



NAAPO (North American AstroPhysical Observatory)

"Signals"
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RO INFO**By: Russ Childers****Subject: Maser sources**

On Thu, 1 Sep 1994, Herb Johnson wrote: "Just for my information, what are we archiving for now? The continuum signal, I presume, of some bandwidth; and I imagine some channels of signals over some period when the Search sees a "hit"; and some information on matches between data and *Ohio Survey* source locations. And one final note: could future reports of findings be expressed in 1950 and 2000? I know the former is Bob's preference; but 2000 is also popular."

Russ replies:

We are recording a continuum channel of some 20 MHz or so, centered on 1413 MHz. The channel is stored once every 10 seconds. No record of the *Ohio Survey* matches are made, since this can be duplicated offline. The **SETI** system records data once every 20 seconds. Most of the data stored is the output of the pattern match algorithm:

- * The number of channels matching the antenna pattern (strikes) (3000 max),
- * The average of the above channels' match "error",
- * The channel number of the "best match" (0->2999),
- * The above channel's match "error",
- * The above channel's "peak-to-peak" value,
- * One channel's data out of the 3000 (currently channel 255, centered on 1423.05 MHz)
- * The above channel's match "error",
- * The hour, minute, and second, Universal Time.
- * During a "followup", when the feed horns are moved, the data for the past several minutes for the "strike" channel is saved.
- * The data from all 12-10 kHz receivers are recorded during followups.
- * Also saved are text lines printed out on the hardcopy.

I use epoch 1950 because most of my references (e.g., the *Ohio Survey*) are in those coordinates. One set of coordinates reduces the confusion, plus it's easy to print one set on graphs. A simple calculation can precess you to whatever epoch you want. Remember that EXACT precision is not needed because of the relatively large

beam of the **Radio Observatory**.

COORDINATOR'S CORNER

By: Phil Barnhart

Again, I have been the hold-up in getting this issue of *Signals* out to our friends. I apologize for being pre-occupied with trivial things when so much is happening at the **RO** and there are things you need to know.

As you will gather from the meeting notes recorded here-in a number of activities are being carried out. As in any volunteer operation fixed time-lines and job deadlines are an ideal that rarely sees the light of day. The willingness to pursue tasks without supervision has meant that things get done — often before expectations or estimates of completion are achieved.

Storage of materials and supplies has been a problem since the renovation and remodelling of the headquarters building. Much storage space was given up to the apartment area and a lot of material was moved out of the shop area to make that room user friendly. The 45-foot trailer into which the 'stuff' was moved has a floor full of miscellaneous pieces and nearly identifiable things. From mid-thigh (*of a moose*) height to the 8 1/2 foot ceiling there is a large volume of ideal storage space that is totally empty. Shelving to provide order and access to nearly 450 cubic feet of this space was designed and is being assembled by the stalwart crew of volunteer carpenters.

During the operation on Saturday the cast of ten included seven PhDs, a founder and former CEO of a world renowned software company, a retired AT&T engineer and a practicing attorney. There were no splinters, smashed thumbs nor injured feet, in spite of the fact we all operated within the rain-shrouded facility garage. Much levity was expressed by Dr. Dixon concerning the fact that he did not see how the many parts could possibly fit together once they were fabricated. He, of course, may be correct. But I was able to point out that all that was necessary to see how it goes together is the ability to recognize intelligence. He is still mulling that point over.

We have installed, and removed, the new HEMT low noise amplifiers. There was no apparent improvement in system noise nor increase in gain when compared to the old GaAs-MESFET amplifiers. A careful study is being instituted to try to locate the limiting feature contributing to system noise, since the LNA's do not

seem to be playing the major role.

We have also begun the implementation of the new power supply cards purchased with the HEMT amplifiers. A glitch in procedure has sent us back to the manufacturer for a replacement for one of them. Accidents will happen, according to Murphy.

Bids for painting the telescope are again being solicited. There is something to be said for bureaucracy — none of it pleasant, none of it printable. I wonder — will a bright green telescope look somewhat out of place in the snow?

We have received a fine bit of coverage and recognition in the Sept. 18 *Cleveland Plain Dealer* magazine section. *Barry Kawa, the CPD Columbus Bureau Chief* wrote a clear, well illustrated account of our situation and the nature of our attempts to overcome "shoestring funding". The cover illustration is a poster-like image of Bob Dixon standing in the midst of what looks like the Eta Carinae nebula. Such a gifted photographer to catch him so far from home! Our efforts are also noted in the latest issue of *SETI News* out of the *Phoenix Project* — the refugees from the **NASA HRMS** program. They acknowledge the many improvements brought about over the last few years.

In a surprise move the *Fox Network* show "*The X-Files*" featured in their season premier show on 16 Sept. a segment mentioning the **Ohio State Radio Observatory**, Jerry Ehman and the 'Wow' signal. Somehow they got the essence of the event correct and it even made sense in the story line. Paul Hurm, one of our Southwestern Ohio Volunteers reports many messages on an X-File bulletin Board he reads concerning this episode and has volunteered to make available to readers of that BBoard information about the **RO**, our projects and potential ways to offer support. Thanks, Paul.

Tuesday, 7/26/94 Dreese Meeting Notes

By Tom Hanson

Last night's Tuesday night meeting was upbeat. Dr. Dixon attended a meeting on the observatory lease which he said was encouraging, but that we are not out of the woods yet. Steve Brown has continued work on the *Berkeley* equipment, and most recently found a dial which was off alignment, leading to incorrect readings. It sounds as though Steve will be ready to move the equipment to the observatory in the next couple of weeks.

Raul has made progress in discovering the procedure for writing a compact disk with card data, and I have made some progress in gathering all the data into a single data set, for transmission to the CD Rom facility. CD Rom disks apparently cost \$20.00, and if a **Radobs** member desires a personal copy of the data, I would be happy to receive requests. The only issue would then be the willingness of the CD Rom facility to make multiple requests. It should be noted that this initial CD is **not** the final product! Since the VAX is out of service, Steve Brown has pressed HP system(s) into use for preparation of card reconciliation diskettes. However, the data on the MVS system is massive and it should be moved off at the earliest opportunity. After the CD has been successfully written, and after a means of reading the disk is available to **Radobs**, I intend to delete the data from the MVS system. After card reconciliation is complete, we can undertake to write a final CD. It should be noted, as well, that there are still a number of cards which are unread. An effort will be made to adapt a keypunch to write card data to a PC. Anyone with knowledge of designing electronic circuitry would be welcome to assist with the keypunch adaptation.

Summary of Card Project Status

By: Tom A Hanson

Our current focus is transferring data from the MVS system to Compact Disk. The two major collections of data are ready for transfer. Raul is investigating the time required to transfer the data via ftp. Preliminary information to make up a table of contents has been assembled, and requests for assistance in preparing the table of contents for maximum value to PC operators have been extended. An ideal situation would be to have an index to the locations of individual boxes or trays included on the Compact Disk. However, I am unable to think of a way to build such an index, unless it could be done on the PC used to write the compact disk itself. One of the

ways to prepare to write a compact disk, according to Raul, is to build the entire collection of information on a PC hard drive, and to then transport that hard drive to the compact disk machine, and connect it to that PC. If we use this method, then we could build an index on the hard drive. However, it is not clear to me that the disk addresses on the hard drive will translate correctly to the compact disk addresses. An alternative is to collect the data on the compact disk, and then build an electronic index on the hard drive of the PC used to read the compact disk. **Ideas, suggestions, insights, reassurances — all are welcome!**

NAAPO Saturday Meeting, August 6, 1994

Present: Barnhart, Brooman, Campanella, Childers, Dixon, Ehman, Horton, James, Janis, McConnell-Goelz, Schumacher, Mark Sundstrom. The meeting started at approximately 11 am.

Barnhart reports that an **RO** Bash is scheduled for Sunday afternoon, August 14th at Bob Dixon's house and loch. It looks to be a major wingding with 27 guests confirming attendance so far. With the imminent departure of Steve Janis, Phil requested a volunteer to take over the taking of the minutes of these Saturday meetings. One of Phil's astronomy students from *Otterbein* has expressed interest in volunteering with the **RO**; Al Jenkins is scheduled to attend the next Saturday meeting. Al is proficient on MAC computers and is interested in the realtime sky display project of John Ayotte's.

Mark Sundstrom, a founder of **Aldus Corporation** (*known for Aldus Pagemaker* (ed. note: Signals is produced using Pagemaker Version 4)) is a new resident of Columbus, an amateur astronomer, and interested in the **RO**.

Concrete work at the telescope site continues under the leadership of Phil Barnhart and Don James. The western 5 flat bay piers have each been patched to some extent.

Childers reports that the telescope is at the declination of +35 degrees, 20 minutes and the **LOBES** survey continues, but with no notable discoveries during the past fortnight. Russ has also found several large leaks in the radiator of the **RO** truck; replacement of the radiator is recommended, but right now is low on the priority list. He also reports that the cable trays in the floor of the focus room have been flooding after heavy rains. This has been a problem in the past when drainage pipes have clogged.

Al Horton has taken on the job of clearing the trays of unnecessary cables, and investigating the drainage problem.

Dixon reports that Charlie Bender, *Director of the Ohio Supercomputer Center at OSU*, is very interested in the **Argus** project and has offered his assistance and support in obtaining funding for a stepped-up development project for the Argus telescope. The bids for painting and lead abatement of the **Radio Telescope** have been received by *OSU Purchasing*, but seem to be somewhat out of line with the needed work. Dixon and Janis will be working with *OSU Purchasing* to explore alternatives and, if necessary, to pursue amended bids.

Campanella reports that Tap Lum at *UC Berkeley* has tested the HEMT pre-amps he assembled and the results are quite good. The new pre-amps yield a very high gain with a much reduced noise temperature. Ang will arrange for the HEMT's to be shipped back from **Berkeley** and Phil Barnhart will take care of the testing fees. Ang has also located some documentation regarding a backup printer which is compatible with the strip chart printer being used in the focus room. Bob Dixon expressed his support for obtaining a backup for the digital strip chart printer.

Steve Janis reports that a new order of **Big Ear** logo t-shirts has been received and are available to volunteer staff/supporters.

The meeting adjourned at 12:10pm.

Saturday 8/20/94 Meeting Notes

Don James put in a productive session with concrete mix, before the meeting. As Don was working the concrete, a number of other regular members arrived, and we all took a tour of the focus room, where a great deal of work has taken place recently.

Topics considered at the meeting which followed the tour included: **1)** The painting initiative — Dr. Dixon was provided an article about the potential benefit of using polyurethane based paint to seal lead based paint onto the work, and this may assist with negotiations to establish a contract. **2)** The recent, very successful *Steve-Janis-Going-Away-Bash*, which included a playing of a recent *WOSU* radio interview with Dr. Dixon, Dr. Kingsley and Tom Burns. **3)** Steve Brown is back from his vacation, and he has made considerable progress in the past week or so. The

Serendip system is installed in a rack in the focus room, except for the system PC, which must have special mounting within cable distance of the rest of the equipment. Steve showed the new low noise amplifiers, assembled by Ang Campanella, and commented again on the quality of Ang's work. Dr. Dixon estimated that the new amplifiers would achieve an improvement in performance equivalent to increasing the size of the telescope by a factor of 3.

Al Horton has spent a great deal of time working on the focus room problem with water in the cable conduit. He reported a list of work which is needed to correct other problems which he discovered recently. There was discussion about Al's report, including recollections by Dr. Dixon and Steve Brown about the history of the focus room. In addition to his work on the focus room, Al took the time to order belts to extend the life of the IBM 029 Key punch, which Dr. Dixon saved from elimination when card reading capability was removed from Baker Systems (*for the * * last * * time*). It is my hope that this key punch can be adapted as a slow but sure card reader, interfaced to a PC, in order to read unread boxes and trays, and to re-read a few boxes which were not read correctly initially.

Attending today's meeting were: Steve Brown, Dr. Dixon, Don James, Cindy and Andrew Brooman, Jerry Ehman, Russ Childers, Al Horton, Please forgive omission of last names here (*my Radobs list is not up to date*), Dan (*who submitted a proposal to NASA to work on Argus*), Mark.

Al Horton has spent a number of hours recently, working on problems in the focus room. He noted that mice had found green insulation somewhere, in order to make a nest in the cable way which had been filled with water. Al has prepared a list of issues which are of concern in the focus room, and there was extended discussion of some of the issues. In addition to his work at the observing site, Al ordered new v-belts for the key punch which was salvaged from the card reading equipment removed from *Baker Systems*. It is my hope that we will be able to adapt the key punch as a slow but reliable card reader. We have a number of unread boxes and trays, and there were a few boxes and trays which were read but the results are unusable. Two members of the **Radobs** organization have expressed interest in assisting with the logic interface required to enable a PC to control and to read data from the key punch.

Tuesday 8/23/94 Report

By Tom Hanson

Dr. Barnhart conducted the meeting of 8/23. Steve Brown, Russ Childers, Cindy Brooman and Raul Ordonez attended, and despite the small crowd, discussions went on for some time.

Dr. Dixon and his boss are in Washington. It appears they will try to find support for **Argus** while they are there on other business.

Dr. Barnhart read correspondence from Herb Johnson, which included a copy of a letter from Steve Janis, informing Herb that Dr. Dixon had approved supply of a compact disk to him. Herb's check for \$30.00 was accepted by Dr. Barnhart.

Steve Brown informed us that the price of a campus parking permit for the next year has climbed to \$108.00.

Russ Childers is continuing the sky survey, working on the *Wow* signal historical data, and he is now maintaining the **Radobs** petty cash account as well.

Steve outlined a plan for moving forward with the card data. Steve has offered to collect and to backup the data on his personal computer. However, there is need for work to be done with diskettes, between the reconciliation process and Steve's archiving step. Steve will prepare instructions for the intermediate step, and volunteers will be sought for this phase. The work would consist of examining the data, and adding comments to the floppy diskette, so that Steve can assign the data to appropriate groups.

Tuesday 8/30/94 Meeting Notes

By: Tom Hanson

This evening's meeting was attended by Drs. Dixon and Barnhart, Cindy Brooman, Raul Ordonez, Steve Brown and Russ Childers.

Dr. Dixon's opening monolog featured what may be progress on the painting front, and his recent trip to Washington.

Steve Brown has been attempting to solve problems in compiling code for the

Serendip system, without remarkable success to date.

Raul is on the verge of writing the (3) CD rom disks, with an appointment for 1:30 PM Wednesday. Raul intends to use a mouse click capability of the CD rom system, to transfer MVS files on an individual basis, thus solving the problem of providing an index structure for convenience of reconcilers and researchers.

Cindy and Andrew repaired a wooden grate at the entrance to the focus room.

Dr. Barnhart has been in contact with Wataru Ebihari, who is attempting to establish a **SETI** newsgroup on *Freenet* in Cleveland.

Russ Childers reports that the telescope is working at 33 degrees, 0 minutes, which is almost 1/3 of the full travel. This is almost exactly 1 year after the start of the current survey. Russ has assembled numerous pages of legal paper notes on **SETI** data recovered from the punched card data. This work is part of the *Planetary Society* funded research of the *Wow* data. A reference to the award of a 'Phase II' grant to *Ohio State* was found in the current edition of the *Planetary Society* report.

9/3/94 Meeting Notes

The meeting of 9/3/94 was attended by a number of members, some of whom actually showed up as early as 8:30 AM, and others of whom drifted in at more reasonable times. Everyone got an opportunity to pitch in on hard physical labor. The meeting in the conference room was well attended, and quite interesting.

The highlight of the day was the announcement that the new HEMT LNA's, assembled painstakingly by Ang Campanella, are now in service, thanks to Steve Brown and Russ Childers. Russ agreed to hold the flat reflector at the current position for a few days, in order to be able to compare the performance of the new LNA's to that of their predecessors, looking at the same arc of sky.

Another announcement, at the close of the meeting, informed us all that Dr. Barnhart has finally managed to prepare all his teaching materials and plans *before* the start of classes. This will be his last year, after 35 years at Otterbein.

SUBJECT: JPL MAGELLAN WINDMILL EXPERIMENT

From: Admin@ccmail.Jpl.Nasa.Gov

Date: Thu Sep 08 13:42:03 EDT 1994

Organization: Jet Propulsion Laboratory - Pasadena CA

PUBLIC INFORMATION OFFICE.

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FOR IMMEDIATE RELEASE

September 7, 1994

NASA's Magellan spacecraft has begun a unique experiment designed to return data about the upper atmosphere of Venus and the behavior of a spacecraft entering it. The experiment marks the beginning of final activities for the spacecraft, which is expected to burn up in the atmosphere of Venus by October 14. "This is the next to last act of a truly magnificent performance by *Magellan* and its science and operations teams," said Dr. Wesley T. Huntress, associate administrator for space science at **NASA** Headquarters, Washington, D.C. "*Magellan* has far surpassed all of its original mission goals and, in the process, revolutionized our understanding of a planet that represents what Earth might be like with a runaway greenhouse effect." With its primary mission of mapping the surface of Venus successfully accomplished, **Magellan** has been used for a series of experiments that were unanticipated before its launch. In the latest maneuver, known as the "windmill" experiment, the spacecraft's wing-like solar arrays are turned in opposite directions — like windmill sails — to encounter pressure from molecules in the upper atmosphere of Venus. The experiment is measuring how much torque will be needed to keep the spacecraft from spinning on its axis, said Project Manager Doug Griffith at **NASA's Jet Propulsion Laboratory**. These data will allow engineers and scientists to better understand basic gas-surface interactions and to gain additional aerodynamic and atmospheric data on Venus for future mission designs. The windmill experiment is scheduled to last until September 14. Two weeks later, more orbit trim maneuvers are scheduled to lower the spacecraft's altitude to prepare for the final termination experiment. Three further trim maneuvers will change the altitude by 8 to 9 kilometers (5 to 6 miles) each on October 10, placing

the altitude of periapsis — or closest approach to the planet — at 155 kilometers (96 miles). The spacecraft's orbit will be lowered finally to 136 kilometers (85 miles) on October 12, with *Magellan* again put in a windmill attitude to collect more atmospheric data during its final entry. Gravity data acquisition will continue during all these periods up until October 10. "After October 12, *Magellan* will permanently enter the atmosphere in about two days, possibly in one day," Griffith said. The atmosphere will drag the spacecraft toward the surface of the planet, but it will burn up high in the skies over Venus, he said. There are two primary possibilities leading to **NASA's** final loss of contact with *Magellan*, Griffith said. Either the spacecraft will overheat and its communications systems will be damaged, or *Magellan's* control thrusters will be unable to maintain pointing control toward ground-based receiving dishes on Earth as the spacecraft spins to its demise. In recent weeks, the performance of the spacecraft's solar arrays has begun to degrade due to the extreme temperature changes as the spacecraft passes from direct sunlight to shadow during its orbit. The thermal stress after more than five years in space and several weeks in low orbit has caused degeneration of its solar cell connections and has brought the spacecraft near the end of its useful life, Griffith said. "It is a race to the finish," said Betsy Beyer, *Magellan* program manager at **NASA** Headquarters. With the continuing loss of power due to the solar cell degeneration, the spacecraft may shut down even earlier than projected, before a planned entry experiment. "*Magellan* has done more than its duty," Beyer said. "If it goes in its own way, instead of how we planned to end it, it is still a winner." Controllers sent commands to *Magellan* in late August for orbital trim maneuvers that reduced its altitude from a near-circular orbit of 197 by 541 kilometers (123 by 338 miles) to an orbit of 172 by 390 kilometers (107 by 242 miles). These altitude reductions were required to set up conditions for the final experiment phases. *Magellan* was launched in May 1989, and began mapping the surface of the planet using synthetic aperture — or side-looking — radar in September 1990. In three cycles, each comprising one Venus day or 243 Earth days, the spacecraft mapped 98 percent of the planet's surface, providing unprecedented views of its unique pancake domes of lava, strange volcanic structures, craters and high mountains. In three subsequent cycles, it has measured Venusian gravity over 95 percent of the planet, gathering data so that scientists can map the planet's interior. *Magellan* also has contributed to ongoing study of the planet's massive atmosphere of carbon dioxide and high sulfuric acid clouds. This period included the first-ever "aerobraking" of a spacecraft into a near-circular planetary orbit, for *Magellan's* final operations. The data which have streamed back from *Magellan's* radar imager, its atmospheric studies and its gravity

data acquisition maneuvers have built a vast database of new knowledge about Venus and the formation of the solar system that will be studied by scientists for decades to come, project officials said. **JPL** manages the *Magellan* project for **NASA's** Office of Space Science, Washington, D.C.

NASA illustration of a planned unmanned Mars lander, rover, and base.



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Designed by Jerry Ehman

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