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"Signals"
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A REPORT FROM THE ASSISTANT CHIEF ENGINEER
June 28, 1994

The all-sky survey continues, with 24 percent of the observable sky surveyed. The survey started on September 29, 1993, at declination +62 degrees 20 minutes. The sky is observed in a "drift scan" mode with two identical switched feed horns. Celestial sources drift through each beam in turn, and create a characteristic S-shaped curve. Two concurrent observation programs are currently running at the **OSURO**. A 3000-channel **SETI** (*Search for Extraterrestrial Intelligence*) receiver scans the 1.4 -1.7 GHz band once every 20 seconds. If a narrowband signal is detected, the feed horns will move to track the source. A 1410 MHz continuum channel is also being recorded and analyzed. This data is being compared to the *Ohio Survey*, with the intention of finding variable radio sources. A real-time data analysis algorithm looks for point sources, and identifies their catalog number and coordinates from the *Ohio Survey* when sources are detected. I change the declination of the *Radio Observatory* by 20 minutes of a degree, two times a week. The current survey is scheduled to finish in September, 1996. The current antenna declination is +38 degrees 40 minutes. When the declination passed +39 degrees 20 minutes, the vignetting effect stopped. The vignetting effect is the reduction in power received, caused by the foreshortening of the flat reflector with respect to the parabolic reflector of the *Radio Observatory*. This occurs when observing high northern declinations. The remainder of the survey (77%) is conducted with a filled aperture.

-- Russ Childers --

A REPORT FROM THE ASSISTANT CHIEF ENGINEER
July 7, 1994

The current antenna declination is +38 degrees 00 minutes. The sky survey is 24% complete. The dl0 disk drive on the PDP failed to restart after a power glitch that occurred three hours before the declination change. A spare RL02 disk drive has replaced the defective one in lieu of repairs. The **LOBES SETI** system recently detected a powerful OH maser. The system followed up on the celestial point source 12 times, for a total of about 15 minutes. The 12 followups are the most caused by any source since the all sky survey began in September, 1993. The maser is a naturally-occurring narrowband radio source. This source did not show on the continuum channel because it is not in the proper frequency range. Characteristics of the source are:

Frequency	1612.540 MHz
Bandwidth	25 kHz
Intensity	420.0 Jy
RA (epoch 1994)	20h 44m
DEC (epoch 1994)	40d 00m
Gal. Longitude	80.8 degrees
Gal. Latitude	-1.9 degrees

I first noticed the sources in the **LOBES** printout on Thursday, June 9, 1994. In order to determine whether the source was celestial (fixed against the backdrop of stars), I tracked the source and recorded the output of the 100 kHz and 10 kHz channels, centered at 1612.540 MHz. The source acted very celestial. Upon consultation with Bob Dixon, I listened to the output of the *ICOM* communications receiver. If there was an artificial signal, it would be identifiable as a carrier. No such carrier was heard. Further consultation lead to the eventual identity of the source. This source provided an excellent test of the **LOBES** system. Now we know where to look when we want a narrowband point source to calibrate our system.
-- Russ Childers --

WOW Signal Parameters:

Discovered: 1977
By: Jerry Ehman
RA: 19h 17m
DEC: -27d 03m
Frequency: 120.184 MHz

NAAPO SATURDAY MEETING, APRIL 2, 1994

Present: Barnhart, Brown, Campanella, Childers, Dixon, Dan Fleisch, Hanson, James, Janis, Bill Miller, Bill Schultz, Schumacher.

SITE GROUP: Steve Brown has had a dumpster delivered to the telescope site. A general cleanup of the garage area and debris removed from the old horn cart but filled the dumpster about halfway, with more of the old horn cart to follow as its demolition continues.

HANSON CARD PROJECT GROUP: Steve Brown has performed his portion of the post-read processing on about one hundred more boxes. These are now ready for reconciling by volunteers, and Tom Hanson transported these to the site for distribution. Reading continues primarily through the efforts of Jenny Kelbley and Tom Hanson. The rest of the meeting was taken up with a discussion of the upcoming May 14th **Radio Telescope Open House**. There are still a number of exciting volunteer positions available for those wishing to participate in the *Open House*.

The meeting adjourned at approximately 1:00 pm.

NAAPO SATURDAY MEETING, APRIL 16, 1994

Present: John, Ken, and Christine Ayotte as well as one unnamed daughter, Barnhart, Brown, Campanella, Childers, Dixon, Fleisch, Hanson, James, Janis, Schumacher, *OSU* Mech. Engr. students Scott Akin and John Swyt, *OSU* Elec. Engr. Professor Chuck Klein.

SITE GROUP: The remaining pieces of the old horn cart hut, which were dismantled by Russ Childers, were transported to the dumpster on site. Also, scrap metal from the *Foster Grant* was loaded onto a *Worly Recycling* truck and a less ambitious general cleanup of the garage area succeeded in filling the dumpster to its limit. A new battery has been purchased and installed in the **RO** truck. Some preparation of the fuel system must be done to once again return the truck to operating condition, but it is anticipated that Russ Childers will have no problem with this.

GENERAL MEETING: Russ Childers reports that the telescope is at a declination

of 45 degrees. A discussion of the upcoming Open House on May 14th was the main topic. Volunteers are still needed to fill spots on the tour and to help in general with parking or general information. Concerns of the landlord, which were received through the *OSU Property Management*, about needed concrete patching, painting of the office building, and repair of the bathtubs under the flat reflector bays were discussed along with the major job of painting the telescope. Dixon and Janis are pursuing bids for painting the telescope through the *OSU Purchasing Department*. Concrete patching and painting of the office building seem to be jobs which our volunteer workforce could handle once materials are determined and obtained. A more involved job would be the rebuilding of the bathtubs. Card reconcilers returned many finished boxes of cards to the site. Dan Fleisch and Phil Schumacher pursued a lengthy discussion of the **KLT** after the meeting adjourned at approximately 12:30 pm.

NAAPO SATURDAY MEETING, JUNE 4, 1994

Present: Barnhart, Cindy Brooman, Brown, Childers, Dan Fleisch, Marilyn McConnell-Goelz, Hanson, Al Horton, Janis, Bill Schultz.

With a number of new volunteers present, the working groups were dispensed with this week and the entire group met in the main office building. Phil Barnhart chaired the meeting after giving a reporter from the *Cleveland Plain Dealer* the VIP tour of the Telescope. He introduced the new volunteers to his oral history of the *Radio Observatory* and the Ohio **SETI** Program. Various options for connecting the new volunteers electronically to the Observatory's email/bboard system were discussed. Steve Janis will pursue providing access to the appropriate facilities.

Cindy Brooman is a programmer/analyst with the Ohio Dept. of Education, an original subscriber to *Cosmic Search*, and is interested in using her programming skills in **SETI**.

Al Horton's background is in Biology and writing/editing and he is interested in helping with publicizing the *Observatory's* activities.

Marilyn McConnell-Goelz is an attorney in private practice with an interest in **SETI** whom Tom Hanson recruited.

Dan Fleisch reports that he has finished a draft of a grant proposal to **NASA's** small

business initiative program. If successful, this will provide money to Dan's company, *Lintek, Inc.* in Powell, Ohio to perform feasibility studies on the **Argus** concept. Dan and Lintek would then be collaborating with the *Observatory* in this study. If the study provides worthwhile results, the next step would be to apply for a larger grant from the same **NASA** program, which would provide for much more extensive study and testing of an **Argus** prototype. Dan's focus in the study would be to use an **Argus** array to study atmospheric phenomena, as this is more directly aligned with **NASA's** current interests.

Russ Childers reports that the *Telescope* is at a declination of +40 degrees, 20 minutes. He also reports that he has tentatively identified a recurrent **RFI** source as being weather balloons launched from the Dayton area. He also presented skymaps from the current survey which seem to show the presence of a strong radio source not found by the original *Ohio Sky Survey*. Russ will be further examining the old and new data before making a definite conclusion.

Steve Brown reports that the **SERENDIP III** system has arrived at the *OSU* campus. Unfortunately, a bent pin and a rough trip from California have left it less than perfect condition. Steve Brown and Chuck Klein are in contact with Dan Werthimer at Berkeley about how best to remedy the situation. Steve is busy with finals this week, but intends to have **SERENDIP** physically installed in the focus room by the end of next week, June 17th. The current **LOBES** system and the **SERENDIP** system are incompatible in a number of ways that prevent them being in operation simultaneously as currently configured. **LOBES** will probably end up being changed to accommodate **SERENDIP**, but will still most likely run simultaneously albeit with a narrower bandwidth and correspondingly higher sensitivity. The actual configurations will be hashed out by Brown, Childers, Dixon and Klein.

The meeting adjourned about noon.

NAAPO SATURDAY MEETING, JULY 2, 1994

Present: Ayottes (John and Ken), Barnhart, Brown, Campanella, Childers, Dixon, Jerry Ehman, Hanson, Helwigs, Janis, Barry Kawa: *Plain Dealer* Columbus Bureau Chief, McConnell-Goelz, Schultz, Schumacher, Van Horne.

Phil Barnhart opened the meeting at about 11 am by delivering fuses to Al Horton and contracts to Childers and Janis. A small site group (Barnhart, Hanson, and Janis) showed up early this morning and, despite a torrential downpour, succeeded in patching the concrete steps leading to the focus room.

Childers reports that after further investigation, he was able to tighten belts on both the air conditioner and air compressor. The tape recorder used for audio recording and playback of interesting signals died this past week, but was replaced by a recorder donated by Tom Hanson. **LOBES** is now programmed to reject *RFI* from the regularly scheduled weather balloons which have been interfering with the telescope lately. This program now ignores about 100 of the 3,000 channels of **LOBES** for about 4 to 6 hours each day.

Janis reports that plans are underway to do away with the *private.radobs* newsgroup and to replace it with a listserver. This change should allow a similar electronic discussion environment for **RO** group, but with easier access. *MGM* studios called and requested photos of the telescope focus room to assist them with set design on an upcoming film currently entitled "Species". Phil Barnhart has volunteered to take the photos and Janis will see that they get to *MGM*.

Bob Dixon reports that a Japanese TV crew would also like to film at the telescope for a program on **SETI**.

John and Ken Ayotte started work this morning on a prototype styrofoam box to hold the new HEMT pre-amps.

Brown reports that the **SERENDIP** multi-megachannel receiver has been returned to *UC Berkeley* for repairs necessitated by damage presumably incurred during shipping.

Attorney Marilyn McConnell-Goelz, a more recent volunteer, has volunteered to

assist Phil Barnhart with routine legal matters pertaining to maintaining **NAAPO's** not-for-profit corporate status.

Barry Kawa of the *Cleveland Plain Dealer* has been interviewing various members of the staff and will be writing a feature article about the **RO** to appear in the *Plain Dealer's Sunday Magazine* sometime in late July or early August.

Jerry Ehman, a principal player in *Phase II* of the **Ohio SETI Program** and noted writer of "**WOW**" in the margins of printouts, has rejoined the group and is eager to get back to work at the **RO**.

Ang Campanella reports that tractor feed printers like the one in the focus room currently serving as a digital strip chart recorder are becoming harder and harder to find. He recommends a spare one be purchased as a backup and for parts. Ang also showed some of his handiwork in assembling the new HEMT pre-amps. A discussion of where and how to mount the power supplies ensued. Ang will work with Steve Brown on this.

Bill Schultz reports that his Cincinnati amateur astronomy group is awaiting Jupiter's upcoming comet encounter.

The Helwigs arrived near the end of the meeting with their new cement mixer. They promised its availibility for future concrete projects at the Telescope.

The meeting adjourned around 12:15.

TOP QUARK DISCOVERED

An international team of scientists, working at the *Fermi National accelerator Laboratory* in Batavia, Ill, believe they have finally found the top quark, one of 12 subatomic particles necessary to the Standard Model theory. The announcement was originally made Saturday, 4/23/94 in the *Chicago Tribune*.

COORDINATOR'S CORNER

The delay in getting this issue out rests largely on my shoulders. Earl has bugged me every chance he gets for the past month to get with it and get the stuff in. I have finally caught up with the tasks that kept me out of circulation for the past three months. The new mega-channel **SETI** back end has arrived (somewhat the worse for being dropped in transit), tested out to be non-functional, sent back to *Berkeley*, and finally, this week has returned to be bench tested and placed in service. This will put **Big Ear** right in there with the best in the world in the **SETI** search with the capability of monitoring 4 million 0.6 Hz channels for evidence of artifacts attributable to extra-terrestrial technologies. The big concern now is how to keep the continuum survey and the 3000 channel receiver operating at the same time. Certain incompatibilities arise when the two systems operate at the same time at the output of the feed horns. We are working through the possibilities as you read this. Ange Campanella has finished assembly of the new HEMT low noise amplifiers to go onto the feed horns. Wiring in a new set of power supplies is all that stands between us and a better front end. Good things are happening again to us as a result of the May Open House. We have a new class of volunteers willingly digging in to find their niche in our environment. So far we are very pleased with the response to the open visitation. We are looking forward to making the event a regular feature every six months.

I am finding my way back into the cement patching business. There are a few places at the observatory site where crumbling concrete is becoming unsightly and hazardous io those walking to and fro. The steps to the focus room loading dock have been patched and reshaped. A final pour in that area is scheduled for the July 16 working session. I am replenishing the soft drink inventory this week. We encourage all comers to make use of the nicely cooled refreshments, make requests for those flavors you crave but do not find, and please remember to make your donation to defray the expense of cement patching when you guzzle the sweet juice. If you are unable to pay when you become parched, please leave an IOU in the cold cash box so we know who to put on weed patrol. (*Bob Dixon got rained out while spraying ground plane weeds last week during the working session.*) Send us some news. We are always eager to hear from our friends who reside beyond a simple commute. (At present the simple commute includes Cincinatti. Bill Schultz has become a regular at the Saturday sessions!) Just jot your question or news item on the back of a $20 bill and mail it to us.

-- Phil Barnhart --

ACHTUNG!!!

Star time has come! If you still have stars (*****) by your address on the label **THIS** will be the last issue of **SIGNALS** coming your way. To reinstate your interest in the most important search in human history, let us know of your continued interest, and lay a few bucks on the barrel head to defray the cost of keeping you informed. We do not turn any amount down, but $25 is what we figure we can get by on.

VOLUNTEER LIST GROWS

The *Observatory* roster has grown over the past few months as new volunteers come to our project. We find word of mouth and general open house visitations provide the most effect means of recruiting fresh volunteers. This spring crop offers much needed talent and great enthusiasm to the on-going program at the **RO**. Tom Hanson, a long time volunteer and cardreading guru, introduced our opportunity to Marilyn McConnell-Goelz, a Columbus attorney with an eye to space exploration and a fascination with our universe. Marilyn has taken on the task of advising our naive and somewhat casual **NAAPO** Coordinator about the legal ins and outs of operating a non-profit research and educational organization. We look forward to her continued support and pro bono services in the various clerk's offices and state bureaus and chambers of red tape. A volunteer, who stumbled into a public lecture presented by Phil Barnhart and sought to explore further a few hints dropped about potential volunteer opportunities, is Dan Fleisch (*who, incidentally, volunteered Jill, his fiancee, for the awesome task of maintaining the gift shop during the May Open House*). Dan is a radar specialist with a small company in Powell and brings great promise to the problem of funding for some of the activities of the *Observatory*. We will certainly gain valuable exposure to the real world through his efforts. The May 14 open house brought four new volunteers to our doorstep. Computer programmers, Cindy and Andrew Brooman are gearing up to work on the interfacing of the **SERENDIP** receiver and other programming tasks that might appear. Al Horton, with a degree in biology, is interested in writing about **Big Ear**, fund raising, **Argus** development, and has been working on several phases of the HEMT power supply fabrication and installation. Sam McCarter is a graduate student at *Ohio State University* with a background in statistics. He will be working with Russ Childers on the current survey and archive data. Finally, we welcome back into the volunteer fold a long-time and somewhat notorious contributor to the **SETI** search, Jerry Ehman. After a decade of pursuing other interests, Jerry has

decided to again look for other examples of his now famous "**WOW**" signal. We are very glad to have him back as a volunteer.

SERENDIP RECEIVER ARRIVES - AGAIN

The million channel **SERENDIP** receiver from *Berkeley* has arrived in central Ohio for the second time. It was damaged in shipment the first time around and could not be made to work during the initial bench tests by Steve Brown. We should know its present status within a few days. We still plan to have it operational yet this summer.

OPEN HOUSE A GREAT SUCCESS

On May 14 a large volunteer staff organized and operated a general public open house at the radio observatory. What appeared to be an insurmountable publicity catastrophe was overcome by modern electronic communication and dedicated volunteer activity. Two days before the event was to occur it became evident that general publicity sent out a few weeks prior was not making it into the local media. Newspapers and radio announcements were not appearing as requested. With Bill Miller, our volunteer publicity guru recovering from foot surgery (*and complications*) Bob Dixon posted messages on two or three electronic bulletin boards announcing the open house. He and other volunteers then posted handbills at a variety of public places in northern Columbus, Powell and Delaware. Well over 200 guests responded to these postings and the large sign planted in the median of Route 23 just outside the entrance to the observatory driveway. The message got out very effectively, netting four new volunteers and donations in the gift shop of about $400. Our response to this fine turn-out on short notice is to plan to hold future open house programs twice a year, spring and fall. We also wish Bill Miller a speedy and thorough recovery.

OBSERVATORY VISITS

During the past several weeks there have been visits to the *radio observatory* by a variety of groups. On Friday, June 17, Ardis Maciolek brought a group of students from *Grosse Point Michigan* to tour the observatory. Steve Brown conducted the tour which also included a teacher and students from Cincinatti interested in building and operating a radio telescope. Steve had helped the *Grosse Point* group a year ago get their observatory started by aligning a receiver for them. June 24 found a group of *Columbus Academy Space Camp* participating in a tour of the facility. Phil Barnhart showed them around and introduced them to some techniques for exploring the universe beyond the solar system. For the past three Saturday Working Sessions, Barry Cowan [sic; correct last name is "Kawa"] and an AP photographer have been on site preparing for a *Sunday Supplement* article for the *Cleveland Plain Dealer* which will appear late July or early August. Tuesday July 19 is a scheduled visit by a Japanese film crew preparing a program on **SETI** for broadcast in Japan. **Big Ear** is to be included as one of two active observatories in the U. S. engaged in the search. They will go on to Paul Horowitz's observatory after leaving here.

EXTENDED OBSERVATORY WISH LIST

We are always interested in the possibility of useful donations of equipment for the on-going programs of the observatory. We are now in need of two items that may be available from someone whose company or business might wish to discard in our direction.

1. We need a PC computer with large (*100 megabyte or greater*) storage capacity. It need not be a very powerful computer, but must be able to handle large storage capacity.

2. In preparation for finally getting the archived data onto compact disc we have the need for a CD reader compatible with a PC. Any help in this direction will be greatly appreciated. If you have any leads on such equipment please contact: Dr. Philip E. Barnhart, NAAPO/Otterbein, Otterbein College, Westerville, Ohio 43081. (614) 823 - 1516. (FAX) (614) 823 - 1968
pbarnha@magnus.acs.ohio-state.edu

CHILDERS ACHIEVES ANOTHER FIRST

Russ Childers racked up another first for the *radio telescope*. After having a very limited spectral range for the narrow-band receivers for so many years it is a luxury to be able to look with narrow-band detectors at the OH region of the spectrum. In June this year while observing at 40 degrees declination the **LOBES** program locked onto a narrow-band source and tracked it for a record number of times. When Russ found the **LOBES** flag for this object he obtained signals on successive days and ultimately identified the narrow-band source as OH 80.8 - 0.9. This is the designation of an OH (*i. e., the hydroxyl molecule*) maser, several dozen of which are known in the galaxy. The catalog designation should not be confused with the *Ohio Survey* catalog numbers for the 6 to 7 hour right ascension band. The catalog number given in *Ap. J. Supp. 27, 331* is the galactic longitude followed by the galactic latitude with the prefix OH to indicate it is an OH maser. This is the first time an OH maser has been detected at **Big Ear**. The fact that it was detected by the **LOBES** algorithm indicates that at the program is doing what it was designed to do. The fact that OH 80.8 - 0.9 is the brightest OH maser known does not detract from the significance of the detection. It is reasonable to expect in the future to be able to use these masers to serve as a check on the correct operation of the **SETI** detectors.

[Note from webpage editor: For each of the three figures below, click on the figure to obtain a larger version.]

FIGURE 1. Simultaneous plots of ten channels surrounding the 1612 MHz OH maser line from OH 80.8 - 0.9.

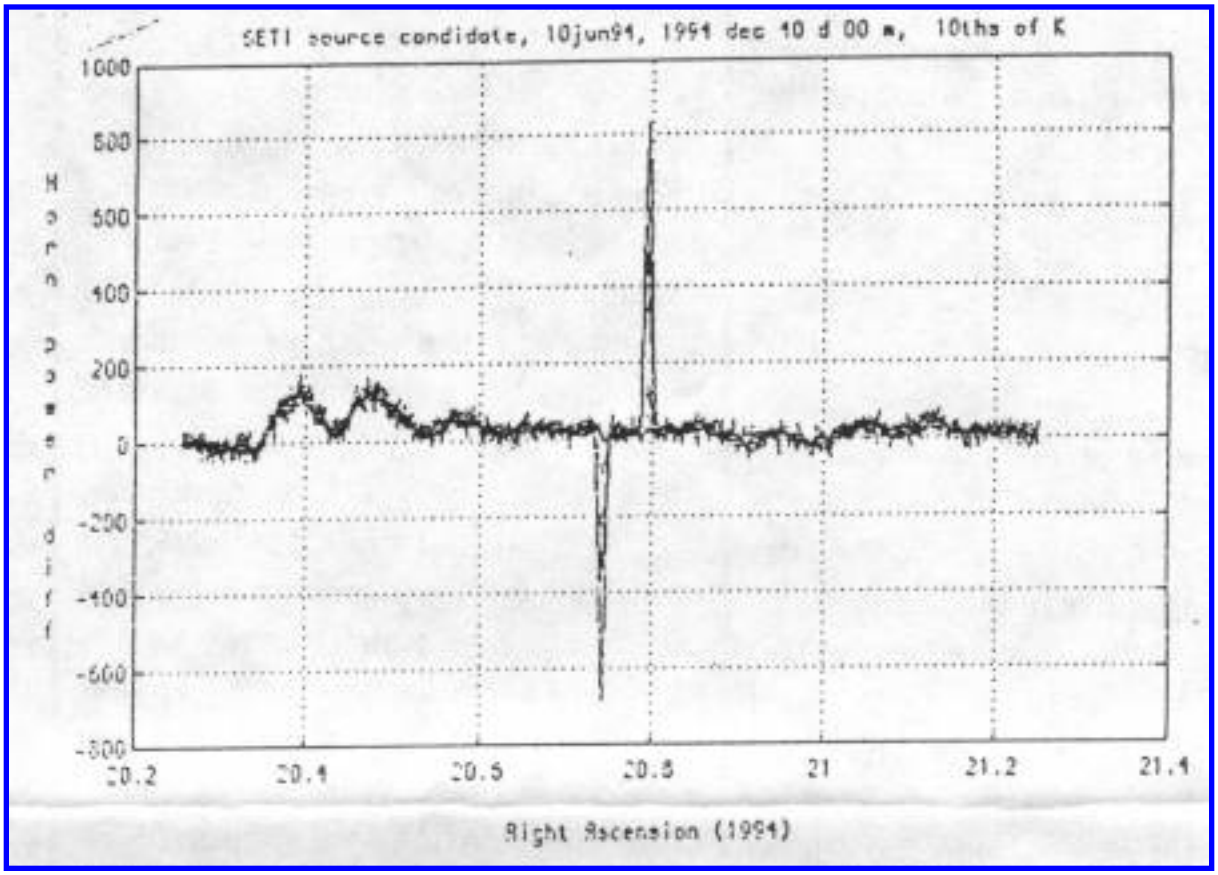


FIGURE 2. Expanded time scale for the observations illustrated in Figure l.

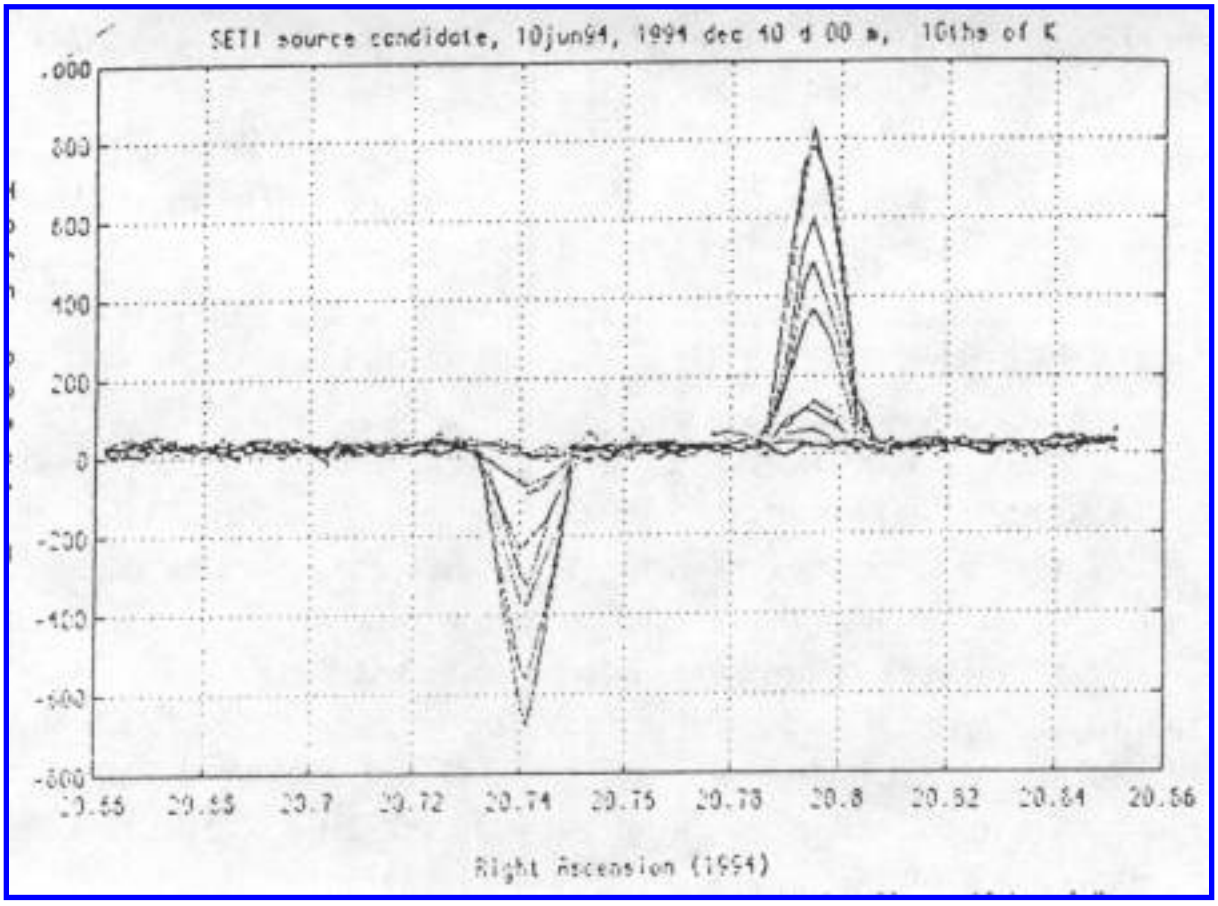
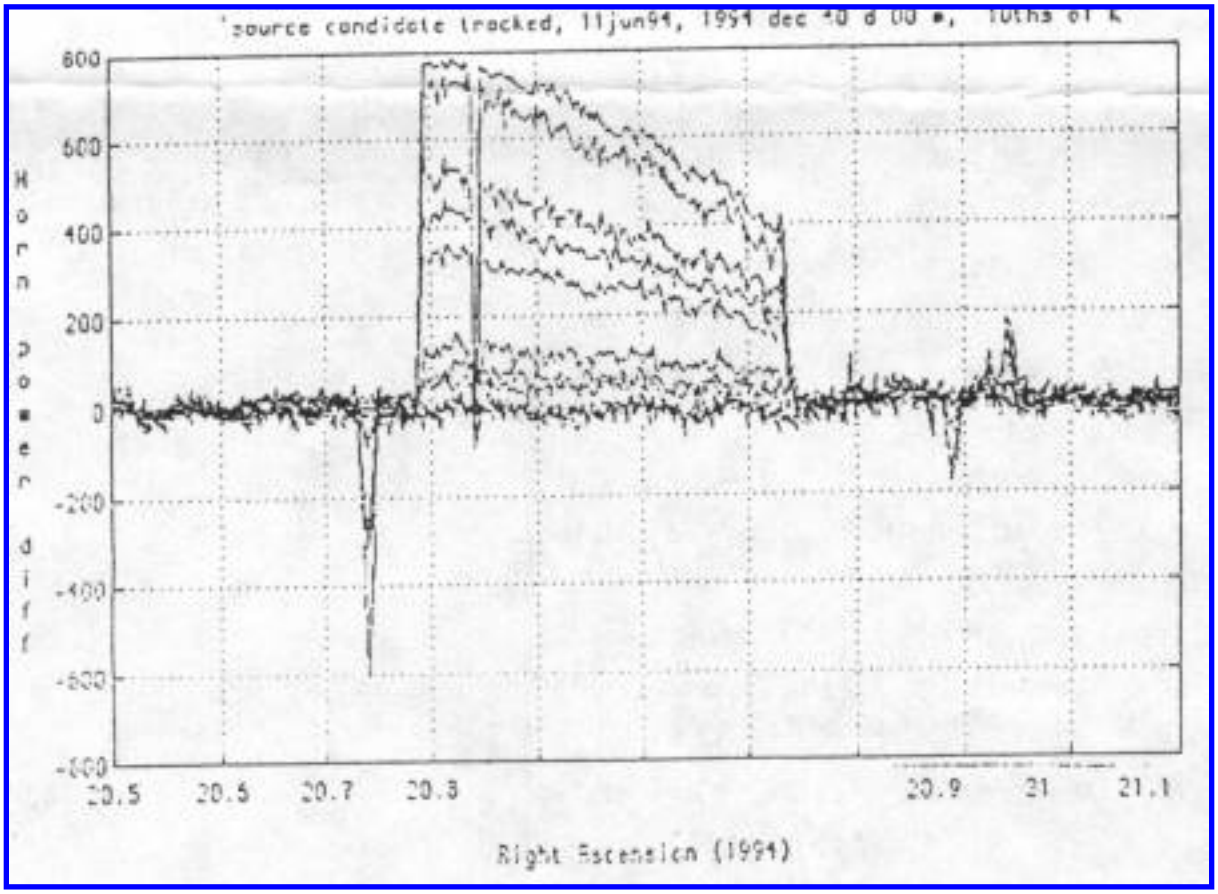


FIGURE 3. Tracking of OH 80.8 - 0.9 with the horn cart while maser image is located in the east horn. Note the maser is recorded in eight channels and the fall-of in intensity as the horns move away from the meridian (the central axis of the telescope).



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