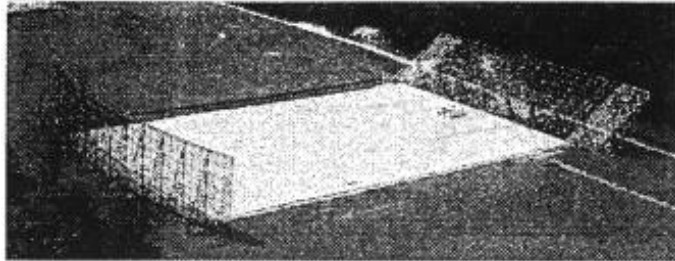




## NAAPO (North American AstroPhysical Observatory)

"Signals"  
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# SIGNALS



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**Chief Observer's Report****November 2, 1995****By: Russ Childers***rchilder@magnus.acs.ohio-state.edu*

The 60 percent mark in the current survey has been passed: the declination of the **Radio Observatory** is +02 degrees, 0 minutes. The survey started at +62 degrees, 20 minutes, in September, 1993, and is scheduled to finish at -37 degrees declination in early 1997. The survey proceeds 1/3 degree at a time, requiring 300 declination changes in total. Two concurrent surveys are actually being conducted. One is the continuum survey, which is re-analyzing the same frequency and sky area observed at **Big Ear** in the **Ohio Survey**. This survey looks for natural signals. The other is the **SETI** survey, where 3000 channels are being analyzed for artificial, celestial signals. This survey looks for signs of extraterrestrial intelligence. The system that analyzes the data is called **LOBES**, which stands for *LOW Budget ETI Search*.

I purchased a 540 Mbyte hard drive (*with NAAPO funds*), and Chief Engineer Steve Brown installed it in the **LOBES SETI PC**. This replaces a 20 Mbyte drive. With this new storage capacity, it is possible to store all the data currently being analyzed by **LOBES**. (*The data will be transferred to compact disks for permanent storage.*) There are great advantages in this new storage capability. We can now reduce noise by adding several days' worth of data together, allowing faint signals to emerge. Different kinds of signals, like the **WOW** signal, are now open for re-examination. **LOBES** will still conduct real-time followup of signals, because **SETI** signals may not stick around for re-observation after post-processing.

We are about to have a third survey conducted at **Big Ear**. Bill Brown, the Graduate student working with Chuck Klein, is going to start collecting 1000 hours worth of data from the **SERENDIP** system. Observations with **SERENDIP** will interrupt **LOBES** and the continuum survey for that 1000 hours, but Bill and I have agreed to trade observing times. This will allow Bill to make a systematic survey of several degrees of declination, as the other surveys continue. I look forward to seeing Bill's data.

Winter time is here, which means the best observing conditions of the year. With the long, cold nights, the receiver system has a chance to stabilize its temperature. The cold helps the reception, because there is less electron noise jiggling in the wires. Rain causes strange interference in the **SETI** system and just outright ruins the broadband survey. Snow does not seem to affect the reception at all, however. In fact the colder and icier, all the better. The only time the snow becomes a problem is when it drifts over the cart which carries the feed horns. **LOBES** needs to move this cart to follow possible **SETI** signals. With big drifts, the cart can get snowbound, leaving it in a limbo between the start and the end of its journey. This happened during the deep freeze of January, 1994. As I was snowbound at home as well, I had to wait for the first thaw (temperature above 10 degrees F) to rescue The Ear.

**MEETING NOTES****Saturday 10/21/95****By: Tom Hanson**

The Observatory meeting room was pleasantly warm, as members gathered on this cold, blustery day. Rain threatened to pour from the scudding dark clouds, but it held off until we were ready to leave. Dr. Dixon circulated the obituary notice for former member, Ron Houk, printed in the *Columbus Dispatch* on October 6th. Attending today's meeting were Drs. Dixon and Barnhart, Steve Brown, Don James, Jerry Ehman, Cindy Brooman, Russ Childers and Dan Fleisch.

Dr. Dixon's opening monologue dealt with the ongoing **Big Ear** saga. The 10 years lease has expired and the current lease is continuing on a month-to month basis. Negotiations for sale to the new owner are still underway. The project to remove "toxic wastes" has indeed consumed the bulk of the \$200,000 which was originally anticipated as a benefit of giving up the existing telescope and site.

On the positive side, Dr. John Young has expressed an interest in the potential value of the **Argus** concept as a way of increasing efficiency of cellular communication, since it offers the prospect of allowing the same frequency to be used by multiple subscribers in a given transmitter coverage area.

In discussing possible sources of income to provide funding for **Argus** development, the suggestion was made that pulsar researchers may be potential clients. Pulsars were reported to range in periodicity from milliseconds to seconds. Dr. Dixon commented that papers will be given by pulsar researchers at the conference he plans to attend in England, in the not-too-distant future. There was some discussion of the technical issues which would face an **Argus** developer, in trying to meet the potential needs of these clients. Steve Brown commented that the wide bandwidth commonly associated with pulsars would increase computational requirements for a digital system significantly. On the other hand, Steve is continuing to learn about possible non-digital (*optical*) means for extracting signals, and he expressed cautious optimism that this ongoing research may produce useful results. He specifically mentioned resolution of multiple beams with wide bandwidth as a potential capability of a lense based system.

Steve listed several items which he thought would be of interest to pulsar researchers:

- 1) Properties of media between Earth and subject pulsars
- 2) Time bases
- 3) Short term variation of pulses
- 4) Internal motions within neutron stars (*star quakes/Dr. Barnhart*)

Steve's comment was that some of these items would require knowledge on a pulse by pulse basis.

Russ Childers inquired about how many elements would be required for an **Argus** pulsar receiving station. Steve Brown recalled that several hundred dipoles were used in England (*?Jodrell Bank*). Dan Fleisch commented that gain increases directly with the number of antenna elements.

Dan went on to point out that builders of an **Argus** facility might derive income by supplying data to others. Dr. Dixon responded with a reminder that while sale of data would be an option for an **Argus** facility, he would prefer to hold to the idea of extracting value from the data as well as gathering it. At minimum, Dr. Dixon would like to see realization of his concept of an all-sky, real-time video display at the observing site.

Dr. Barnhart requested an update as to the *Motorola Iridium* project, as it impacts the Observatory. Dr. Dixon replied that the Motorola people were here, and they seem willing to address the potential problem of their interference with

radio observatory observations by offering the technology to turn off receiving equipment during a time period when all Iridium satellites would be transmitting earthward. The Motorola engineers apparently believe their plan will accommodate variations caused by movement of the satellites themselves with respect to the fixed ground site. Steve Brown commented that the Iridium system will effectively prevent observation in certain frequency ranges, due to long integration times. Jerry Ehman inquired as to the effective radiated power of the proposed satellites, and Steve said each satellite will be capable of radiating 100 watts. However, radiation will be divided into multiple spot beams. Dr. Dixon reminded us that Arthur C. Clarke had predicted that eventually there would be no difference between long distance calls and locals. By coincidence, the September 1995 issue of *Moon Miner's Manifesto* includes a reference to this prediction. David Dunlop stated: "A new driver for cheap routine access to space will be commercial telecommunications demands. The new global satellite telecommunications networks will change again the shape and feel of the world. Arthur C. Clarke in 'How the World Was One' predicted the end of the distinction between the local and long distance telephone call around the turn of the millennium."

Thus ends Dr. Dixon's (*interactive*) opening dialogue.

Dan Fleisch briefly reviewed the less than encouraging results of a recent presentation of the **Argus** concept at his company, and he concluded that the battle for funding of new ideas seems to be a constant of life.

Cindy Brooman has been working hard in development of her family owned World Wide Web site construction business. Her current largest client is the *Columbus Chamber of Commerce*, which appears to be Yet Another Bureaucracy (*YAB*) (*as in YABBA YABBA DO?*). Meanwhile, Cindy's promotional efforts on the Web have resulted in several inquiries, including one from an organization in Canada. It was pointed out that Cindy's own Home Page recently underwent extensive renovation, including implementation of the new corporate logo. For anyone with Web access, Cindy's URL is <http://www.point-and-click.com>.

Jerry Ehman reported on his participation in filming of a visit to the Observatory by a crew from the *Discovery Channel*. The crew was here from 2 in the afternoon to 7 PM. Jerry understands the result of this visit will be a series of four one-hour episodes, which should appear in about 13 months. Apparently the film crew used various colored lights for artistic effect. We can all look forward to seeing Jerry illuminated in an interesting shade of green. In response to an inquiry, Jerry reported that he is continuing to work on his goal of writing a **SETI** Primer. He received copies of Jim Bolinger and Steve Brown's Masters theses, and he intends to actually 'read' them both. This led to Steve Brown's prediction that if Jerry follows through with this intention, then there would be four people in the world who have actually read the document.

Don James is trying to keep the Observatory crane running. He reported that the motor is fine, but that the clutch is in poor condition. Don asked if the crane would be needed in the future, while wondering if his efforts were worthwhile. He received several reassurances that the crane would be likely to be needed in the next three years, as the Observatory prepares for closing. Dr. Dixon commented that the Administration Building might be moved, if a way could be found to do that economically.

Russ Childers announced that the telescope is gathering signals from exactly 3 degrees. In the next few days he will move to the 60% point in the ongoing survey. He said that all 3,000 channels are being saved to disk every 20 seconds, and his is accumulating 20 megabytes of data each day. Russ will pick up a Colorado External Tape backup device, using an authorization form supplied by Dr. Barnhart at today's meeting. Russ commented that the external backup technology will be discontinued by Colorado.

With due caution in light of past disappointments, Dr. Barnhart announced that there may be a display of meteors on November 17th or 18th, due to the Earth's movement through a 'sheet' of debris from a comet. The comet has a period of 33 1/4 years. The total window for viewing is only about an hour. In any case, the shower will be visible in the morning sky, appearing to originate in the constellation Leo. In a personal note, Dr. Barnhart described his recent

conversation with a nephew who works for the Interstate Commerce Commission. It appears that the commission will disappear, but the people and functions will simply merge into other departments.

"*Signals*" is now being printed at *Kinko's*, thanks to Joe Mitchell, who has volunteered to do the printing. **NAAPO** is charged only the price of materials.

Dr. Barnhart and Esther are handling the mailing duties, now that he is retired. The entire distribution of 150 copies takes about four hours.

Cindy Brooman passed along a tip for users of the Netscape program. It turns out that a right mouse click is a shortcut for downloading an image.

After the meeting, Russ Childers and Steve Brown applied a gold foil label "East West Railroad" to a metal panel. This was one of a pair which were intended to be mounted on the horn cart. If one is careful to choose lighting conditions properly, the result of their efforts looks quite good.

## **HERB JOHNSON'S REPORT**

I'm pleased to see that, after initially showing disinterest in pulsar research, the Observatory is now intrigued with the possibilities! Maybe my dialogs and writing had some impact after all!

In discussing possible sources of income to provide funding for **Argus** development, the suggestion was made that pulsar researchers may be potential clients. Pulsars were reported to range in periodicity from milliseconds to seconds. Dr. Dixon commented that papers will be given by pulsar researchers at the conference he plans to attend in England, in the not-too-distant future. There was some discussion of the technical issues which would face an **Argus** developer, in trying to meet the potential needs of these clients.

You *\*might\** want to make sure these people have money in the first place, and are looking for a facility in the second place. Most interest in pulsars is in astrophysics, not a highly funded area to begin with. However, a telescope proposal that included pulsar research would have incremental value. Steve listed several items which he thought would be of interest to pulsar researchers:

- 1) Properties of media between Earth and subject pulsars
- 2) Time bases
- 3) Short term variation of pulses
- 4) Internal motions within neutron stars (*star quakes/Dr. Barnhart*)

Steve's comment was that some of these items would require knowledge on a pulse by pulse basis.

Yes and no. Pulse shape requires the intergration of hundreds, or thousands, of pulses due to variations in signal reception, both locally and through the interstellar medium. If you could collect from distant sites and synchronize to microsecond resolution (*no simple task!*) you could reduce some terrestrial variations. I might also note that pulsars signals are an order of magnitude stronger at 600 MHz than 1400 MHz.

Variations in pulse timing is to some extent pulse-to-pulse, but the above considerations require gathering many pulses. The typical pulsar of interest is at millisecond, or submillisecond, rates; for gathering thousands of pulses you need a very solid timebase to microsecond resolution. And of course you need to track over seconds, minutes, maybe more to a consistant degree. In non-synthesized apertures this just means mechanical tracking: you might consider the signal variations that would occur in a synthesized aperture and formed beam, and how these would impact the millisecond and microsecond structure of pulsars.



All in all, an interesting analysis in communications theory! There's probably a master's thesis in this issue? It would help if you had an **Argus** technical specification, of course.

Dan went on to point out that builders of an **Argus** facility might derive income by supplying data to others. Dr. Dixon responded with a reminder that while sale of data would be an option for an Argus facility, he would prefer to hold to the idea of extracting value from the data as well as gathering it.

Since this was part of my interest when I rejoined the Observatory a few years ago, I might make some comments. With the advent of CD-ROM's and the Internet, there is already a large amount of \*raw data\* available essentially for free (*i.e. the cost of distribution*). What is less available is processed data, or data that is part of some particular application or use or need. For example, Dr. Dixon knows well the value of his stellar and non-stellar cross reference lists of the 1970's: and he can also tell you the effort it took to compile them! That cataloging and computational effort is somewhat reduced in the 1990's, but on the other hand EVERYONE has the computational capacity now to do it.

I have found that individual researchers tend to have their own ideas as to what is useful data — mostly only their own. And, I've found it is very very difficult to get GOOD descriptions of data and methods of data collection from researchers in order to do proper data reduction.

The bottom line is: it is no small task to try to "add value" to raw data, to package it with appropriate software or background materials, and to distribute it. And, to do this for some particular market. I can only note that the Observatory has shown not little, but NO interest in this before, if not outright resistance.

Dr. Barnhart requested an update as to the *Motorola Iridium* project, as it impacts the Observatory ... meanwhile, here is a commercial company that is CLEARLY showing interest (*of a sort*) in radio astronomy, who \*also\* has the capacity of providing technological support for **Argus**, and yet I've heard ZERO about trying to pump money from them!!! even for our technical assistance!!!!

I hope I have not offended anyone by citing past history or overstating my points. I have raised these issues before or explored these possibilities previously: that they come up again suggests they are options to consider, but none of them are free or simple. Clearly, it is appropriate and necessary to establish both funding mechanisms and an astrophysical research program for an **Argus** project, and I hope this contributes to that end.

On Mon, 23 Oct 1995 07:55:19 -0400, tahanson@postbox.acs.ohio-state.edu (*Tom Hanson*) wrote: *Radobs Saturday Meeting, October 21, 1995. Russ Childers announced that the telescope is gathering signals from exactly 3 degrees. In the next few days he will move to the 60% point in the ongoing survey. He said that all 3,000 channels are being saved to disk every 20 seconds, and his is accumulating 20 megabytes of data each day.*

This is very encouraging! congratulations! I want to reiterate that this data will be useful in comparisons to the 50-channel data collected by the 1976-83 **SETI** program. In addition, it will provide a baseline of pre-Iridium conditions at the upper end of the Survey (*1620 MHZ if I recall correctly?*) that may be of great research value. I thank Russ, and **NAAPO** for funding this effort. I will be a "customer" for the 3000 channel data CD-ROM's, so keep me in mind when they are created.

*Russ will pick up a Colorado External Tape backup device, using an authorization form supplied by Dr. Barnhart at today's meeting. Russ commented that the external backup technology will be discontinued by Colorado.*

..but the tapes are standard, and I believe the format is standard. I would suggest that the backup software used be verified as being "reasonably" compatible. A third-party software product might be considered in this regard. It is

also my understanding that the long-term backup medium would be CD-ROM, and tapes are merely an intermediate step. As tapes and recordable CD's are about the same price, and I presume the CD's have a better shelf life, the CD's will be the archival choice.

Here's a review of a recent article on our **SETI** programs, and on other current programs. It also describes what the **SETI League** is up to. I've written a review, which I'll probably send around elsewhere, so it mentions my involvement with the OSU program specifically. I'd certainly be pleased if this review got into *Signals*. I'd appreciate any corrections. The article itself might be useful as part of the "intro to **SETI**" that was recently asked for in the maillist: *Popular Electronics* usually sells reprints for some fee, or the author may cut a better deal!

One of the more "senior" people at the Observatory may want to write or sign a letter to *Popular Electronics* to describe the current status of the Observatory, and any comments on the article, as publicity opportunity. You might mention the recent grant from the **SETI League** in that context.

The December 1995 issue of *Popular Electronics* has a feature article on "*The Search for Extraterrestrial Intelligence*" by Karl T. Thurber. The nine-page article includes an untitled color picture of Jill Tarter and friends during the **Phoenix Project's** June 1994 **SETI** survey at *Parkes Observatory* in Australia, and a picture of the Ohio State University "**Big Ear**" parabolic reflector. This caught my attention at the newsstand recently, as I am a volunteer engineer at the Ohio State **NAAPO** Radio Observatory, where **SETI** search programs have been running for the last 25 years or more. But the article provides a good introduction to other programs as well, and includes many useful and classic references for further interest and even amateur involvement.

OSU's **SETI** program gets almost a half-page description, including discussion of the current radiotelescope and prospects for a proposed **Argus** array of hundreds of small antennas. Berkeley's Space Science lab is discussed as the developers of a series of multichannel receivers called **SERENDIP**, which have been used at many sites for **SETI** (including OSU most recently). The **Phoenix Project** is described as "rising from the ashes" of the cancelled **NASA SETI** program. The Planetary Society's (actually Paul Horowitz of Harvard) **META** and successor **BETA** programs is also reviewed.

A section on "Results" included the OSU "**Wow!**" event and also reports of "narrowband pulses lasting less than ten seconds" — actually a unnamed reference to the sampling rate of the **OSU SETI Survey** of the early 1980's which produced the "**Wow**". Some discussion follows on what we would do if a signal was detected, namely decode it and try to send a reply.

The article concludes with discussion of how the reader can get involved, namely by joining the **SETI League's All-Sky Survey** which will begin April 20th, 1996 (*Earth Day*). Using antennas with 3-degree wide beams, and Digital Signal Processors commonly found on IBM-PC compatibles for audio processing, an amateur could scan "about 14.4 kHz of spectrum at 10 Hz resolution" during the time a source would be in such a beam.

There are useful lists of contacts and references in the article, including Internet sites, books, articles; and a descriptive list of organizations and publications. OSU gets its share of these: Kraus's books on "**Big Ear**" and his classic "*Radio Astronomy*"; the OSU Internet HTTP site operated by Dr. Klein; and OSU's "*Signals*" newsletter. Other institutions referenced include The **SETI League**, **SETI Institute**, **SERENDIP**, and the *Planetary Society* among others.

All in all, it's a reasonable introduction to the recent and upcoming state of **SETI** research, and provides a good set of references and contacts. Some of the particulars in the article are not referenced as I've noted, but that could be due to the magazine's editing. I do not know the author's affiliation, but if he is not a **SETI League** member he is certainly sympathetic to them! This would be a useful, electronically-oriented introduction to **SETI** activities and resources, and particularly organizations and literature.

The same issue of *PE* also has an article on MMIC amplifiers, very small and simple-to-use IC amplifiers good to 2 GHz or so: just the kind of devices a **SETI** experimenter would be interested in! It seems that **SETI** is receiving more interest in the last few years, particularly as the bulk of **SETI** work is now privately funded and individually sponsored. So a list of current work and sites, including Internet addresses, is a timely resource.

## Saturday Meeting Report

November 4, 1995

By: Tom Hanson

Dr. Dixon was just concluding his opening monolog when I arrived. Cindy Brooman informed me later, that his recent posting about the tour of possible sites covers that portion of his remarks. Judy Dixon visited Washington recently, and she discovered an exhibit about **SETI** at the *Air and Space Museum*, which included a picture of the **OSU Radio Telescope**, complete with a picture of Dr. Dixon.

A local ham radio operator is in contact with a representative of the *Radio Society of Great Britain*. The staff of their ham radio magazine has requested a 'color print' of the OSU observatory, for a forthcoming article on **SETI**. Dr. Barnhart offered to provide a photo from the set taken during a recent flight with Ang Campanella.

Attending today's meeting were: Dr. Dixon, Bill Brown, Cindy Brooman, Jerry Ehman, Mark Sundstrom, Phil Schumacher, Steve Brown and Dr. Barnhart. Bill Brown is conducting a series of observations using **Serendip**, as described in a recent posting by Russ Childers. Bill described his program and responded to several questions. He reminded us of a recent definitive observation of an orbiting satellite.

Cindy Brooman is continuing to develop her World Wide Web service. She will be making a presentation to another potential significant client this coming week.

Jerry Ehman responded to a question about the *Smithsonian Institution*, by confirming that they do have a Web page, at SI.GOV. The discussion had evolved from Dr. Dixon's report of Judy Dixon's discovery of the **SETI** display at the *Air and Space Museum*.

Mark Sundstrom has been travelling recently. He visited a friend who has constructed a CCD imaging system for his telescope. Mark referred to a "CCD Cookbook". The image collector is about the size of a postage stamp. It consists of an array of 378 by 242 pixels, and the gray scale value of each pixel is represented by a 12 bit word. Mark is considering building a comparable system for his Meade LX200 8 inch telescope.

Phil Schumacher has been busy with family activities during the football season, but he is hoping to attend Saturday meetings more frequently now that the high school season is over.

Steve Brown was staring at a book on "*Green's Functions*", during quiet portions of today's meeting. He opened his report by challenging attendees with the mathematical question he is attempting to answer. A debate over the relative merits of differential equations vs integral equations followed, with Phil Schumacher and Dr. Barnhart supporting the differential side, and Steve stoutly advancing the integral cause. Dr. Dixon commented that **Argus** may lead to a whole new field of mathematics. One of Steve's current objectives is to find a computationally practical way of transforming from spherical to rectangular coordinate systems.

Dr. Barnhart is settling into his (*active sounding*) retirement life. He was assisted recently by Earl Phillips, in an attempt to bring up Homenet for Dos on a 286 class system. The initial login appears to have been successful, but a problem occurred when Homenet attempted to access Dr. Barnhart's electronic mail on Magnus. Information for the



IRS has been prepared, with a little prodding from Marilyn McConnell-Goelz. Dr. Barnhart explained that Marilyn had hoped to attend today's meeting, but she encountered a problem with her daughter's car seat.

Russ Childers has completed purchase of equipment to be used to back up incoming data to magnetic tape.

The formal meeting ended at about 11 AM.

After the meeting, as snow flurries descended, and a white tailed deer ran by on its way to the focus room (*no doubt*), a group of sympathetic members listened to Dr. Barnhart's description of his attempt to activate Homenet for Dos.

The bright fall colors have faded to deep browns, and the winter treeline is beginning to appear.

Don James hard work in repairing the electrical heating system in the administration building is continuing to keep the facility pleasantly warm, despite the cold winds outside.

## **ULYSSES OFFERS NEW INSIGHTS ON CONDITIONS OVER SUN'S POLES**

**3 Nov 1995**

*PUBLIC INFORMATION OFFICE  
JET PROPULSION LABORATORY  
CALIFORNIA INSTITUTE OF TECHNOLOGY  
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
PASADENA, CALIF. 91109  
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After a journey of more than 3 billion kilometers (*2 billion miles*), the Ulysses spacecraft has completed the first pole-to-pole passage over the Sun, showing scientists some of the solar forces at work in high latitude regions never before explored.

Scientists on the international **NASA/European Space Agency** mission gathered at Dana Point, CA this week for a 2-1/2-day workshop at which they compared notes on results from the spacecraft's first complete solar orbit and presented preliminary results of Ulysses' recently completed pass over the Sun's northern pole.

*"This has been an exceptional journey to explore regions of the Sun never visited by spacecraft before," said **Willis Meeks, U.S. project manager at NASA's Jet Propulsion Laboratory.** "Spacecraft data over the polar regions of the Sun are allowing scientists to begin assembling the first three-dimensional picture of the heliosphere ever compiled."*

Several scientists from the Ulysses team explained the mission's results in a panel discussion that aired today on **NASA Television**. They included Dr. Edward J. Smith, U.S. project scientist at JPL and a co-investigator on the magnetic fields experiment; Dr. John Phillips of Los Alamos National Laboratory, principal investigator on the solar wind plasma experiment; Dr. Antoinette Galvin, University of Maryland, a co-investigator on Ulysses who also works with x-ray images of the Sun from the Japanese Yohkoh mission; Dr. Richard Marsden, ESA project scientist and a co-investigator on the cosmic rays and solar particles experiment; and Dr. J. R. Jokipii, an interdisciplinary scientist from the University of Arizona.

Over the course of its five-year journey, Ulysses confirmed some theories about the Sun and found a few surprises, the scientists reported:

- Ulysses verified global differences in solar wind velocity, composition and temperature.

- The spacecraft saw outward-propagating, high-speed and long-period Alfvén waves continuously in the high-speed solar wind over both poles of the Sun. (*Alfvén waves are waves which move along magnetic field lines and accelerate charged particles.*)
- An increase in magnetic field intensity in the polar regions was not seen, as was expected. Instead, Ulysses found a uniform magnetic field whose intensity did not change from equator to pole.
- The theoretical "cosmic ray funnel," which would allow easy access of cosmic ray particles into the polar region, was not found. Only a slight increase in cosmic ray intensity was seen over the pole.

With its northern pass completed, Ulysses will begin to journey back out to the orbit of Jupiter. The spacecraft will reach the giant planet's distance of 5.4 astronomical units (*about 800 million kilometers or 500 million miles*) on April 17, 1998. Once there Ulysses will loop back and return, this time arriving in the vicinity of the Sun during its most active sunspot phase.

*"The Sun will be near solar maximum in the fall of 2000 and the solar magnetic field will have reversed polarity,"* said **Dr. Edward J. Smith, Ulysses project scientist at JPL.** *"We expect the profile we obtain five years from now will be dramatically different and give us many new insights into the dynamics of this star at the center of our solar system."*

Based on the importance of its investigations and the excellent condition of the spacecraft, the Ulysses mission will continue through a second set of polar passes beginning in September 2000. At the conclusion of its mission in December 2001, the spacecraft will have collected data on solar phenomena at all latitudes during the quietest and most active phases of the 11-year solar cycle.

The Ulysses mission is an international project of the *European Space Agency* and *NASA* to explore regions of space above and below the Sun's poles. The *Jet Propulsion Laboratory* manages the U.S. portion of the mission for *NASA's Office of Space Science*, Washington, D.C.

## **GALILEO MISSION STATUS**

**October 21, 1995**

*PUBLIC INFORMATION OFFICE  
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CALIFORNIA INSTITUTE OF TECHNOLOGY  
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
PASADENA, CALIF. 91109  
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A test of the tape recorder onboard the Galileo spacecraft conducted Friday, October 20, was successful, project officials report. On command, the tape recorder moved and read its tape in a normal manner.

The investigation team will now focus on developing a conditioning plan and new constraints for use of the tape recorder that will maximize its reliability for future operations. *"The recorder's performance has been anomalous and, therefore, substantial new efforts must now be taken to protect against future difficulties,"* said **Galileo Project Manager William J. O'Neil.**

## SAD SETI ANNIVERSARY

By: **Larry Klaes** (*SETIQuest Magazine Editor*)

On October 12, 1992, **NASA** began its first **SETI** program called **HRMS** — *High-Resolution Microwave Survey*. Unfortunately for all, Congress decided the project was spending way too much money — even though it received less funds per year than your average big league sports star or film actor — and cut all money to **NASA** for **SETI** work. This act saved our national deficit by all of 0.0002 percent. Fortunately, **NASA SETI** was saved as a private venture called **Project Phoenix** and run by *The SETI Institute*. Earlier this year they completed a six-month survey of the Southern sky from Australia (*no confirmed ETI signals*) and are now trying to find another radio observatory which will help them scan the Northern skies. Why all the hassle for a program that costs so little and could return so much? Check out the *SETI Institute* Web site at: <http://www.seti-inst.edu>

## COORDINATOR'S CORNER

By: **Phil Barnhart**

Big Ear continues to produce more and better publicity for the University. Yet the administration continues to ignore and deprecate the function and accomplishment of one of the biggest financial bargains in research and public awareness it has going for it.

**Item:** *"The 1996 Guinness Book of World Records"* devotes a special 2/3 page coverage of the **Big Ear SETI** program. In spite of the fact they printed the photograph of the venerable volunteers backwards, it is a complimentary and accurate coverage.

**Item:** The *Columbus Dispatch* published a summary of the *1996 Guinness Book* coverage of Ohio events — and ignored the page containing the **Big Ear** story.

**Item:** Bob Dixon sent a letter to the editor pointing out the **Big Ear** coverage exceeded the copy of all Ohio events combined! The *Dispatch* printed the letter changing "1996" in the original to "1986" in print. Duh!

**Item:** The December 1995 issue of *Popular Science* carried coverage of the US **SETI** programs including a photo of **Big Ear**.

Our efforts continue to bring attention and interest in the central Ohio game of high technology, but the decision makers and bean counters at the university continue to oppose and log-roll the observatory. 'New' guidelines for university support of Radio Observatory functions continue to snowball. Unprecedented road-blocks are thrown up and potential financial support is steadily withdrawn in an obvious effort to squeeze out the work being carried out by a renegade group not officially recognized by the power structure of the university.

A \$12.5 million contribution from a local business has placed the family name on a new \$75 million sports arena and the name of a cut-rate furniture outlet on the basketball/practice arena. For \$15,000 per year the University could retain one of the most inspiring and publically recognizable scientific endeavors. It looks like we need to enlist the support of the commercial community to keep us going. We could even name the **Argus** system something like the *Taco Bell Drive-up Telescope!*

## PIONEER 10 STATUS

10/31/95

Distance from Sun: 63.43 AU

Speed relative to the Sun: 12.5 km/sec (27,962 mph)

Distance from Earth: 9.37 billion kilometers (5.82 billion miles)

Roundtrip Light Time: 17 hours, 22 minutes

Active Instruments:

Charged Particle Instrument (*CPI*)

Cosmic Ray Telescope (*CRT*)

Geiger Tube Telescope (*GTT*)

Ultraviolet Photometer (*UV*)

The spacecraft is healthy and continues to make valuable scientific observations in the outer regions of our Solar System. The available instrument power is insufficient to continue the operation of the Plasma Analyzer instrument, and the instrument has been turned off. The remaining instruments are turned on according to a power sharing schedule, roughly on a monthly basis. For the month of November, the CPI, GTT, and UV instruments will be turned on. ...per week at the moment. [sic; Missing text]

**Frequently-asked Questions** (*FAQ's*):

**Question:** If the spacecraft are leaving the Solar System, why does the distance from Earth sometimes get shorter?

**Answer:** It is a matter of a hyperbolic escape trajectory, geometry, and relative velocity vectors. The distance from the Sun is always increasing. However, since the Earth travels around the Sun faster than the spacecraft moves away from the Sun, the spacecraft-earth distance decreases for a few months, and then rapidly increases again.

**Project Manager: Fred Wirth**

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## Three of our Volunteers

Three of the hard-working volunteers that has helped keep "Big Ear" operating so well, for so long. We will be publishing more photos as they get scanned. Many thanks to Cindy Brooman for scanning the photos into a useable format, and for providing space on her ftp site for easy transport.



**Ang Campanella**



**Jerry "WOW" Ehman**



**Mark Sundstrom**

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