

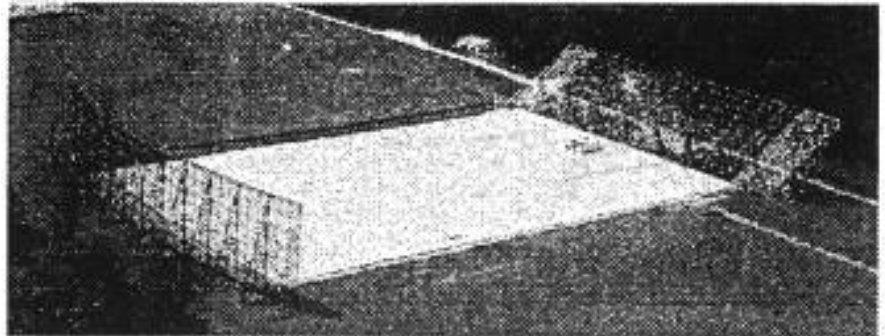


NAAPO (North American AstroPhysical Observatory)

"Signals"
Volume 14 Number 02
The NAAPO Newsletter
(March - April 1998)

SIGNALS

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IN THIS ISSUE:

- 2/7/98 Meeting Notes
- 2/21/98 Meeting Notes
- NASA Begins Another SETI Project
- Alien Hunters Announce Annual Press Briefing
- Voyager 1 Now Most Distant Man-made Object In Space
- 3/7/98 Meeting Notes
- 3/21/98 Meeting Notes
- 4/4/98 Meeting Notes
- Coordinator's Corner
- Souvenir Report
- Current Task List
- Letter To the Coordinator
- Response from the Coordinator
- A Communication From Chris Slack v4/25/98 Workshop Report

Saturday, 02/07/98 Meeting Report

By: Tom Hanson

Attending were Dr. Dixon, Dr. Barnhart, Harry Kitchen, Bob Tournoux, Ang Campanella, Cindy Brooman, Jerry Ehman, Jian Yi (Masters student from Mainland China), Tom Hanson.

The working party began at 9 AM. Harry Kitchen and Cindy Brooman were joined by Bob Tournoux and Ang Campanella and Phil Barnhart. Another working party was at Dreese Hall, removing antenna components from the roof. The meeting began at 10:20, since the two working parties were trying to finish various projects.

Dr. Barnhart reported: \$175 has come in for Radio Observatory mementos. Dr. Barnhart suggested sending mementos to selected persons [without donations required]. He has constructed 12 framed pictures with wire mesh from Big Ear. The memento consists of a glass frame covering a copy of the **WOW!** signal. Attached to the top of the frame is a section of screen from the flat reflector. There is an authentic section of vine interwoven among the grids of the screen. There was discussion of how we might enhance the **WOW!** signal image. Dr. Barnhart reported that Dick Smith salvaged more items from Delaware than we realized. Some of these items will be helpful in the months ahead. Dr. Barnhart received several calls from the contractor who will be demolishing the telescope. An opportunity exists for someone to assist the contractor in lowering the flat reflector for the last time.

Ang Campanella purchased some resistors for the pre-amplifier project for the **Argus** audio simulator. Dr. Barnhart reported that a supply of precision resistors is available from the Delaware site. Bob Tournoux and Cindy Brooman were successful in connecting their computers to the Internet using the SatComm Ethernet link.

The next order of business was to collect keys from volunteers. The keys collected included ones for Dreese 805, and for various locks at the Delaware site.

Dr. Dixon's report: Ohio State University has recently expressed support for the current Radio Observatory efforts. They have decided to accept the grant from the SETI Institute. It turns out that several people associated with the ElectroScience Laboratory have expressed interest in supporting. One of these is a tenured professor, and he would serve as the [co-]principal investigator for the grant. Among those who expressed interest are Steve Ellingson, who is a [past] member of the volunteers. It

appears that some research currently underway at ESL may coincide with some of the goals of the Radio Observatory. A concept is to build a test facility which can detect global positioning satellites. The proposal has been sketched out in considerable detail. A complication is that the existing Serendip system is designed to accept RF input. The system would have to be modified to accept digital input. Dr. Dixon told Steve Brown about the prospects for the proposal, and Steve expressed interest in supporting the effort. There appears there may be an opportunity for a paid graduate student to join the effort. At this point, Dr. Dixon emphasized the value of the work currently underway to build an audio spectrum **ARGUS** system. Ang reminded us of the weekly sounding of sirens around Franklin County, which could provide a useful 'natural' audio phenomenon for test purposes. Harry Kitchen inquired about the frequency of sampling in the audio **ARGUS**. Dr. Dixon expressed confidence that beams could be formed despite a low sampling rate. He then described his vision of a presentation he would like to make using the radio frequency version of the **ARGUS** prototype. He would like to be able to show a video tape of a round video display, with the zenith in the center of the screen, and with the sky visible around the rest of the screen. The tape would be speeded up so that the passage of global positioning satellites could be seen easily. The target date for this vision is September of 1998, because the fiscal year for the SETI Institute ends then. Their grant awards committee will be deciding which projects to fund for the following year at that time.

The next extended topic was the future of the data collected during the just-completed sky survey. Dr. Dixon reminded us that Russ Childers was quite successful in generating sky charts from data collected during the recent survey, when the telescope was viewing in the 60 degree range. The challenge for Russ was to compensate for the use of two horns in the current survey, since the original survey only used one horn. Russ developed an algorithm to reconstruct the equivalent of a single horn, by combining data from the two horns. Unfortunately, the results of this process do not appear to work as well as the telescope was moved towards the south, where objects appeared more and more closely in the data record.

Dr. Dixon shared with us some interesting work currently underway by Clive Goodall. This led Dr. Barnhart to reveal that he is currently working on a book.

Jerry Ehman ran off a fresh copy of his 20th Anniversary Report on the **WOW!** Signal. Dr. Dixon suggested that the report should be sent to the Planetary Society, in fulfillment of the grant which they provided for analysis of the **WOW!** signal.

Discussion then followed on possible other venues for publication of this report. Jerry described a recent issue of Seti News which makes reference to the **WOW!** Signal.

Harry Kitchen has nearly completed software to read signals from two microphones, and to produce a display. He posted a question on the Radobs list inquiring if anyone would care to assist him with the programming needed for the audio **ARGUS**. Chris Slack and Bob Tournoux responded.

Cindy Brooman has succeeded in connecting the computer she has made available to Radobs onto the Internet. Cindy spoke to Dan Fleisch recently, and she encouraged him to consider visiting the member section of BigEar.Org, to keep up with activities of the group, since he is not currently reading the listserver messages. Cindy then initiated a lengthy discussion of the Radio Observatory memorial which was partially funded by the golf course developer. Ang Campanella will contact Paul Hurm, because Ang may know one or members of the University architect's office. Cindy concluded her report by leading a discussion of harmonics which she has experienced on the power at her home, since she installed a sizable UPS from Liebert Corporation.

Bob Tournoux brought in a CPU from home, to assist in diagnosis of the Ethernet connectivity problem we had been having earlier today. It appears that the RJ45 cable we brought from Dreese 805 may have been defective. A new cable brought in from MicroCenter was successful in connecting the new Ethernet hub to Cindy's computer. Bob also offered to lend a copy of C++ to the SatComm facility.

Ang Campanella is working on audio system components for the audio range **ARGUS**. He arrived at SatComm this morning with two circuit boards fitted with components, and he spent a portion of today's working session soldering components together. Each system will have four inputs and four outputs. Harry Kitchen asked Ang to provide a switch on each device, so that Harry could deactivate filtering as needed.

The meeting ended at 1 PM.

Saturday, 02/21/98 Meeting Report

By: Tom Hanson

Attending: Dr. Dixon, Dr. Barnhart, Jerry Ehman, Cindy Brooman, Harry Kitchen, Bob and David Tournoux, Ang Campanella, Jian Yi, Tom Hanson.

Paul Hurm has assisted Dr. Dixon by preparing much improved graphics for publication in the proceedings of his recent Australian trip.

Dr. Dixon explained the new policy on keys to SatComm. Only University Staff or students will receive keys.

We are still waiting for the check for \$25,000 from the SETI Institute.

In addition, Dr. Dixon is pursuing the possibility of enlisting an additional student to carry out an honors level project to adapt the Serendip system to accept digital input. This student would be an undergraduate. Dan Wertheimer was the builder of the Serendip system we have, and he has assured Dr. Dixon that the Serendip system can be modified in this way.

Dr. Dixon announced that he will be meeting with ESL faculty every Friday afternoon, in Baker Systems. All volunteers are invited to attend.

Steve Ellingson has been providing a high level of support for the **ARGUS** project.

The ESL group has taken an active interest in the **ARGUS** test project, which will detect and locate GPS satellites in orbit. A concept under discussion is an array of printed circuit boards, each of which will be etched with a number of dipoles arranged in a V shape. The array of circuit boards will be mounted over a ground plane. Random phase effects are a likely challenge for the designers. In past experiments, designers have constructed arrays of antennas, only to find that at certain angles, no signals are detected at all.

There was discussion of how the SatComm facility can be adjusted to permit re-activation of Serendip for the student who will be doing the honors project. It was decided we will hold a working session next Saturday. Note: after the meeting, members set up a table for the Serendip system, and arranged the components of the system, ready for activation.

Bob Tournoux expressed interest in joining the sound card effort. His particular interest would be trying to write drivers to run under Windows NT 4.0.

Harry Kitchen reported on the work party last week. He said that the Plug-and-Play cards require a configuration manager to run under DOS. Unfortunately, the configuration manager chokes when Harry tries to configure more than one card. It was suggested that Harry try to configure each of the cards separately. Harry posted an inquiry on a newsgroup, asking for assistance with this problem. Harry then inquired what protocol might be needed for input to the modified Serendip system. Dr. Dixon replied that it may be too early to pursue this, until the honors student understands how the Serendip might be modified.

Jian Yi ran a number of tests using sound cards borrowed from SatComm.

Cindy Brooman is trying to find a controller card which will work correctly with the version of Windows NT she has donated to NAAPO. Her inquiries of Microsoft were unproductive. Cindy reported that she found an announcement in the Delaware Gazette, informing the public of a petition to add some land to the city of Delaware. The Dornoch project is apparently involved, although they do not appear to want all of their land included in Delaware. Cindy inquired about the Big Ear souvenirs announcement which she was attempting to prepare for the BigEar.Org website. There are enough options available that prospective purchasers might become confused. Cindy has been receiving inquiries about volunteers. She pointed out that when NAAPO was supporting Big Ear, there were opportunities for a variety of volunteer activities. At SatComm, the needs for unskilled volunteers are limited. Several suggestions were offered for activities which would be valuable.

Dr. Barnhart reported that Malinda MacKay wrote him and ordered a souvenir. She expressed interest in assisting with the current effort.

Ang Campanella has a stack of 5.25" floppies he is processing for the card project. He estimated that about a third of the collection of boxes and trays have been transferred to floppy. During last week's working party, Ang spoke to Steve Brown about how data might be pulled from the raw data CDROM to provide more input for card reconcilers. Ang has been working on a filter box for the audio frequency **ARGUS** project. He ran into a hurdle involving the cable he was using.

Jerry Ehman reminded us of the angle of 54.7 degrees which exists between the dipole end its support, in one of the proposed antenna cluster designs. 57.29+ degrees is the value of a radian. All projections on the plane probably will be 60 degrees. The angle between the support and the plane containing two of the dipoles would be 45 degrees. Dr. Barnhart is currently assembling the Mark III version of a model antenna. Jerry has run MININEC on three different models. A challenge for using MININEC is that the operator must prepare tables for input to the program. Jerry had to plan the tables on paper before he could add values to the tables. Jerry showed us a number of graphs he has generated, including color coded plots "3D Display of Radiation". The color coded graphs were intended to provide a representation of 3 dimensional patterns of radio signal strength. Jerry tried an experiment, in which he envisioned an antenna structure using quarter wavelength dipole elements arranged along the X-Y-Z axis, and wired together to use only two transmission lines. The graphs produced for this model were quite striking. Jerry's third experiment involved an arrangement of three dipoles, one of which was fed by a transmission line, and the other two of which were connected to 50 ohm loads. Results indicate minimal interference between the driven and dummy dipoles.

Dr. Barnhart concurs with desk organization project at SatComm. Money is still coming in for souvenirs. Skip Lewis sent a donation to assist with NAAPO's projects. There was an inquiry about adding the names of key personnel who supported Big Ear over the years to the proposed monument. In particular we need to emphasize Gene Mikesell's long and valued contributions. Dr. Barnhart reminded us of the need for a new logo to represent the **ARGUS** project. As of today, the flat reflector is still standing vertically. The parabola is gone and the aluminum from the ground plane has been removed.

Jerry Ehman found an article on forming beams in a sonar system, in Proceedings of the IEEE.

After the meeting, space was provided for work on the Serendip system. A working party is planned for next Saturday, to move various items out to the trailer. After the meeting, Jian Yi stayed et SatComm and worked with the sound cards.

(ED. NOTE: WONDER HOW LONG BEFORE THE FUNDING FOR THIS PROJECT GOES THE WAY OF THE LAST NASA-SETI PROJECT. . .?)

NASA POISED TO SCOUR GALAXY FOR 'PALE BLUE DOTS'

An ambitious and unprecedented effort to detect extra-terrestrial life in the most remote parts of the Milky Way galaxy is quietly underway at the US space agency NASA. Between now and 2015, the National Aeronautics and Space Administration will unleash an armada of probes, observers and orbiting telescopes to search the 50 to 100 light years around the sun and the solar system in search of a planet like Earth – or any other form of life as we may not know it.

"When these missions are launched, then the scientific community will have truly set NASA on a course to answer THE question we have all asked: are we alone?" NASA Administrator Daniel Goldin recently told a gathering of astronomers in Washington. "To find a life-bearing planet would change everything."

NASA scientist Ed Weiler said the agency's startling announcement two years ago that it had unearthed an ancient meteorite from Mars that might contain extra-terrestrial life sparked the public fascination that led up to what NASA calls its Origins Program.

"Then the discovery of other planets and the continuing stream of discoveries from (the space telescope) Hubble has excited the country and got ... the Origins Program over the edge," Weiler said. For now, the US government has agreed to fund the program at one billion dollars over five years. Some 2,000 people are currently involved in the effort.

"To understand the (program), you have to ask some basic questions," Weiler said. "How do we go from the Big Bang to galaxies? How does a star form? How does a planet form around a star? And most importantly — the end goal of all this program — are there other what (astronomer) Carl Sagan called 'pale blue dots' out there, Earth-size planets?"

The first device set to go into space is an "interferometer" in 2005. Composed of several space telescopes, it will be capable of spotting planets 10 times smaller than those that can be observed from Earth.

Two years later, NASA is set to put into orbit the Next Generation Space Telescope with the power of looking some 300 million years beyond the Big Bang.

In 2011, NASA will send off a gargantuan version of the interferometer. With the power of a telescope the size of a football field, this "planet searcher" will be capable of taking the first photos of planets orbiting around other suns.

Scientists expect the interferometer to help them analyze these planets' atmospheres and detect carbon dioxide, oxygen and water vapor — the chemical combination crucial to the creation of life.

Scientists say they are confident such planets exist. "It's not a guess, it's a statistical argument," Weiler said. "In our Milky Way galaxy there are 200 billion stars. We know that there are 50 billion galaxies in the universe. How can we sit there and speculate this universe is made for us?"

"There is an absolutely 100 percent chance that there are other forms of intelligent life in the universe," he said. "In the next 20 years, we will confirm the discovery of Earth-like planets and get strong evidence that there is life out there."

ALIEN HUNTERS ANNOUNCE ANNUAL PRESS BRIEFING

For more information contact: Dr. H. Paul Shuch, Executive Director. (201) 641-1770, or email n6tx@setileague.org

LITTLE FERRY, NJ, February 21, 1998

The fourth annual Membership Meeting of The SETI League, Inc. will be held at the non-profit educational and scientific organization's headquarters at 2 PM Eastern Standard Time on Sunday, March 29, 1998.

SETI League members and credentialed members of the press are cordially invited to be our honored guests at an Open House and press briefing commencing at Noon. We are located at 433 Liberty Street, just two blocks North of Route 46 and a mile East of the Teterboro Airport. We respectfully request that you inform us of your intention to attend, via email to rsvp@setileague.org, or by voice-mail to (201) 641-1770, not later than March 10, 1998.

At the press briefing, SETI League scientists will report on the progress of their Project Argus search, launched just two years ago. Perhaps the most ambitious radio astronomy project ever undertaken without Government equipment or funding, the real Project Argus (the name was used for a fictional search by the late Carl Sagan in

his 1985 novel Contact) is an effort to deploy and coordinate roughly 5,000 small radiotelescopes around the world, in an all-sky survey for microwave signals of possible intelligent extra-terrestrial origin. When fully operational, this effort will provide the first ever continuous monitoring of the entire sky, in all directions in real time.

SETI scientists seek to determine through microwave measurements whether humankind is alone in the universe. Since Congress terminated NASA's SETI funding in 1993, The SETI League and other scientific groups have been attempting to privatize the research. Experimenters interested in participating in the search for intelligent alien life, or citizens wishing to help support it, should email to join@setileague.org, check the SETI League Web site at <http://www.setileague.org/>, send a fax to (201) 641-1771, or contact The SETI League, Inc. membership hotline at 1(800) TAU-SETI. Be sure to provide us with a postal address to which we will mail further information. The SETI League, Inc. is a membership-supported, non-profit [501(c)(3)], educational and scientific corporation dedicated to the electromagnetic Search for Extra-Terrestrial Intelligence.

VOYAGER 1 NOW MOST DISTANT HUMAN-MADE OBJECT IN SPACE

In a dark, cold, vacant neighborhood near the very edge of our Solar System, the Voyager 1 spacecraft is set to break another record and become the explorer that has traveled farthest from home.

At approximately 5:10 p.m. EST on Feb. 17, 1998, Voyager 1, launched more than two decades ago, will cruise beyond the Pioneer 10 spacecraft and become the most distant human-created object in space, at 6.5 billion miles (10.4 billion kilometers) from Earth. The two are headed in almost opposite directions away from the Sun.

"For 25 years, the Pioneer 10 spacecraft led the way, pressing the frontiers of exploration, and now the baton is being passed from Pioneer 10 to Voyager 1 to continue exploring where no-one has gone before." said Dr. Edward C. Stone, Voyager project scientist and Director of NASA's Jet Propulsion Laboratory (JPL), Pasadena, CA.

"At almost 70 times farther from the Sun than the Earth, Voyager 1 is at the very edge of the Solar System. The Sun there is only 1/5,000th as bright as here on Earth, so it is extremely cold, and there is very little solar energy to keep the spacecraft warm or to provide electrical power. The reason we can continue to operate at such

great distances from the Sun is because we have radioisotope thermal electric generators (RTGs) on the spacecraft that create electricity and keep the spacecraft operating," Stone said. "The fact that the spacecraft is still returning data is a remarkable technical achievement."

Voyager 1 was launched from Cape Canaveral on Sept. 5, 1977. The spacecraft encountered Jupiter on March 5, 1979, and Saturn on Nov. 12, 1980.

Then because its trajectory was designed to fly close to Saturn's large moon Titan, Voyager 1's path was bent northward by Saturn's gravity, sending the spacecraft out of the ecliptic plane — the plane in which all the planets except Pluto orbit the Sun.

Launched on March 2, 1972, the Pioneer 10 mission officially ended on March 31, 1997. However, NASA's Ames Research Center, Moffett Field, CA, intermittently receives science data from Pioneer as part of a training program for flight controllers of the Lunar Prospector spacecraft now orbiting the Moon.

"The Voyager mission today presents an unequalled technical challenge. The spacecraft are now so far from home that it takes nine hours and 36 minutes for a radio signal traveling at the speed of light to reach Earth," said Ed B. Massey, project manager for the Voyager Interstellar Mission at JPL. "That signal, produced by a 20 watt radio transmitter, is so faint that the amount of power reaching our antennas is 20 billion times smaller than the power of a digital watch battery."

Having completed their planetary explorations, Voyager 1 and its twin, Voyager 2, are studying the environment of space in the outer Solar System. Although beyond the orbits of all the planets, the spacecraft still are well within the boundary of the Sun's magnetic field, called the heliosphere. Science instruments on both spacecraft sense signals that scientists believe are coming from the outermost edge of the heliosphere, known as the heliopause.

The heliosphere results from the Sun's emitting a steady flow of electrically charged particles called the solar wind. As the solar wind expands supersonically into space in all directions, it creates a magnetized bubble — the heliosphere — around the Sun. Eventually, the solar wind encounters the electrically charged particles and magnetic field in the interstellar gas. In this zone the solar wind abruptly slows down from supersonic to subsonic speed, creating a termination shock. Before the spacecraft travel beyond the heliopause into interstellar space, they will pass through this

termination shock.

"The data coming back from Voyager now suggest that we may pass through the termination shock in the next three to five years," Stone said. "If that's the case, then one would expect that within 10 years or so we would actually be very close to penetrating the heliopause itself and entering into interstellar space for the first time."

Reaching the termination shock and heliopause will be major milestones for the mission because no spacecraft have been there before and the Voyagers will gather the first direct evidence of their structure. Encountering the termination shock and heliopause has been a long-sought goal for many space physicists, and exactly where these two boundaries are located and what they are like still remains a mystery.

Science data are returned to Earth in real-time to the 34-meter Deep Space Network antennas located in California, Australia and Spain. Both spacecraft have enough electricity and attitude control propellant to continue operating until about 2020, when electrical power produced by the RTGs will no longer support science instrument operation. At that time, Voyager 1 will be almost 150 times farther from the Sun than the Earth — almost 14 billion miles (more than 20 billion kilometers) away.

On Feb. 17, Voyager 1 will be departing the Solar System at a speed of 39,000 miles per hour (17.4 kilometers per second). At the same time, Voyager 2 will be 5.1 billion miles (8.1 billion kilometers) from Earth and is departing the Solar System at a speed of 35,000 miles per hour (15.9 kilometers per second).

JPL, a division of the California Institute of Technology, manages the Voyager Interstellar Mission for NASA's Office of Space Science, Washington, DC.

SATURDAY, 03/07/98 MEETING REPORT

By: Tom Hanson

Attending: Dr. Barnhart, Jerry Ehman, Ang Campanella, Cindy Brooman, Jian Yi, Russ Childers, Dr. Dixon, Bob Tournoux, Guest - Erin Shea - Columbus School for Girls, John Ayotte, Ken Ayotte, Mike Brooks, Harry Kitchen.

Dr. Dixon's report: We still don't have the check from the SETI Institute. Apparently an error may have taken place at the SETI Institute, but Dr. Dixon has been assured that the check is now **** really **** in the mail. Dr. Dixon has been corresponding with Dan Wertheimer at Berkeley, regarding the conversion of the Serendip system. Dan is a member of the advisory board for the SETI Institute, as well as the developer of Serendip. Ohio State's ElectroScience Laboratory is continuing to express interest in the **ARGUS** idea. Steve Ellingson provided a circuit which could perform an A to D conversion via the parallel port. Steve has also produced a number of documents supportive of the **ARGUS** concept. A document arrived in Dr. Dixon's mail, announcing a program to support undergraduate research. The announcement was given to Ken Ayotte. The flat reflector is still standing.

Russ Childers reported that he had indeed been contacted by the contractor, about lowering the reflector, so they could remove the winches. Russ suggested that the contractor leave the reflector straight up. The latest word is that the contractor is thinking of using explosives to lay the reflector on the ground plane.

Bob Tournoux - Bob has started work on NT drivers. He brought in a 486 system board which could be used as a replacement for the Serendip system, if necessary.

Russ Childers - LOBES data storage - Russ has checked the CDs prepared by the Ayottes. The very last one appears to have a data error, so Russ has assembled Zip disks for a replacement of that CDROM, and to complete the saving process. Russ is planning to add software to the next CDROM, to permit researchers to use the data. There was a discussion of how the data which Russ collected over the past several years might be prepared for publication. Russ confirmed that he used Matlab software to produce contour maps. Russ ran into a problem, as the survey progressed toward the south, and the data points got closer and closer together. He said that part of the problem may have been that he had increased the gain on the receiver system, part way through the survey.

Dr. Dixon reminded us that the original survey was done with a single horn, and the latest survey was done with two horns. Russ wrote a de-convolution algorithm to convert the two-horn data to resemble one-horn data. He warned that it is necessary to use care in working with the data under these circumstances. Dr. Dixon then reviewed the history of the original survey for our guests, and explained the potential value of being able to compare the contour plots of the original survey with new plots of the latest survey. It was agreed that new algorithms are needed to process the data, to avoid some of the problems which have been encountered.

Cindy Brooman reports the Big Ear web site received 10,822 hits last month. Cindy set up a souvenir sale section on BigEar.Org. Cindy has been working with the photographs of Big Ear which were taken by Scott Weaston, and she has improved the display code. This led to a discussion of various articles which have appeared about Big Ear, as well as an article under development for "Sky and Telescope" magazine. Cindy described the high quality pictures which were taken for Dr. Kraus, by a professional photographer. She showed us faxes of some of the pictures. Cindy described her continuing effort to solve a problem she is seeing on the PC she donated to the Observatory. The PC is running NT 3.51, and while running in NT mode, the floppy disk drive is inaccessible. The floppy drive works fine if the PC is accessed in DOS.

Dr. Barnhart reported on correspondence with Mrs. Gene Mikesell. She is concerned about the need for reporting of the contributions of various people, such as her husband. She also mentioned that she has some photographs which might be of interest.

Ang Campanella - Now has a photoscanner - this unit is capable of scanning negatives, as well as slides. 250 pixels x 167 pixels is the size of the pictures which Cindy chose for the Big Ear slide show. Ang reported on the large size of some of the files produced by the scanner.

Mike Brooks took the ICOM receiver home, and found that several of the cables used to connect the receiver to the PDP had been snipped during the move from the focus room. The red book of notes prepared by Jim Bolinger was located and turned over to Mike.

Jerry Ehman has been continuing his investigations using the MiniNec program. He brought in pictures which illustrated a series of graphs. Dr. Dixon said that the results

indicated that the software is performing well. The project can now advance to the design phase. Jerry compared examples of log-periodic design to quasi-log-periodic design. Some of the results were surprising to Jerry, and to his audience. Dr. Dixon reviewed the goal. The objective is for each dipole to act independently. The reason to use a single transmission line is because the signals will be fed to a single receiver. He reminded us that a design constraint is for the dipoles to increase in size directly as they are located further out from the center. He stated we are not building a log periodic antenna. John Ayotte said that it is desirable for the elements to be far enough apart so they don't interfere with each other, but not so far apart so the assembly is unreasonably large. Dr. Dixon responded to a question, by stating that the only dipole which should be active for a given frequency, is the one which is resonant at that frequency.

John Ayotte brought in pictures which rendered a vision of Dr. Dixon's, for a possible antenna design. In looking at the picture, Dr. Dixon said that he now realizes that the sphere is nearly empty. There was a reprise of the discussion about the number of poles. It was reemphasized that the maximum number of equally spaced poles on a sphere is 20. Dr. Dixon asked John to recreate the rendering, so that the result looks less sparse. This revised picture will be helpful for presentations. 50 ohms was agreed upon as the desired transmission line impedance for the design Jerry will be building. The directivity of the array is to be constant with frequency. The shell of the structure that radiates at any given frequency should be a sphere with constant radius from the center.

Jian Yi - reported on his experiments with multiple sound cards.

Harry Kitchen is planning to go back to non-plug-and-play cards, to try to get three of them working at one time. He said that he needs as many older sound cards as we can find. He reported that the speed of taking readings from the cards has proven to be a problem. The explanation is that DMA cannot be used, since the program is trying to control multiple sound cards. The program is currently able to support a maximum frequency of 67 Hertz.

Dr. Dixon thought some more about antenna design. His Suggestion - alternate orientation of dipoles. Another Suggestion - use multiple transmission lines.

Dr. Barnhart has developed a new logo for **NAAPO**. It is quite striking. Readers of *Signals* will find the new logo on envelopes used for mailing. He will be away for the

next four meetings, as he had planned a trip to New Mexico.

Paul Hurm had requested a discussion of the memorial. Apparently Dr. Dixon has not yet received materials from Paul. There was planning for the forthcoming HamFest in Dayton. Steve Ellingson, Steve Brown and Dr. Dixon will go to the HamFest in May 15th.

Erin was asked for her thoughts on the meeting, and she said: "Wow!"

The meeting adjourned. Jian Yi stayed to work on the sound card problem. Five attendees went to Paul's Restaurant for lunch and conversation.

Saturday, 3/21/98 Meeting Report

By: Tom Hanson

Attending: Dr. Dixon, John and Ken Ayotte, Cindy Brooman, Jian Yi, Russ Childers, Harry Kitchen, Bob Tournoux.

There is a new sign on the entrance to the SatComm Radio Observatory room: "**Radio Observatory Receiver Development Data Analysis**".

Dr. Dixon asked for a volunteer to respond to an inquiry from a youthful correspondent. He received documentation from the conference he attended in Australia, and he will leave the notebook at SatComm for anyone who is interested. Kym Kuenning sent Dr. Dixon a copy of an article she wrote about Big Ear. Kym drove up from Cincinnati while Big Ear was still standing.

Russ Childers reported on a remarkable success searching for information on the "Excite" search engine on the Web. He suggested that students who write asking for general information about astronomy should be advised to try that search engine.

John Ayotte demonstrated several renderings of **ARGUS** antenna designs he has prepared for Dr. Dixon to use in future presentations. The design employs 20 poles, according to the specification that 20 is the maximum number of equally spaced surfaces which can exist on the surface of a sphere.

Harry has returned from trips to California and Michigan taken over the past two weeks.

Russ Childers asked about Bob Gray's VLA **WOW!** observations. A message about Bob's investigation appeared on the Radio Observatory listserver recently.

Bob Tournoux asked if we needed the video card he had brought in. Cindy had brought one in, as it turned out. The new card which Cindy provided is able to display 256 colors, and the World Wide Web display now looks excellent. Bob Tournoux has been asked to travel to Japan, and he had just renewed his passport just in time.

Dr. Dixon left for another appointment.

Bob Tournoux talked about Road Runner service, with which he is very satisfied.

Russ Childers and Ken Ayotte discussed LOBES and continuum data.

After the meeting, Cindy Brooman and Jian Yi reviewed the extensive capabilities of the computer she has made available for use at SatComm.

Saturday, 4/4/98 Meeting Report

By: Tom Hanson

Attending: Dr. Dixon, Jerry Ehman, Ang Campanella, Cindy Brooman, Harry Kitchen, Jian Yi.

Dr. Dixon began the meeting by reporting that various interesting signs can be obtained from a catalog he showed us. The catalog is "Brainstorms", P.O. Box 13131, Reading, PA 19612-3131.

Cindy was asked for news of Dr. Kraus. She had stopped in to see him. On her first visit she learned that Dr. Kraus had received a number of visitors, and had asked for a pause. She returned later and found the whole family there. Dr. Kraus told Cindy he had suffered a mild heart attack. He seemed to appreciate Cindy's visit. Jerry Ehman said that Dr. Kraus is 87.

Cindy said that the flat reflector is still standing. Dr. Kraus had related a story about Russ Childers having refused to assist in the destruction of the flat reflector, and expressed appreciation for Russ's loyalty.

Cindy brought a card for the group to sign.

Dr. Dixon received a postcard from Dr. Barnhart. The card showed the Very Large Array at Socorro, New Mexico. Dr. Barnhart's message read: "We made it this far. On to Arizona next week. There is a potential visit to the Trinity Site April 4. See you in May."

Jerry Ehman was announced as the "Highlight of the Meeting". He reported that the "X-Files" will be repeating the episode which features Jerry and the **WOW!** Signal. He went on to discuss his recent work with antenna design computations. This work was undertaken to assist the design team in attempting to understand the behavior of various concepts under consideration for **ARGUS**. Jerry's first discussion concerned the preferred transmission line impedance of 50 ohms. He performed an analysis to try to determine if the 50 ohms value is practical. He showed graphs which indicated that round wires with an air dielectric would not allow 50 ohms impedance. He suggested using 200 ohms, and carried out the remainder of his analysis using that value. Dr. Dixon pointed out that he has a commercially produced antenna which does operate at 75 ohms impedance. However, this antenna uses rectangular conductors rather than round ones. It was suggested that a dielectric other than air might be needed for mechanical reasons. Jerry went on to show a table of values which reflected the graphs he had produced, using 200 ohms impedance as the working value. He then cleared space on the table to set out printouts from 6 variations on a theme. This analysis uses a Quasi-Log Periodic methodology. This is like Log Periodic, but instead of crossing wires, the transmission lines are straight parallel lines. Wire diameter is 3 millimeters for this set of variations. 200 ohms is the characteristic impedance for the transmission line. 15 centimeters is the length of the lowest wavelength dipole section. 5 centimeters is the length of the shortest wavelength dipole section. Each graph was supported by a set of table printouts. More plots appeared after the tables. The plots showed considerable variation in impedance. Dr. Dixon said that he believed the elements are not being matched to the transmission line at this point in the analysis. Antenna patterns were shown next. Jerry summarized that his investigation of these models seems to show that there are many variations of antenna patterns with azimuth and frequency changes. Dr. Dixon restated that he is hoping the analysis will improve when the antenna elements are matched to the transmission line. Dr. Dixon suggested that Jerry try an impedance of 75 ohms. He suggested that Jerry also try redoing the analysis, using one dipole at a time. The program should display graphs which show the pattern for a single dipole, at its resonant frequency. The antenna array to be designed would provide a frequency range with a ratio of 3, with the highest frequency being three times the

lowest. In discussion with Ang and Jerry, Dr. Dixon said that the **ARGUS** antenna could not be built so long as the patterns are as unstable as Jerry's computations have revealed so far.

Harry Kitchen reported that last Saturday, Jian Yi and he had succeeded in enabling three sound cards to read three microphones at a sampling rate of 8 kilohertz. Ang said that the speed of sound is approximately one foot per millisecond.

Cindy Brooman reported that BigEar.Org has once again received 10,000 hits during the past month. She said that her server has received over 50,000 hits during this period.

Dr. Dixon was reminded that he had sent a report to the Planetary Society, in response to their grant for investigation of the **WOW!** Signal. He has heard from the Society, and they are interested in receiving a report on the history of the **SETI** program at Ohio State. He will write back that there is interest in fulfilling this request, but the group will be concentrating on **ARGUS** in the near term.

Ang Campanella has been communicating with Harry about the Audio **ARGUS** experiment. A discussion developed on how the project team could progress beyond the current status. It is likely the team will develop a technique for passing data from the PC reading input from microphones, to another PC which will perform correlation between the digitized data streams. The meeting came to an end at noon, and several members of the group rejoined for lunch at Paul's Restaurant on 5th Avenue, in Grandview.

COORDINATOR'S CORNER

By: Phil Barnhart

As Tom Hanson pointed out the other day there has been a working session **EVERY** Saturday since the first of the year. While much time was spent moving out of the long time campus headquarters in Dreese Hall, a number of volunteers devoted these sessions to the software challenge of **ARGUS**. To this end donated hardware is being fitted with multiple sound cards to accomplish the simultaneous sampling and processing of different receiver inputs. At the same time, software is being developed to control the different inputs and calculate the beam forming information. Operating systems designed to aid the armchair PC user seriously get in the way of real time processing of multiple inputs. At the same time, Tom, Cindy and Ang have brought the **ARGUS** office into contact with the outside world. We now have a phone line to

which is attached the RO answering machine. Call 292-2394 to receive a warm and friendly greeting from our congenial phone host, Ang Campanella. An ethernet connection has also been accomplished so that world wide communication is available at all times in the workroom.

Webmaster (mistress?) Cindy Brooman puts us in touch with the electronic world at the drop of a question in our Saturday meetings. Our March 7 meeting was crowded by the 14 attendees. There will have to be further organization in the room if we are to get any more people into the Saturday sessions. Trailer clean-up has been accomplished so some of the gear may be shifted to that venue when strong backs appear in the door. Working sessions have taken on a vitality with the **ARGUS** project in full swing. Discussions of hardware, software and antenna design have been free-wheeling and productive. Graphics displays and crude models have stimulated many new ideas. Jerry Ehman is producing multiple pages of antenna pattern plots and design specs for multiple dipole arrays, working his way up to the 6-hexapole configuration we are contemplating for the array elements. John Ayotte is producing spectacular images of the element configurations. Each session becomes an eye-opener for all of us involved. **NAAPO** has committed to technical and supply support to both these vital efforts.

CURRENT TASK LIST

For those interested in becoming involved in various phases of the Radio Observatory operations and the **ARGUS** Project we list here the various tasks with a brief description and status report. If you have a desire to get involved with any of these tasks call the RO office and leave a message. Be sure to include information about what you can do and a means to get in touch with you. You can always write to the Volunteer Coordinator (Barnhart) whose address appears on the front of the newsletter.

TASKS

ARGUS — Hardware: generating input, A/D conversion, circuit construction, platform utilization. Software: computer data collection and analysis. Antenna design and fabrication: computer modelling, prototype fabrication, antenna pattern synthesis, design and modelling of array structure.

STORAGE AND CLEAN-UP — Trailer levelling: jack up and block east side of storage trailer, organize and store from workroom, trash unwanted stuff.

DATA MANAGEMENT — Card File Reconciliation: Finish checking for bad card images on CD. Continuum survey: complete the contour maps, match the sources recorded to the original Ohio Survey. **LOBES** Files: Sort out 'hits' from **RFI**, catalog hits.

MAILING/SOUVENIR CONSTRUCTION — Mail lists/ mailing: maintain and correct mailing lists, assemble souvenirs, mail out souvenirs, mail newsletters.

CLERICAL/BUSINESS MANAGEMENT — Maintain office area at SatComm site: File, compose letters, stock supplies, answer inquiries, manage petty cash, generate publicity, maintain publicity file. Fiscal management (**NAAPO**): purchase, disburse, maintain accounts.

PUBLICITY/PUBLICATION — Newsletter: Edit, print, copy and mail. Press releases: Publication: [This list is not comprehensive. Additions will occur. Corrections and additions are solicited.]

LETTER TO THE COORDINATOR

Dr. Barnhart;

Though we have never met to my recollection, you have known me via my husband Gene for many years. I read with interest the most recent communication included with Signals indicating that Big Ear had been operated "for the past 25 years by volunteers". I wonder what those volunteers would have done had my husband not been there in the years from 1958 until 1987 at the time of his death, which by the way included 14 of those 25 years aforementioned.

I was also sorely disappointed that we were not informed through Signals of the Open House so it must have been a private affair.

I was sorry to learn of the unfortunate manner in which the whole affair of the closing of the buildings and the departure from the premises has taken place at the telescope. I made a visit one Sunday afternoon and you must realize that it was quite a shock to me since I had not been on site since the day I went to collect my husband's belongings from his office and the shop back in 1987. It is truly heartbreaking to me to see all the effort of all those years trodden underfoot — most literally. I had wanted to be on site the day it comes down since my husband was

there in the days it was designed and put up. However, after making my visit that sunny Sunday afternoon, I am not sure. There are too many memories there for me and I probably will never go back.

I have many pictures (some of the red truck with the jet engine mounted on the back which were taken on the day he (Gene) fired up that engine to test it) and many memories which are too precious to put under that wrecking ball or whatever is used to bring it down.

Thank you for your efforts to save Big Ear.

Sadly,
Mrs. Gene Mikesell.

COORDINATOR'S RESPONSE TO MRS. MIKESELL

Dear Lois;

We have indeed met, though I hardly expect you to remember me. My wife and I attended Gene's memorial service. I had known and worked with Gene off and on over the years. For most of my career I was associated with Perkins Observatory.

All of us in the NAAPO organization are saddened by the thoughtless elimination of the radio telescope. We struggled against an almost invisible monster at Ohio State University to try to work out an accommodation to save the instrument. Indeed we fended off the final blow nearly 16 years.

We also appreciate dedicated contributions of people like your husband, Ed Teiga, John Kraus, Bob Dixon and many others who helped make this a world-class telescope. The fact that we have not continued to call attention to these people does not detract from either their contributions or our deep gratitude to them.

Perhaps some degree of solace may be gained when you learn we are designing a memorial monument — hopefully to be displayed prominently in a public location. Included will be a permanent plaque upon which will be listed those noted for their contributions to the effort. Gene Mikesell's name will be prominently displayed on this plaque.

Thank you for keeping in touch. We are becoming interested in exploring your

collection of Big Ear photographs for possible use on our web page.

Sincerely,
Philip E. Barnhart.

A COMMUNICATION FROM CHRIS SLACK, FORMER RO NAAPO INTERN

After leaving the RO I went off to Clarkson University and majored in Computer Engineering; freshman year I managed to get 3 credits partially for helping out 2 senior physics majors in a project on radio astronomy and partially for my high school project on the application of fuzzy logic to source recognition in radio astronomy. Oh, and I should mention that spending the summer at OSU/Otterbein made the transition to college/dorm life very easy. I already seemed to know some of the things that people were just finding out for the first time at school, like living in a dorm and doing laundry, etc.

The summer after freshman year I worked with Steve Willard on a project for a company in Florida redesigning the machines which put people on magazine covers that they have in various amusement parks. During sophomore year I began applying for co-op jobs and companies were very impressed with my experience stemming from OSURO, which landed me several positions of which I accepted one at Harris RF Communications where I worked in the systems engineering division working on projects for the Amir of UAE and for the new Hong Kong airport.

Between my junior and senior year I got a job working at Raytheon in their international air traffic control systems division, again when I applied for this job they were interested in my work at the RO, even though it just about nothing to do with IATC systems software. At just about all of the interviews I had they mentioned the RO, even when they didn't mention some of the other experience. People seem to find radio astronomy interesting and mysterious, and it has almost always provided something interesting to discuss during interviews. Finally I accepted a job with GE Medical Systems, primarily because it seemed like a job where I could do some good and help people, and the entry level leadership program which is considered to be the best in industry. I am very happy so far, having worked for 6 months in CT software, and now doing my 2nd 6 month rotation, in ultrasound hardware engineering, I have 2 more rotations left as part of the leadership program and I am not sure what they will be in. I have been very lucky in the amount of experience I have gotten and I owe some of that to you guys who provided me with that first bit of experience which

helped lead me on to "bigger and better", or perhaps smaller and different is a better phrase here since things were pretty enjoyable at the RO, and there aren't too many things bigger. . . . I attribute much of this success to the start you helped provide for me. Feel free to let people know where I have been since I was at the RO if that is the kind of story you are looking to write, sort of a "where are they now?" kind of thing.

SATURDAY, APRIL 25, 1998 WORKSHOP REPORT

By: Tom Hanson

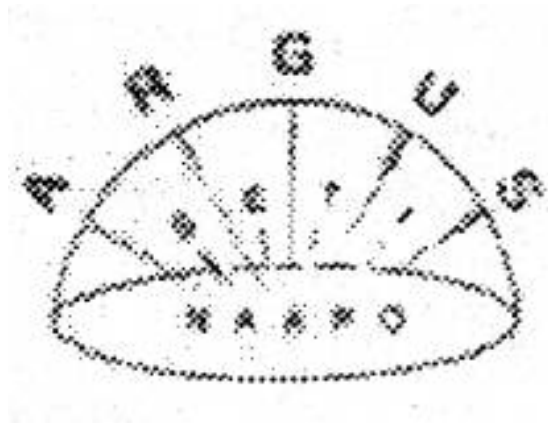
Cindy Brooman, Harry Kitchen and Ang Campanella joined today's working session at SatComm. Harry and Ang made progress in testing the Audio Argus system.

Ang attempted to bring a pre-World War II audio oscillator back to life, in order to generate to a tone for testing the Audio Argus. The oscillator glowed from all vacuum tubes, but never issued a peep. Ang then adapted an oscilloscope he was using to debug the oscillator, and produced a suitable square wave at 1 Kilohertz.

While Ang and Harry ran a variety of tests, I prepared to back up the Serendip system. When Serendip first powered up, it gave the same error it had given before Steve Brown re-installed the Serendip cards to the AT system. However, I discovered that powering down and back up would eventually bring the system to life. Since Serendip used to run all the time, I am inclined to leave it on, once all the peripherals have been connected. The backup taken today uses DOS 6.22 MSBACKUP. Before starting the backup, I prepared two recovery diskettes. Because this system uses a 5.25 inch drive for Drive A:, I formatted and configured a floppy for use as a boot diskette. The boot diskette is accompanied by a 3.5 inch floppy containing all the files needed to perform a restore.

LOOKING FOR GRAPHIC DESIGNER

I am looking for an aspiring (or even experienced) Graphic Designer to take our new logo (reproduced below) and "bring it into the 21st century"! If you think you can do it, or even if you're not sure you can do it, email me at earl@pdesign.net, and I will send you an electronic copy, and you can have at it!



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Designed by Jerry Ehman

Last modified: May 19, 2004