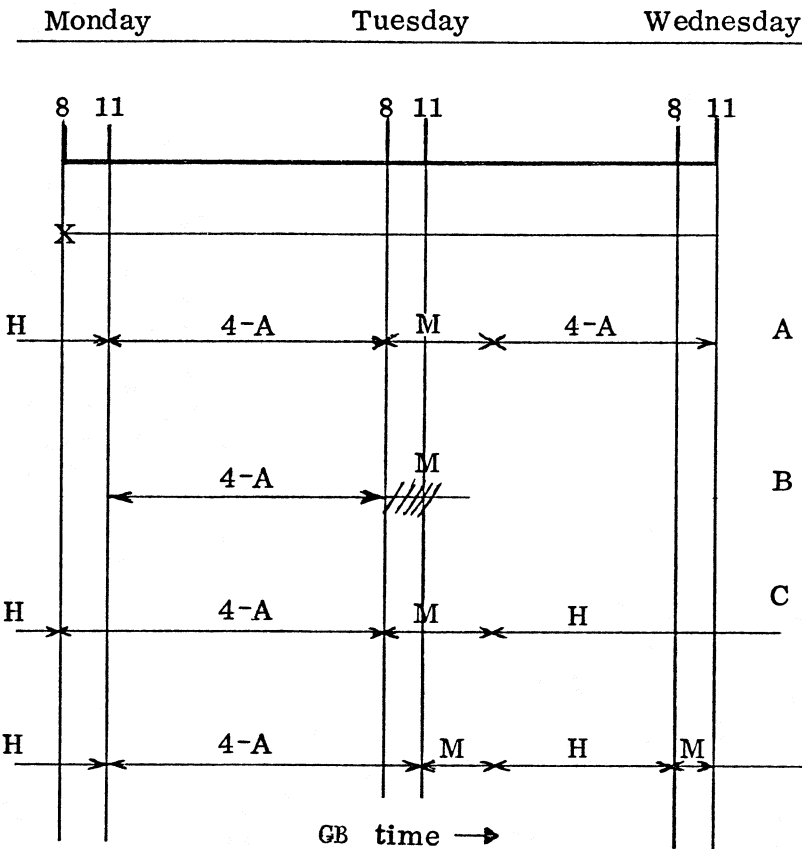


Figure 1: The Schedule at Various Stages

Old Astronomical Proverb:
 "He who sticks not to the schedule,
 often misses the boat."

Editor's note: Shouldn't that be?
misses the source.

FOUND

Found: -Knife-owner may claim by identifying knife. Call Wally Oref on Extension 270.

HELP! Wanted: Cartoon ideas... Articles: funny ones, controversial ones, newsy ones, and others.

HAIL STORM

Wally Oref

About 8:30 p.m. on the night of July 21, 1971, three members of my family and I experienced an unusual hail storm that hit the Green Bank area. The storm was unusual in that apparently the severest part of the storm was of very limited extent and by the large amount of three-eighths inch hail that fell and by the deep accumulations of hail stones that occurred.

The storm, as best I know, started in or near the vicinity of Slavin Hollow (formerly traversed by the Old Hosterman Road) about 8:30 p.m. on the night of July 21. As far as I know, probably the first and hardest hit house was our house, the old Hardy House, at the mouth of Slavin Hollow. I and three of my children were at home when the storm hit. The following is what I recollect of the storm: "About 8:30 p.m. the sky became quiet and very dark. A few minutes later winds began to gust and rain started to fall. Ten or fifteen seconds later, a terrific wind raged and rain began coming down in torrents. With the wind and rain, hail came down in almost unbelievable quantities, pelleting our house and yard. At the same time lightning flashed continuously and the thunder sounded like repeating explosions of dynamite. In a matter of minutes the wind's intensity forced rain into cracks along every window on the northern side of the house, and half-flooded three rooms. One sill over a door, almost in the middle of the house, leaked water for five minutes.

Outside the hail rapidly piled up in the yard. Within five minutes I estimated the hail had covered our yard and all the area I was able to see to a depth of several inches. By the time the storm passed over, about 3 inches of hail covered the same area. Elsewhere during this time some unusual hail accumulations were taking place. Along the north side of the house, hail piled up against the house like drifting snow. Some of these piles, measured after the storm was over, were a foot deep. At the bottoms of drain spouts, hail piled up in cones. Some cones were 8 inches deep and 2 1/2 feet wide at the base. The cones reached up into the drain spouts.

Shortly after I saw the hail piling up to the drain spouts, I went upstairs to look out the window. When I looked out the window, I saw that all the gutters were already filled with hail and about six inches of hail stones laid on flat roofs over the porch. It was from here that I first saw my garden. I could hardly believe my eyes. The plants in the garden were beaten to almost beyond recognition and several inches of hail laid all around the plants.

Below the driveway and at several other places, piles of hail accumulated in snow-like drifts. One such pile at the bottom of our driveway, 12 feet long and 7 feet wide, was over a foot deep. One of the pictures shows me standing in this same hail pile 12 hours later. 20 hours later you could still see some of this pile of hail. In about



Wally Oref examines hail stones that accumulated below his driveway. Picture taken 12 hours after storm.

20-25 minutes it was all over.

The next morning I went out and looked at my garden. The hail storm had beaten my garden to death. Corn leaves were shredded and looked like a bunch of limp mops. The stems of my tomato plants were scarred, broken, and stripped of all their leaves. Little green tomatoes were scattered all over the place. Cabbage leaves were torn

Continued, next page--

into small pieces and some of the heads ripped apart. Of the cucumbers, no leaves were left on the vines and the cucumbers were almost peeled ready for the table.

From a whole row of young leaf lettuce, I could not find one whole leaf. And so it was for almost everything in the garden. In probably a little over 15 minutes my garden



This was one of the better-looking squash plants.

I really don't understand why this storm was confined to such a limited area. For instance the 140-foot telescope is only 2500 feet away from our house and all it got was a little rain and a scatter of hail stones. In the vicinity of the 300-foot road coming west from the grade school, no hard hail was encountered until the second sharp right angle turn. Evidence indicates the path of the storm was in a southeast direction, for the interferometer building was hit very hard by the same storm. The interferometer building is one mile to the southeast of our house. No reports of a violent hail storm were reported in the Green Bank area. For reasons unknown the storm missed Green Bank. Probably the last people hit by the same storm were people living in the Wesley Chapel area.

In retrospect.... I wonder if someone up there wasn't trying to tell me something.

DOWN, DOWN AND AWAY ON PIPESTEM'S NEW TRAM

PIPESTEM, W. Va. -- A ride on Pipestem Resort's new 3,600-foot tramway is a necessity for those staying or meeting at its just-opened Mountain Creek Lodge, situated at the base of Bluestone Gorge. But the tram also is a pleasure trip for anyone visiting the state park resort who wishes to enjoy the six-minute ride down through the dogwood and over the shoals of Bluestone River 1,000 feet below. Visitors also can shop and dine at the Visitor Center, departure point for a tram ride or wait and enjoy one of the specialties of the steak house restaurant in Mountain Creek Lodge.



Gondolas travel new Pipestem Tramway

The 18-gondola tramway is one of the newest features of West Virginia's newest state park. With the opening of Mountain Creek Lodge, Pipestem Resort can house up to 400. All visitors to the park, even if just for a day, can take advantage of the championship 18-hole and 9-hole golf courses, the mountaintop Olympic and indoor pools, horseback and bicycle rides, any one of the five restaurants, and the several gift shops.

"WHAT'S ALL THAT EARTH MOVING ABOUT"

Thomas Williams

We have been asked this question relative to work the Maintenance Division has been doing this summer. We have been moving some earth on three projects.

One has been the excavation for the addition to the 300' Control Building. This project, under contract with Bradley, Garrett and Roberts Construction Company, is making progress which will provide a far more suitable Control Building than the original building has provided for the past three years. Due to the expansion of programming on the 300' telescope, the original building has been crowded for room for some time.

More recently, we have been "moving earth" behind the Laboratory Building in preparation for the erection of electronic test facilities there. Progress has been evident recently on this job, and soon the erection of a steel tower will make this progress more evident.

Perhaps the question of "Earth Moving" was more specifically directed toward our third such project.

This has been a lower priority project and explains the elapse of a longer period of time since we started on it in the spring. This refers to the work being done along the sides of the main road from the Guard House to a point beyond the gate at the Works Area Building. The purpose of this project is to eliminate the hazard of the deep ditches, reduce the maintenance work required and to improve the appearance along the main road. The excess earth is being used to widen the narrow entry road into the 85'-1 Control Building and the Whistler Building.

The project is about 50% completed, with the north side ditch being eliminated. The wet weather has hampered us a little in getting the south side completed, but it will be completed before the cold weather arrives again.

LETTER TO THE EDITOR

"The Observer"

The undersigned was shocked, humiliated, and embarrassed; our characters have been defamed and our integrity impugned, following the publication of a certain "cartoon" (Webster's Seventh New Collegiate Dictionary - "a satirical drawing), satirical (same source) "a literary work holding up human vices and follies to ridicule or scorn") in the last issue of "The Observer".

We were moved to take legal action against The Observer, the Editor, the Guest Editors, and the "Originator" of the "cartoon idea", and consequently consulted our attorney-at-law. After considerable consultation and soul-searching thought, we were prevailed upon by our attorney to take this alternate means of redress. We will take no further action and will consider the matter a closed incident if this letter, together with an editorial apology, is published in the next "Observer", stating unequivocally that there was no basis in fact for the implied action of the undersigned in the so-called "cartoon" and that there was no malicious nor malevolent intent in the publishing of the "cartoon".

Very truly yours,

T. Williams
S. C. Smith

EDITOR'S APOLOGY

Gentlemen:

Your letter has been duly published as part of our humble apology. The Editor, Publishers, Editorial Board, and Staff in no way intended to cast aspersions on the authenticity of your honesty or to take a side swipe at a nationally popular game. We

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NRAO PICNIC CONTEST EVENTS AND WINNERS

Sex	Age	Event	Prize	Winner(s)
Male	16-18	100-yard Dash	Exerciser/Chest Pull	Rusty Taylor
Female	8-9	Sack Race	Sewing Chest	Melinda Crist
Male	10-12	Football Throw/Kick	Football	Gart Westerhout
Female	6-7	25-yard Dash	Cosmetic Kit Chalk Board	Tina Taylor Lois Hogan
Male	7-9	50-yard Dash	Wacky Wheel	Danny Dolan
Female	15-18	Sack Race	Make-Up Set	Sandy Lambert
Male	5-6	Ball Throw	Tonka Loader Hard Hat	David Liptak Carl Behrens
Female	8-9	50-yard Dash	Watch	Amber Ralston
Male	13-15	Football Throw-Kick	Football	Mike Smith
Female	12-14	75-yard Dash	Badminton Set	Karen Wade
Male and Female	19-88	Wheel Barrow Race	Hand Warmer Kitchen Clock	Bob Crist Cathy Crist
Male	3-4	Ball Throw	Dump Truck Sea Plane	Michael Eskanazy Adam Van Horn
Female	3-5	25-yard Dash	Blocks Doll	Michelle Cassell Michelle Balister
Female	19-88	50-yard Dash (egg and teaspoon)	Electric Razor	Louise Collins
Male	13-15	100-yard Dash	Basketball and Net	Gary Cassell
Female	15-18	75-yard Dash	Pen	Charlotte Beverage
Male	16-18	Football Kick/Throw	Basketball	Bob Beverage
Female	12-14	Sack Race	Dymo Label Maker	Debbie Smith

Continued, next page--

Male	10-12	75-yard Dash	Rod and Reel	Roger Wilson
Female	10-11	50-yard Dash	Badminton Set	Elizabeth Hawkins
Male	7-9	Sack Race	Rod and Reel	Brian Waslo
Female	6-7	Ball Throw	Design Machine Frisbee	Tina Taylor Lois Hogan
Male	5-6	25-yard Dash	Marble Game Chalk Board	Robbie Houch Michael Carpenter
Female	10-11	Sack Race	Dymo Label Maker	Debbie Ralston
Female	19-88	Sack Race	Poly-Perk (coffee pot)	Emily Chestnut
Male	3-4	25-yard Dash	Stump Jumper Wooden Beads	Adam Van Horn Anthony Westerhout
Female	3-5	Ball Throw	Bonnie Beauty Shop Doll	Michelle Balister Johnna Ralston
Male and Female	19-88	Egg Throw	Tackle Box Electric Can Opener	Wally Oref Caroline Cassell
Male and Female	0-2	Pick Up Golf Balls	Alligator Loco Step Stool	Stuart Horner Karen Eskanazy Tamara Sharp
Male	19-88	Golf Driving- Distance- staying within area 75 yards wide.	Thermos	Herman Coleman
Male	19-88	Golf Driving- Accuracy- closest to 150 yard marker	Coleman Gasoline Stove	Bob Crist

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Continued, from page 14 --

intended, and hoped, only to bring a little humor into the lives of our employees. We try so very hard not to infringe upon the feelings of others, but in these trying days of gardening and picking berries, it is not easy to do. Herewith, as Editor, I solemnly

swear that no more poker cartoons depicting known poker players will appear in "The Observer" before one or the other of you retire. Bless you, sirs, and I hope you win next week.

- The Editor

LIBRARY NEWS

Virginia Van Brunt

ADCOMSUBORDCOMPAC.... What is it? Looks like someone's fingers were on the wrong line of the typewriter. However, these letters are the Navy's short-form name for Administrative Command, Amphibious Forces, Pacific Fleet, Subordinate Command. How do we know? The library has a new reference book called ACRONYMS AND INITIALISMS DICTIONARY which contains over 80,000 cryptic abbreviations, which mean something to some people, but maybe not to others.

Some foreign meanings for a few familiar abbreviations include: NRAO... Navy Regional Accounts Office; GB... Gall Bladder, Great Britain, Greenish Blue; CV... Continuously Variable, Control Van, Chief Value, Check Valve... not to mention NSF... "not sufficient funds." - and the Zip in Zip Code which stands for Zone Improvement Plan.

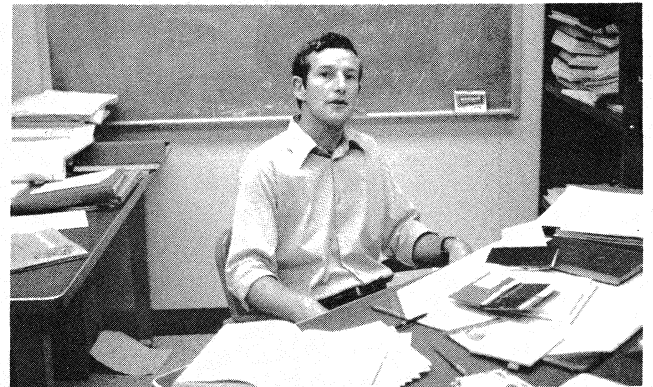


After being called for the nth time about standards and specifications, perhaps this is the place to spread the word. Yes, indeed, there are standards galore, and we can get them all - MIL-SPECS, NFPA, ANSI, ASIS, IEEE, ISO, whatever alpha combination you find, we can identify the organization from the directory above. I have several catalogs and lists, and if we haven't got the one you need, we can get it. All it takes is one phone call, we may even have it already.

And if you are planning a fall holiday and want to know where to stay... We have just bought the HOTEL AND MOTEL REDBOOK, which is a directory of the membership of the Hotel and Motel Association, and provides a rather good guide to lodging possibilities around the country.

NEW EMPLOYEES

Dr. Donald C. Backer, Basic Research
Victoria L. Taylor, Admin. Services
Terry Richardson, Admin. Services
Wayne K. Shuman, Central Shops



Dr. Anthony R. Kerr, Electronics

REHIRES

Claude N. Williams, Scientific Services
Dr. Robert W. Haas, Electronics
Keith H. Johnson, Tucson Operations
Lloyd H. Taylor, Plant Maintenance

TERMINATIONS

Marjorie H. Andrews, Basic Research
Dr. Takenori Nakano, Basic Research
Dr. Eugene H. Tadamaru, Basic Research
Dr. Richard N. Manchester, Basic Research
Dr. John S. Broderick, Basic Research
Dr. Hugh S. Murdoch, Basic Research
Dr. Stephen T. Gottesman, Basic Research
Dr. Thuppalay K. Menon, Basic Research
Barbara A. Manchester, Basic Research
Maxie A. Gum, Central Shops
Gary C. Beverage, Electronics
Susan M. Gillispie, Admin. Services
Ira E. Jeffries, Electronics
Lloyd H. Taylor, Plant Maintenance
Shirell A. Farris, Computer
Lewis C. Snyder, Engineering
Dr. Francois Biraud, Basic Research

