



NAAPO (North American AstroPhysical Observatory)

**"Signals"
Volume 4 Number 1
The NAAPO Newsletter
(June 12, 1988)**



Edited by: John Ayotte, 528 Whitson Drive, Gahanna, Ohio 43230
[614-476-3834]

NAAPO Coordinator: Dr. Philip E. Barnhart, Dept. of Physics/
Astronomy, Otterbein College, Westerville, Ohio 43081 [614-898-
1516]

Radio Camera

The following article gives a non-technical description of Jim Bolinger's Radio Camera project. I couldn't resist the opportunity to publish the picture of Jim and Bob's smiling (?) faces on top of Dreese Lab.

From: The Columbus Dispatch
Sunday, May 29, 1988

By David Lore (Dispatch Science Reporter)

'Fly eye' would search all of space

OSU researchers develop a radio camera to scan wide area at once

Robert S. Dixon [to the right in photo below] is tired of using needles to search the haystack of space.

It's time to cast a broader net for evidence of extraterrestrial life, says the computer expert at The Ohio State University.

His proposal is to build a new type of radio telescope called a radio camera.

Unlike radio telescopes, which can absorb signals from just one small patch of sky, the radio camera would detect noise from any point in the sky not blocked by the earth itself.

"In the long term, man really needs an instrument like this," said Dixon, deputy director of the OSU Instruction and Research Computer Center and assistant director of the OSU Radio Observatory at Delaware.

The universe is constantly changing but visual and radio telescopes monitor only a small portion of this constant activity, he said.

"People think we're aware of things that are happening in space, but it's not so. We know about things only in the very narrow spectrum where we happen to be observing."

Working under Dixon's direction, engineering graduate student James L. Bolinger [to the left in photo] has built what he calls "a very crude prototype" of a radio camera [behind Bolinger and Dixon in the photo, with the OSU football stadium in the background].



On the roof of Dreese Laboratory, the instrument is capable of monitoring radio activity only along the horizon, not the whole sky.

Less than 3 meters in diameter, the prototype consists of eight antennae spaced equally around a reference antenna in the middle.

Each perimeter antenna monitors a sector of 45 degrees, feeding data into a Digital Equipment Corp. PDP 11/44 computer in the laboratory below.

The Computer is the heart of the system. It coordinates and "deblurs" the signals from the eight overlapping sectors to sharpen resolution and eliminate interference.

In concept, the radio camera is "like a big fly's eye," said John D. Kraus, professor emeritus of engineering and director of the OSU Radio Observatory.

Radio telescopes were developed a half-century ago, but only now are computers powerful and cheap enough to make possible the sort of radio camera being developed at OSU.

"It's a new idea that will have future applications, but it will take a lot of electronics to make it operable," said Kraus.

Bolinger said a radio camera would have four or five times the resolution of a comparable-sized radio telescope.

A 1,500-foot-wide radio camera could theoretically have the same resolution as the

huge Arecibo radio telescope in Puerto Rico at a fraction of the cost.

Through the use of computer graphics, radio data from the camera could be converted into a real-time map of energy activity in the sky.

This would give radio astronomers the same sort of visual representation of the dark universe that optical astronomers have of bright objects, such as stars, planets and comets.

Dixon thinks astronomical events, such as the 1987 supernova, would be detected sooner with radio cameras.

The first development step will be for Dixon and Bolinger to publish results of their prototype tests. Then they will look for money to build a larger model with true horizon-to-horizon monitoring capabilities.

One potential sponsor could be the National Aeronautics and Space Administration's Search for Extraterrestrial Intelligence program, providing Congress approves and expansion of that effort.

OSU's radio telescope is already partly supported by the NASA program and could be the base for a piggyback radio camera, Dixon said.

Bill Mook



In the April 4, 1988 issue of *Business First of Greater Columbus* Dan Shingler did a article about **Rapi-Serv**, Bill Mook's company. Bill has been a volunteer at the Radio Observatory for some time now, and I like to pass on information about the volunteers whenever possible.

It seems that Bill's company has developed a personal computer based point of sale system that is challenging the traditional mainframe systems from vendors like NCR. His lower cost systems is currently under consideration by Firestone for their retail stores. We wish Bill, and Rapi-Serv the best of luck in their endeavors.

Backyard Radio Astronomy

As I mentioned in the last issue, the Astronomy Club of Akron has started a column on backyard radio astronomy. Since we have many new volunteers with non-technical backgrounds, or limited exposure to radio astronomy, I'd like to print some of the basic technical information that I can find in sources like these. (JA)

Antennas, and How they Work

The antenna is perhaps the most important device in the entire radio telescope signal receiving chain. The antenna gathers weak incoming radio waves and converts them into corresponding electrical signals. We will examine the various types of radio antennas.

The General Properties of an Antenna

The fundamental purpose of an antenna is to convert the electromagnetic radiation striking it into a corresponding electrical signal. This is the case whether the antenna is a simple dipole or a 100 foot dish. All antennas can be evaluated in terms of the following: beamwidth, bandwidth, aperture, forward gain, front-to-back ratio, polarization, and impedance. The **beamwidth** of an antenna is a measure of the narrowness of its receiving pattern. Another important characteristic of an antenna is its **bandwidth**. By this we mean the range of frequencies the antenna can receive. It is desirable to have an antenna with a fairly wide bandwidth because extraterrestrial radio signals are essentially wideband "noise". The amount of signal power received is directly proportional to antenna bandwidth, the greater the noise "power" received. The area, or **aperture**, of the antenna is also an important consideration. The larger the area, the greater the amount of signal gathered by the antenna. **Forward Gain** is also an important consideration. The main purpose of any antenna is to convert incoming signals into an electrical voltage that appears across the antenna terminals. The amount of forward gain is determined by the size of the antenna. The larger the antenna, the greater its forward gain. A 3 or 4 element TV-type antenna may have a gain of 4 or 5 decibels, whereas a large parabolic antenna may have a gain of 30 decibels or more. The **Front-to-Back Ratio** of an antenna is the ratio of signals picked up in the forward direction to those creeping in from the sides or back. Next month will have some basic radio telescope receiver info.

NOAO News

The National Optical Astronomy Observatories periodically send out news releases that I feel might be of interest to our readers.

NOAO, Lowell Astronomers Detect Elusive Optical "Smoke" from Central Galactic Fire

...While there have been observational intimations of energy spewing from these nuclei -- large lobes of radio energy have been detected near some active galaxies, some have what appear to be outflowing high-speed jets, and others exhibit a kind of optical chaos near the nucleus -- there has been little opportunity to measure a systematic interaction between the active nucleus and its galactic host.

Now, two astronomers working at the National Optical Astronomy Observatories (NOAO) report they have detected a highly organized flow of hot, ionized gas that

appears to move outward from the poles of an active nucleus into the interstellar reaches of the galaxy. In effect, it is a well-defined column of the missing smoke.

Writing in the September *Astronomical Journal*, Drs. Jean W. Goad, of NOAO's Advanced Development Program, and John S. Gallagher III, formerly of NOAO's Kitt Peak National Observatory and current director of Lowell Observatory in Flagstaff, describe their detection of a "remarkable" velocity field around the active nucleus of galaxy NGC 3516...

...The interesting feature of this apparent outflow is not so much its existence, which is consistent with theory, as its remarkable degree of organization. "Other Seyferts have shown some symmetries, things that people call jets," Goad explains. "What is surprising here is the clarity and definition of these plumes. There's something really definite going on. Often, you map the velocities and it's just a mess. Here is something that looks organized."...

...The discovery of the "bipolar flow" in NGC 3516 was made from an echelle spectrogram taken during an 80-minute observation on December 3, 1984, using Kitt Peak's 4-meter Mayall telescope, and since analyzed with other, more recent data. Such measurements examine the components of light emitted by the galaxy, and how much the light's wavelength is shifted by motions within the galaxy. This shift in wavelength is then expressed as equivalent velocity, usually in kilometers per second.

Gallagher and Goad now hope to map the full velocity field of the plumes next spring, and will also attempt to obtain greater detail using a new fiber-optic system developed for the Kitt Peak 4-meter telescope.

RADOBS: Notes from the BB

A lot of interesting information appears on our bulletin board system on the DEC-20 at OSU. Since many of the readers of the newsletter cannot be online with us, I'm going to try to print things of interest, space permitting here in the newsletter. My editing is mostly restricted to deleting the more personal comments that sneak in in the heat of the moment. Hopefully, this feature will make all of you feel more a part of the day to day action here at the Observatory. I'm going to start off with an interesting note from early last year. If anyone knows which of the older messages on the board might be of general interest, it would save me some time in working

my way back through them.

Wed 11 Feb 87 10:31:30-EST

Bob Dixon

SETI assumptions

Yes, we are restricting our SETI program to signals from outside the earth, as opposed to signal sources that might land on the telescope. 5 minutes is about how long any extraterrestrial signal can possibly be in our antenna beam, due to rotation of the earth. But actually the current algorithm will still detect telescope landings. If a signal is received for longer than 5 minutes, the system will just recycle and declare another event, and run for another 5 minutes, etc. Each 5 minutes it would just pick the then-strongest signal for examination, regardless of what had happened previously. After analysis, with no other evidence (such as skid marks, torched ground plane, impact craters, alien knocking at the focus room door, etc) we would conclude that a terrestrial transmitter was causing interference, and flag that frequency to be ignored hereafter. (The program already has a big table for just this purpose.) Thereafter the interfering signal would not be declared a detection. Thus if a second unobtrusive visitation were to occur, and they were still using the same frequency, they would slip through the Terrestrial early warning net undetected. Then the only hope for man's salvation is to activate the secret subterranean laser defense mechanism complex, hidden away for to these many eons beneath the furthest recesses of the ground plane. But that is too dark a secret to even think about discussing here.

Fri 25 Mar 88 00:50:43-EST

Tom Van Horne

chart records

Jim

I believe Bob meant that we have to assume that the dec setting is the same as indicated by the last log entry and that the flat is not pointing at some other set declination. True declination in 1950 coordinates has to be corrected constantly.

Counting back from labeled points using the time tics is indeed the standard approach I use to determine RA in our continuum records. The problem arises when

the sequence of time tics is interrupted by oh, say the pen going off the edge of the paper for a page or two or what appears to be a large smudge where the pen overwrote the same spot for some time before someone moved it along the paper. Without regular labeling whenever the paper is corrected, reloaded, or generally fiddled with, one interruption makes unusable the rest of the record. Please, everyone, whenever you alter the status of the paper on the recorder, correcting time tic alignments or anything, please put a notation about sidereal time if you don't want to make a formal notation with date, universal time, who's writing, sidereal time, etc..

Fri 29 Apr 88 08:28:45-EDT

Bob Dixon

Visitation Revelations

Tom Hain and I were at the RO last night for several hours, so he could learn more about things and be able to give tours. A few needs were revealed as we did various things:

1. We must have a hard-copy terminal other than the console connected to the 11/23. It is needed to run programs which must have printed output. Since the console is always logged on, it is not suitable for this purpose.
2. Sensor says that the +5V power supply has failed. Needs to be fixed.
3. It is too hot in the focus room. The a/conditioner needs to be adjusted, fixed, turned on or whatever it takes to cure this condition.
4. The focus room looks great, and the cleanup efforts etc have made a big improvement. We do need to put the covers on the patch panels, etc to improve the appearance for tours. The default state should be that they are ON, and we take them off only as needed and then replace them.
5. The chart recorder is working fine, although the time marks are a little faint.

Glad to hear of the progress with the flat.

Fri 13 May 88 08:24:13-EDT

BOLINGER-J

We're Famous

From: "Quest for the Most Distant Objects in the Universe", by Jeff Kanipe, Astronomy, June 1988. "Over the next decade quasars were found at greater and greater distances; the culminating discovery was >>>OQ172<<< (my emphasis Jim) in 1973, an object that lay over 11.5 billion light years away. For almost ten years this quasar was listed in the 'International Guinness Book of World Records' as the most distant object in the universe".

How could we do better than the Guinness Book?

Mon 16 May 88 08:41:12-EDT

BOLINGER-J

Subject: radio camera

According to the printout there is an enormous band opening going on at this time (8:30 am). Very strong signals. The strongest one is 566 power units. Normally they are no stronger than 15 or 20.

Propagation studies is another good application for my system.

Mon 16 May 88 09:56:46-EDT

BOLINGER-J

Two birds with one stone

I talked to Lloyd Barnhart just now. He will bring the discone to the meeting this Saturday. It is not completely finished yet, but he wants it tested before the final bolt tightening. A good idea, I think.

I mentioned the printers Vic Kean has, and Lloyd will talk to Vic and possibly make arrangements for bringing them up in his pickup truck this Saturday. I can use the graphics printer to make plots of the radio camera data.

Mon 23 May 88 13:14:26-EDT

Bob Dixon

Transient Objects

There is somewhat of a debate in optical astronomy about flashes of light detected from astronomical objects. Most of these are dismissed as glint from artificial satellites. However, I have just received a review article on the subject which says that there are well-documented cases of 19 stars having omitted [sic; emitted] optical pulses in the range of 1-1000 seconds long. Can this possibly be related to our own pulse discoveries? Even if it not, it points out that transient events DO occur, and that man is generally unaware of them.

Mon 30 May 88 01:05:02-EDT

Tom Van Horne

names

Okay, the time to act is now. In the 1970's a proposal for a large scale SETI facility that would involve many antennas all looking in the same direction was referred to as project Cyclops after the famous one-eyed titan of Greek mythology. I would suggest that an appropriate name for the radio camera project or for a proposal to build an astronomical radio camera would be project Argus, named for a many eyed titan in Greek mythology who could look in all directions at once. (John Ayotte and I came across the reference while working on project names this week).

I stress again, the time to act is now! -- Why? Well just consider this: in the 1950's a newspaper reporter doing a story on John Kraus' early radio telescope named it 'Big Ear' and that name has lasted until this very day-- this weekend a newspaper article appeared that dealt with the radio camera Jim Bolinger has constructed and named it 'Fly Eye'.

Now Jim, unless you look forward in 20 years to trying to sell a book entitled 'Fly Eye', I would suggest we start stressing another name real quick.

Tue 31 May 88 08:53:14-EDT

DIXON-R

Meeting Reminders

All new people should be advised that I am generally in Dreese Lab 805 from 12-1 and 5-6 each week day, and am available to help you with your project then.

Wed 1 Jun 88 09:47:53-EDT

DIXON-R

News

1. Karen Grenus is a new volunteer assigned to the Mechanical group. She plans to come to the meeting Saturday to see things first-hand.
2. Oscar Green is joining the Software group.
3. Steve Ellingson and Jim Bolinger are testing the Discone antenna at the Electrosience Lab. Preliminary results are that the antenna works fine at low frequencies, but poorly at high frequencies. Steve is studying several papers I gave him on discone design, and will work with the Battelle people for any needed modifications.
4. We received a \$25 donation, via John Kraus.
5. Jim Nugen will help get the tape drives connected to the 11/44 after he finishes the 11/23 archiving software.

Wed 1 Jun 88 14:33:04-EDT

BARNHART-P

NORTH COLUMBUS INTERFERENCE

THERE SEEMS TO BE A MASSIVE (>50dB ABOVE NOISE) RF INTERFERENCE OCCURRING NORTH OF COLUMBUS. IT IS ENOUGH TO KICK WOSU OFF THE AIR AT THEIR 1120 FOOT TOWER NORTH OF WESTERVILLE.

The characteristics are as follows: Equal amplitude 0 - 200 MHz -- comb-line with four teeth per group.

It has been detected from WOSU tower (very strong) to as far west as Columbus Zoo.

It appears as a 2 minute (roughly) blast at random intervals of about an hour, usually less.

It seems to occur around the clock (24 hours a day).

Any information leading to the source or perpetrator should be communicated ASAP to Robert French, Communications Engineer, 3655 Hack Road, Cincinnati ((513) 563-4666 or 1-800-422-2337). This is a BIGGEE!

Wed 1 Jun 88 16:08:52-EDT

DIXON-R

NORTH COLUMBUS INTERFERENCE

When did this start? I have not noticed it in any of my receivers, and they are always on when I am at home. How can an RFI signal affect a transmitter, such as WOSU? To affect it directly, it would have to be almost as strong as EMP from a nuclear blast, and surely such a strong signal would have other effects. One wonders where the energy to create such a strong signal comes from. Perhaps it somehow affects the power line? WOSU-TV is around 600mhz, much higher than the signal in question. If the signal stays on the air for 2 minutes at a time, I can easily tell its direction, and with the help of other local hams, could locate the source of the signal easily. We have such hidden transmitter location tests several times a year.

Wed 1 Jun 88 20:43:27-EDT

BOLINGER-J

NORTH COLUMBUS INTERFERENCE

Do you mean that the WOSU transmitter is shutting off, or that the interference is strong enough to override the WOSU signal? How can it be a flat 0-200mhz comb? What is the rep rate of the pulses?

Thu 2 Jun 88 14:59:30-EDT

DIXON-R

Press Release Hits the Street

The press release from OSU about our new SETI approach has been sent out. I got a final copy yesterday. The Dispatch called today and wanted the full scoop. They had not read the release, so I told them everything again. No Hope. An article should appear in a few days.

Thu 2 Jun 88 15:06:30-EDT

DIXON-R

Bob Stephens status

Bob Stevens is the Canadian SETI person extraordinaire. He spent a summer here. He called today to say:

1. He has an eviction notice to be totally off the property where his observatory is located in 11 days, unless he pays \$4700 in back payments now.
2. He is selling everything, but specifically offers us his Peltier cooling system for \$500. It would be nice for our receiver. It achieves 140K. It is not completely finished, and has never been used.
3. He is looking for a job, and would like to come to Ohio State. If only we had the money.

Sat 4 Jun 88 16:57:10-EDT

DIXON-R

Continuum Kaput

The Continuum program now runs fine since the new console printer was installed. Apparently the old printer intermittently jammed, and that stalled the continuum program. But no sooner did it start to work, than an earlier problem with the receiver became obvious again. The voltage input to the continuum a/d channel is outside the limits, so I had to stop the program. This should have been obvious to anyone familiar with the system, as the console printed many error messages to this effect, and both 50 channel receivers meters read zero.

Mon 6 Jun 88 09:25:18-ED

BOLINGER-J

Subject: Are You sure?

1. We were aware of the over voltage problem with the continuum.
2. The 50ch receiver meters have nothing to do with the continuum receiver. The 50ch receiver is only 100khz wide, so a continuum source would be only 1/4000 as strong in the channels. It may never show up on the meter, particularly since we have two separate receivers now.

3. There is a strong (100%) correlation between the over voltage messages and the chart recorder pegging. The error message goes away after awhile. If it was in the equipment it would persist. How long does it take for a source to go through both beams? 10 minutes, isn't it? You will also notice that the over voltage is first one polarity and then another, as a source passing through both horns would be.

4. Since no one has ever said what the strongest signal will be, how can the receiver be adjusted so that it will never max out? If we did that then we would [(rest of sentence missing; Jerry Ehman, webpage editor)]

Mon 6 Jun 8812:36:47-EDT

DIXON-R

Continuum Problem

I think Jim is suggesting that by coincidence a very strong radio source just happened to be in the beam of the antenna when I was trying to start the continuum program last Saturday. That is of course possible. But nevertheless even if it was, there are other things that need improvement:

1. Since the chart recorder was not operational at the time, it was impossible to correlate it with the computer continuum data.

2. If this is a known over voltage condition that occurs every day at that time, it would be most helpful if those who know that would post the information here, as well as with a note on the receiver. Then the rest of us would know what is going on.

3. The fact that the meters on the 50 channel receivers read zero indicates there is a system problem regardless of anything else. I do not expect continuum sources to show on those meters. The normal readings of the meters is half scale. The net result of all this is that several days of data have been lost, because the continuum program has not been running. If the continuum system is running correctly, I assume that the continuum program would have been restarted.

Working Session Notes

4 June 1988

Attending:

Ayotte-J, Barnhart-P, Bolinger-J, Dixon-R, Huck-R, Van Horne-T, Riordan-E, Ellingson-S, Koch-R and Grenus-K.

Announcements:

1. Press Release ... The press release about the radio observatory has gone out from the OSU Office of Communications.

2. Stephens Plight ... According to Jim [regarding Bob] Stephens' latest communications to Bob Dixon, he has definitely lost his site. Enough money to satisfy the landlord was never forthcoming. He's trying to salvage the equipment and put it in storage till he can work something out. We are interested in obtaining the cooling unit that he has for sale, but the problems of shipping it such a great distance are considerable. Bob and Phil are going to see if something can be worked out to purchase the unit.

3. RFI Flap ... Phil described the RFI problem that has been cropping up in the area of the WOSU transmitting tower (see excerpts from Radobs BB for detail).

4. Conferences ... Bob Dixon will be presenting a paper on new approaches to SETI at the International SETI Conference in Baltimore Aug 8 and 9. The RFI conference follows Aug 13-16. Since the SETI paper will include the Radio Camera, and the RFI work is in part being done by some of the student volunteers, attempts are going to be made to get Jim Bolinger (time permitting) and the students involved in the conferences. The biggest problem is cost, since registration runs \$150 for the SETI and \$100 for the RFI conferences. Bob will also be presenting a paper on SETI Zoom techniques at the Planetary Society SETI Conference in Toronto Oct 7-9. Tom Van Horne will be presenting the slide show and giving a talk on the OSU SETI project at the International Superman Exhibition in Cleveland on June 18th.

Reports:

1. Headquarters... Phil will be essentially full time with the observatory starting

June 15. He will be working on NAAPO activities, proposals, and spending some time at the site.

2. Dreese ... Jim reports that the graphics printer is working, but is still too slow for his needs with the radio camera project. The problems are software related, and he is working on faster routines. The flatbed plotter is also working, but has some bugs.

3. Chief Observer...Tom is checking the soviet hydrogen cloud surveys for our suspected cloud signal, but has no new results to report.

4. Mechanical ... the air hose and actuator switch is repaired. The flat should be moving very soon.

5. St. Vincent's ... the group we were expecting for this meeting did not arrive. We hope to have a couple of summer interns working on digital data reduction techniques and comparisons to analog data.

6. Working Groups ... The current working groups, and their coordinators are as follows:

Mechanical (and electrical) - Ron Huck

Electronics - Jim Bolinger

Software - Bob Dixon

Data Analysis - Tom Van Horne

Publications - John Ayotte

7. RFI Study ... the discone antenna that is central to our measurements of the RFI environment of the site (one of the requirements of the NASA project, as well as being of significant interest to us) has been tested by Jim Bolinger and Steve Ellingson. The preliminary tests are mixed, but have identified several improvements that can be made by the group at Battelle that is fabricating it. Centering the feed without introducing too much mass between the flat plate and the cone is the biggest problem.

Next Meeting:

June 18 at the Radio Observatory

Observations

Tom Van Horne

Recent discussions of SETI have sometimes criticized the field as being bad science. Good science, it is argued, is marked by the ability of experiments to disprove incorrect hypotheses. Since SETI postulates something which may not exist and since it is impossible to prove the non-existence of ETI, SETI studies are said to be open ended money wasters.

Those putting forward such arguments simply misunderstand the nature of the SETI experiment. The OSU SETI study is a direct experimental test of a specific hypothesis - that intelligence in the universe is sufficiently widespread, sufficiently technologically oriented, and utilizes powerful, narrow band signals of microwave radiation for interstellar communication with sufficient frequency that our SETI receivers will detect evidence of this activity within a small number of years. As to the likelihood of this hypothesis actually being true, **there is no evidence**. That is the reason for undertaking the experiment. For all the posturing about colonization of the universe if there were ETI, and the concern that ETI searches will take decades at the least, **no one** has actually looked in the way that current SETI studies are looking.

We know that technology is used by at least one intelligence in the universe. We know that intelligence is not so widespread that its presence throughout the universe is obvious to the casual observer. SETI is an attempt to determine more accurately where between those two extremes lies the role of technological intelligence in the universe. The OSU SETI study may discover ETI and prove its optimistic hypothesis, or it may fail to do so and push slightly back the possible extent of intelligent technological activities in the universe.

Such a contribution to the "big question" of intelligence in the universe requires one thing on the part of our project. We have to analyze and thoroughly study our data.

The OSU SETI project as of this writing consists of three phases. Phase one began in 1973 and consisted of 8 100 Khz receivers tuned to center around the H I line as corrected for the Earth's motion around the galactic center. The data was recorded on chart recorder paper using 8 moving pens.

Phase two, which ran from 1977 to 1984, increased to 50 the number of receivers and narrowed the width of each monitored channel to 10 Khz. During phase two, the signal intensity from each receiver was integrated over a ten or twenty second period and a number was assigned to indicate the strength of the signal. The numbers indicating intensity ran from 0 to 9 and then A thru Z. These were recorded on pages of computer printouts with one line for each integration period. During this phase of the study, a system to identify interesting signals by computer analysis of the data was also implemented. Whenever a signal matched the computer's criteria, a punch card containing the data was automatically produced and a copy of the card image was printed on the listing.

These cards were checked against the listings and used for further computer analysis. The phase two study detected thousands of narrow band signals including many that matched our criteria for candidate ETI signals. The **WOW** signal detected in 1977 was the most spectacular of these and I will discuss it at a later date. Without exception, every candidate ETI signal examined by the project so far has failed to repeat when looked for again.

Phase three of the project is still in final debugging and will be a major improvement over previous searches. Fifty receivers with 100 Khz bandwidths will be tuned by the computer to cover 3000 channels, 50 at a time, with a 1/6 second integration period on each channel. This system will sample all 3000 channels every 25 seconds and will cover the entire range of frequencies known as the water hole. Upon detection of an interesting signal, the computer will stop normal observations and tune our receivers to analyze the detected signal in more detail. At the same time the computer will study the signal to detect any possible modulation. Thus, the phase three system will attempt to get around the problem of non-repeating interesting signals by analyzing any found signals in real time.

In my next installment, I will discuss the current situation of the phase two data and my plans for its analysis.

Last Words

The excerpts from the Radobs BB are a little long this time, but there has been a lot of interest going on. I've omitted information on the new volunteers that have been joining our ranks. Hopefully you'll be hearing of them as they get involved in the work on various projects. The results of Tom Van Horne's recruiting efforts have been fantastic. As soon as time and funds permit, we'll print and send out a roster.

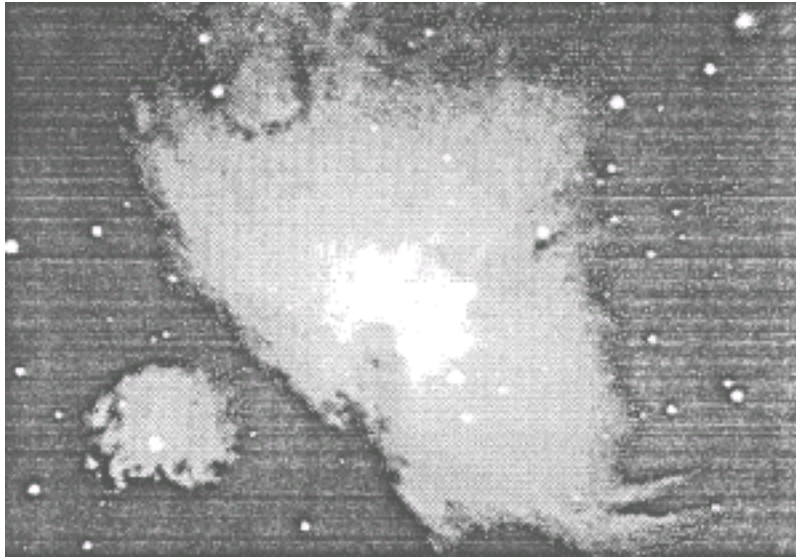
As always, funds are one of our most critical issues. As a result, we are discussing ways to encourage donations from an ever wider circle of individuals. If you know anyone who might be interested in our work, but is not able to become an active volunteer, we are going to make the newsletter available to them for a minimum donation to NAAPO of \$25 per year. Any of you who are currently receiving the newsletter, but find themselves inactive with NAAPO or the observatory, are encouraged to send along something to help defray the printing and mailing costs. Every little bit helps.

On a larger scale, Tom and I are attempting to put together a plan and develop fund raising materials aimed at corporate sponsorship. If you know of any firms that might be interested, let us know.

There were no letters to publish this issue. I hope that some of you will take the time to write and keep us informed of your activities, both SETI and non SETI related. I'm looking forward to future issues of this newsletter, and I hope that you enjoy my efforts.

John Ayotte

Unreferenced Photo



[\[Back to List of Issues in Volume 4\]](#) | [\[Back to List of Volumes\]](#) | [\[HOME\]](#)

[E-mail Webmaster](#)

Copyright © 2004 North American AstroPhysical Observatory
Designed by Jerry Ehman
Last modified: January 2, 2004