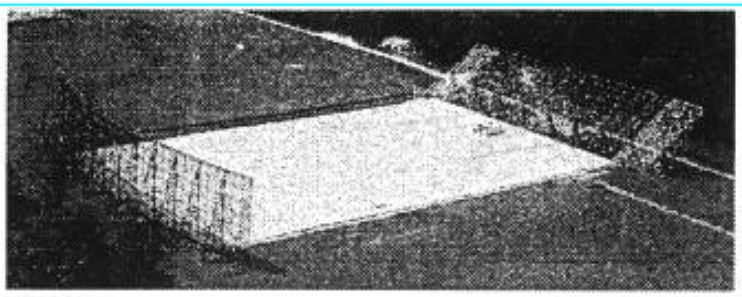
North American
AstroPhysical Observatory

NAAPO (North American AstroPhysical Observatory)

"Signals"
Volume 11 Number 9
The NAAPO Newsletter
(October 1995)

SIGNALS



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IN THIS ISSUE:

ed. note:

You will notice that the RO Logo has been redesigned! Special thanx to Cindy Brooman for putting in many long hours in the redesign effort!

[Note from webpage editor: The graphic below is the redesigned RO Logo referred to in the paragraph above. However, I have kept the older logo above because it is easier to view than Cindy's redesigned logo.]

COORDINATOR'S CORNER

Is there life after...? I have officially retired from the academic game. For ten years I have presided over a collection of volunteers who have maintained and operated a radio observatory officially orphaned by a large educational/research institution. I have seen valuable programs in both environments threatened and dismantled for reasons not clear to anyone, especially those seeking to do the dismantling. Does, indeed, life go on after the work of so many has been deemed superfluous and irrelevant?

This question is not unique to my experience. Cancellation of NASA's SETI program by a benevolent, all-seeing, wise and politically insulated congress is another case of "don't confuse us with the facts (relevance, importance, meaning, spirit, etc.), THIS is what we are going to do." Project Phoenix shows that indeed there is life after congressional fiat.

The Radio Observatory staffed by hard working volunteers is not going to fold up its tents and quietly disappear. We have a long standing commitment — pioneered by Bob Dixon and John Kraus in the early 1970's — to keep our ear tuned to the sky for even the slightest evidence that we are not alone in this wide and wonderful universe spanning billions of light years of space and billions of years of history. If not with

the 110-meter antenna of Big Ear, then the 2500 distributed antennae of ARGUS I. We have a mission to carry on the search even though one of the most important instruments in the history of radio astronomy is ground under to add a few more fairways to one of the 28 golf courses in Delaware County, Ohio.

Our mission will be to rise from the bulldozer's dust to re-institute the survey of the northern heavens and search for transient events in the microwave region that just may bear the imprint of an intelligence not of this world, but of this universe. Above this mission we must face the prospect of informing more of our fellow beings here on earth the intense importance of more, not less, science and instrumentatiom to address the problems and unanswered questions about our existence and relevance in the wider community beyond the few stars in our immediate neighborhood. We must emphasize that years of effort and accomplishment must not be discounted and destroyed for the benefit of self-indulgence and recreation in order to 'save' a few dollars for the federal tax payer or to enhance the chances of building a fine new sports arena.

Ultimately, we have to evolve a set of priorities that includes near the top a consideration of deeper understanding of the wider universe. The most pressing human needs, in fact, do not include the AL, NL, NFL, NCAA, PGA, play-offs, nor for that matter the won/lost record of any team. Rather, we find the oldest unanswered questions still troubling us. Why are we here? What purpose is there to life? How can we survive ourselves? Where is here? Are we all there is?

The one sure way to guarantee ve will never learn about extraterrestrial life and its technology is to stop the search! We must not let that happen.

Phil Barnhart

PIONEER UPDATE
5 Oct 1995

Pioneer 10

(Launched 2 March 1972)
Distance from Sun: 63.21 AU
Speed relative to the Sun: 12.5 km/sec (*27,962 mph*)
Distance from Earth: 9.40 billion kilometers (*5.84 billion miles*)
Roundtrip Light Time: 17 hours, 25 minutes
Active Instruments:

- Plasma Analyzer
- Charged Particle Instrument
- Cosmic Ray Telescope
- Geiger Tube Telescope
- Ultraviolet Photometer

The spacecraft is healthy and continues to make valuable scientific observations in the outer regions of our Solar System.

Due to the motion of the Earth as it moves around the Sun, the spacecraft-earth look-angle (ELA) is

presently 0.6 degrees. Data recovery is still very high. By mid-October, the Earth will be centered in the antenna beam again for optimum signal level. A precession maneuver will have to be performed in January 1996 to re-aim the spacecraft at the Earth.

Pioneer 11

(Launched 5 April 1973)
Distance from Sun: 44.08 AU
Speed relative to the Sun: 12.24 km/sec (*27,380 mph*)
Distance from Earth: 6.60 billion kilometers (*4.10 billion miles*)
Roundtrip Light Time: 12 hours, 15 minutes

The Pioneer 11 spacecraft appears to be healthy at the moment, but there is insufficient power for the operation of any of the scientific instruments. Furthermore, the spacecraft can no longer be maneuvered to point its antenna accurately toward the Earth, resulting in significant data losses. During the month of September only a few minutes of engineering data were acquired. The spacecraft is being tracked only a few hours per month to monitor its condition.

Frequently-asked Questions:
Question:
Why is there less power on Pioneer 11 than on Pioneer 10, if Pioneer 10 is one year older than Pioneer 11?
Answer:
The Radioisotope Thermoelectric Generators (*RTGs*) for Pioneer 10 were selected for highest efficiency from the 8 generators that were manufactured, since Pioneer 10 was the prime spacecraft, and Pioneer 11 was the backup spacecraft. The difference in power output between Pioneer 10 and 11 is not as great as it might seem, (*about 150 milliamperes at 28 volts DC*). The current requirements are different for each instrument, some requiring 300 ma, some 120 ma, others only 25 ma, etc. When the available current is insufficient for a given instrument, then that instrument is turned off.

VOYAGER UPDATE
5 Oct 1995

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Both Voyager spacecraft are healthy and continue their departure from the solar system. As they travel farther and farther from the Sun, the two spacecraft are returning data to characterize the environment of the outer solar system and search for the boundary of the heliopause — the outer limit of the Sun's magnetic field and outward flow of the solar wind.

Voyager spacecraft activities are controlled by a computer with two processors (*processors A and B*). These processors contain computer programs; processor B contains programs to collect science data, while

processor A contains the programs that keep the spacecraft antennae pointed at Earth for communications.

On September 3, the Voyager 1 computer processor B experienced an error that resulted in a halt to the science gathering program. Processor A continued to function normally, thereby allowing the antenna pointing and spacecraft communications to continue normally. An analysis of the contents of the processor A and B computer memories indicated the memories contained the correct programs. A test of the spacecraft clock used by the programs confirmed that the clock was providing the correct time. Since these two spacecraft health checks did not indicate any reason for the processor B program halt, the exact cause will probably remain unknown.

On September 11, commands were transmitted to the Voyager 1 spacecraft to restart the processor B program. The success of these commands was demonstrated the next day when programmed science data gathering events occurred as planned.

Flight controllers believe both spacecraft will continue to operate and send back valuable data until at least the year 2015. It is the loss of electrical power from their respective radioisotope thermoelectric generators (*RTGs*) that will eventually cause them to stop functioning. At launch, the three RTGs on each spacecraft had a power output of 475 watts. Today that output is 341 watts for Voyager 1 and 345 watts for Voyager 2. Approximately 215 watts are necessary to operate the spacecraft and limited science instruments.

The other vital consumable onboard both spacecraft is the amount of hydrazine propellant which keeps the Voyagers stable and pointed toward Earth. Each spacecraft started out with 104 kilograms of propellant. Today, after 18 years of flight, including multiple planetary encounters and trajectory correction maneuvers, Voyager 1 has 34 kilograms of hydrazine remaining and Voyager 2 has 36 kilograms remaining. However, during their current, quiet "interstellar missions," each spacecraft uses only about six grams of fuel a week. Flight controllers stress the Voyagers will run out of electrical power long before they start spinning out of control due to loss of their attitude-adjusting propellant.

It is now estimated that Voyager 1 will pass the Pioneer 10 spacecraft in January 1998 to become the most distant human-made object in space.

Voyager 1 is currently 9.15 billion kilometers (*5.69 billion miles*) from Earth, having traveled 10.87 billion kilometers (*6.75 billion miles*) since its launch in September 1977. The Voyager 1 spacecraft is departing the solar system at a speed of 17.46 kilometers per second (*39,055 miles per hour*).

Voyager 2 is currently, 7.00 billion kilometers (*4.35 billion miles*) from Earth, having traveled 10.28 billion kilometers (*6.38 billion miles*) since its launch in August 1977. The Voyager 2 spacecraft is departing the solar system at a speed of 16.08 kilometers per second (*35,970 miles per hour*).

ULYSSES UPDATE
5 Oct 1995

The Ulysses spacecraft completed its primary mission of exploring the poles of the Sun at 2 a.m. Pacific Daylight Time on September 29, when it left the high latitude region of the northern solar pole. Today the spacecraft is approximately 69 degrees north of the Sun's equator, traveling at a heliocentric velocity of about 84,500 kilometers per hour (*52,500 miles per hour*).

All operations and science experiments continue to go well in this first ever journey out of the ecliptic plane. **NASA's** tracking facilities near Madrid, Spain and at Goldstone, Calif. continue to monitor the spacecraft about 12 hours each day.

Ulysses will now begin to journey back out to the orbit of Jupiter, reaching the giant planet's distance of 5.4 astronomical units (*about 800 million kilometers or 500 million miles*) on April 17, 1998. Once there, the spacecraft will then head back on its high latitude trajectory toward the Sun, returning again to its vicinity in September 2000.

The mission — a joint project of the **European Space Agency** and **NASA** — has been funded for a second pass over the Sun's poles in 2000. When Ulysses returns, the Sun will be in its most active sunspot phase and the solar magnetic field will have reversed polarity. Scientists expect to learn much more about the forces at work in this complex star during the peak of its activity.

TOPEX/POSEIDON COMPLETES PRIME MISSION

TOPEX/Poseidon, the U. S./French ocean-observing satellite, has successfully completed its three-year primary mission to help scientists understand how the Earth's oceans affect our climate.

Having passed the third anniversary of its launch on Aug. 10, 1992, TOPEX/Poseidon has begun its extended mission. Given the health of the spacecraft, the project management team believes TOPEX/ Poseidon will continue to operate at least four more years.

TOPEX/Poseidon's primary science goal is to improve understanding of how oceans circulate. The satellite information is enabling oceanographers to study the way the oceans transport heat and nutrients and how the oceans interact with weather patterns.

*"The extended mission will help us further achieve TOPEX/Poseidon's primary science goal which is to improve our knowledge of how oceans circulate," said **Dr. Lee-Lueng Fu**, TOPEX/Poseidon project scientist at the **Jet Propulsion Laboratory** (JPL), Pasadena, CA. "We are interested in answering questions about long-teen variations in the ocean and understanding what role the oceans play in long-term global change."*

TOPEX/Poseidon, a joint mission between **NASA** and the **Centre Nationale d'Etudes Spatiales** (*CNES*), the French space agency, uses a radar altimeter to precisely measure sea-surface height. Scientists use the TOPEX/Poseidon data to produce global maps of ocean circulation. The satellite has provided oceanographers with unprecedented global sea level measurements that are accurate to less than two inches.

The spacecraft was launched from the **Arianespace Guiana Space Center** in Kourou, French Guiana by an Ariane 42P booster rocket procurred by **CNES**. It was the first **NASA** satellite launched by Arianespace.

In its more than 14,000 orbits of Earth since launch, the satellite has obtained the following scientific results:

* In early 1995, TOPEX/Poseidon detected a new El Nino condition in the equatorial Pacific Ocean. This condition has been linked to the unusually rainy weather in California and the unseasonably warm winter in the Northeast U.S.

* Preliminary results using data acquired from December 1992 to September 1994 indicate a global rise in sea level of 0.12 inches per year. By tracking sea level over the extended mission, TOPEX/Poseidon will help scientists understand whether this rise is a short-term variation or part of a long-term trend.

* In 1994, TOPEX/Poseidon data helped scientists understand that the climatic effects caused by the El Nino phenomenon are much longer lived than previously thought. TOPEX/Poseidon data tracked residual effects from the El Ninos of 1982-83, 1986-87 and 1991-1993.

* In the Gulf of Mexico, data are helping scientists and a U.S. oil company study ocean-circulation phenomena, called eddies, that can disrupt off shore oil drilling.

* In another application, the precision of the satellite's ocean measurements has enabled scientists to calculate global tides across all the open oceans, an important step toward monitoring global ocean circulation from space and understanding the complexities of global climate change.

*"The data set from the prime mission significantly exceeds all pre-launch expectations and has provided oceanographers with their first global data set on the Earth's oceans," said **Charles Yamarone**, the JPL TOPEX/Poseidon project manager. "The satellite is healthy and its critical components are performing at or above expectations, which would allow for more than seven years of flight operations."*

More than 1,400 data images are available through JPL's public access computer site via anonymous file transfer protocol (*ftp*) at the address *jplinfo.jpl.nasa.gov*. TOPEX/Poseidon data are also available via Internet and the World Wide Web at the address *http://www.jpl.nasa.gov*, or by dial-up modem to the telephone number 818/354-1333.

TOPEX/Poseidon is part of **NASA's** Mission to Planet Earth, a coordinated, long-term research program to study the Earth as a single global environment. **JPL** manages the U.S. portion of the mission for **NASA's Office of Mission to Planet Earth.**

GALILEO FLYING THROUGH INTENSE DUST STORM

NASA's Galileo spacecraft is plowing through the most intense interplanetary dust storm ever measured as it closes in on Jupiter after a six-year journey to reach the giant planet, scientists report.

This is the latest and greatest of several large dust storms encountered by Galileo since December 1994, when the spacecraft was still almost 110 million miles from Jupiter. The current storm has lasted more than three weeks. The spacecraft, launched in October 1989, is now about 39 million miles from the planet. Galileo will enter orbit around Jupiter December 7, 1995.

"*During the current dust storm, Galileo has counted up to 20,000 dust particles per day, compared to the normal interplanetary rate of about one particle every three days*", said **Dr. Eberhard Grun**, principal investigator on the spacecraft's dust detector experiment.

The particles, scientists say, are apparently emanating from somewhere in the Jovian system and may be the product of volcanoes on Jupiter's moon, Io, or could be coming from Jupiter's faint two-ring system. The dust particles, probably no larger than those found in cigarette smoke, may also be leftover material from Comet Shoemaker-Levy 9, which impacted Jupiter last year.

Scientists believe the particles are electrically charged and then accelerated by Jupiter's powerful magnetic field. They have calculated that the dust is speeding through interplanetary space at velocities ranging from 90,000 to 450,000 miles per hour, depending on particle size. Even at such high speeds, these tiny particles pose no danger to the Galileo spacecraft, scientists say.

Galileo's dust detector, one of 10 science instruments on the spacecraft, is about the size of a large kitchen colander. It counts particle impacts and observes their direction and energy. From these measurements scientists can estimate particle size and speed.

Grun, a scientist at the **Max Planck Institute for Nuclear Physics**, Heidelberg, Germany, also has dust detectors aboard the Ulysses spacecraft that flew by Jupiter in 1992 on its way to study the Sun, and on the Cassini spacecraft scheduled for launch to Saturn in 1997. His team first discovered dust emanating from Jupiter in 1992 using the Ulysses instrument.

The Galileo instrument first observed dust coming from Jupiter in June 1994. Although both Ulysses and Galileo were able to show that the dust storms seem to come from Jupiter, the intensity and timing of the recent storms seen by Galileo differ from those detected by Ulysses.

Chances of understanding the nature of these dust storms are improving since, after the onset of the current storm, Galileo flight engineers commanded the spacecraft to collect and transmit dust data as often as three times a day, according to **Dr. Carol Polanskey**, team chief for the dust instrument subsystem at **NASA's Jet Propulsion Laboratory** (*JPL*), Pasadena, CA. The normal collection rate had been twice per week.

In addition, the instrument was reprogrammed in July 1994, "*to take advantage of the knowledge gained from the Ulysses experience and just in time to observe the start of the series of storms Galileo has seen*," said Polanskey. The reprogramming also endowed the instrument with new data compression and other improvements, she added.

"*This puts us in an excellent position to view the dust phenomena as Galileo moves toward Jupiter,*" she said. "*We're looking forward to determining the source of the dust storms once we get into the Jovian system.*"

When Galileo arrives at Jupiter this December, it will receive and relay the data from the atmospheric probe that was targeted toward Jupiter and separated from the main spacecraft in July. Galileo will then begin a two-year, 11-orbit survey of Jupiter, its satellites, magnetosphere and the dust environment.

JPL manages the Galileo project for **NASA**'s Office of Space Science. Germany is a scientific and engineering partner in Galileo. **JPL** also manages the U.S. portion of the Ulysses project, a joint effort of **NASA** and the **European Space Agency**.

GALILEO UPDATE
5 Oct 1995

The Galileo spacecraft is reaching the end of its interplanetary cruise sequences and will soon begin the first of two Jupiter approach sequences. The spacecraft is nine weeks away from probe entry and Jupiter orbit insertion on December 7, 1995.

The last Earth-to-Jupiter cruise sequence, EJ-10, which ends October 2, has seen a variety of engineering tests and preparations for Jupiter arrival. Recently this included demonstrations of one-star attitude determination and other preparations for ensuring the most robust spacecraft performance during the critical probe relay and Jupiter orbit insertion. Readouts from the magnetometer, the extreme ultraviolet instrument, and the dust detector continued throughout this period at a frequency of twice per week.

On September 18, the spacecraft switched to the use of the suppressed-carrier downlink, which allows all of Galileo's radio signal to be used for the telemetry data, boosting the effective data-rate performance. Suppressed carrier is now Galileo's standard downlink configuration.

Telemetry data showed on September 18 that the power-on reset detector in one of the two command and data system power converters had detected a power drop, which was later determined to be transient. Analysis of the cause and implications is still under way. This event did not cause any interruption of the ongoing cruise sequence, EJ-10.

About two months ago, Galileo's dust detector observed the onset of the latest in a series of interplanetary dust storms that apparently began in mid-1994. This last storm was the most intense so far, reaching a peak of nearly 20,000 particle impacts per day, and may not have entirely abated. Recent counts are in the range of hundreds of particle impacts per day, still far above the previous interplanetary background of one every three days. A special series of dust measurements is planned for early October to intensely cover a 10-hour Jupiter-rotation period. These dust measurements are designed to search for any changes which may be related to Jupiter's rotation.

The spacecraft continues to operate normally, spinning at approximately 3 rpm and transmitting coded telemetry at 10 bits per second. It is now only 40.8 million kilometers (*25.3 million miles*) from Jupiter and 843 million kilometers (*524 million miles*) from Earth. Its speed around the Sun is 6.78 kilometers per

second (*about 15,000 miles per hour*).

TOPEX UPDATE
5 Oct 1995

The satellite and sensors continue to operate as expected and ground system computers are performing well. The satellite's tape recorders have been played back and the daily science and engineering data products are being produced.

The satellite is now in its 112th, 10-day data collection cycle. The science data team is currently processing data from cycle 110 into sensor data records and interim geophyscial data records.

HUBBLE SPACE TELESCOPE FINDS STELLAR GRAVEYARD

Peering deep into the globular star cluster M4 with **NASA**'s Hubble Space Telescope, Canadian and American astronomers have discovered a large number of "stellar corpses," called white dwarf stars, which may be used eventually to refine age estimates of the universe.

The observation, made by a team led by **Harvey Richer** of the *University of British Columbia*, Vancouver, Canada, was so sensitive that even the brightest of the detected white dwarfs was no more luminous than a 100-watt light bulb seen at the Moon's distance (*239,000 miles*).

The Hubble results will allow astronomers to refine theoretical predictions of the rate atwhich white dwarfs cool — an important prerequisite for making reliable estimates for the age of the universe and our Milky Way galaxy, based on white dwarf temperatures. Present estimates for the universe's age range from eight to twenty billion years, and refining this value is a key goal for modern astronomy and the Hubble telescope.

A white dwarf is the burned-out core of a collapsed star that, like a dying ember, slowly cools and fades away. However, the universe is not yet old enough for any white dwarfs to have cooled off completely to become invisible black dwarfs. White dwarf temperatures can therefore be used as "cosmic clocks" for estimating the age of the universe independently from other techniques.

A globular cluster like M4 contains hundreds of thousands of stars visible with ground-based telescopes. "*We expected that the typical globular cluster should also contain about 40,000 white dwarfs. However, white dwarfs are extremely faint, and to date no ground or space-based telescope has been able to reveal more than a handful of them in any star cluster,*" said Richer. By exposing with Hubble's Wide Field and Planetary Camera 2 for five hours, Richer's team was able to detect more than 75 white dwarfs in one small area of M4. Analysis of the Hubble images was done with computer software developed by Peter Stetson at the National Research Council of Canada, Victoria, British Columbia. The faintest white dwarfs are 40 times fainter than the brightest ones in the cluster. "*Even longer exposures with Hubble could conceivably reveal the ages of the faintest and oldest white dwarfs in M4. This would be a crucial way to distinguish between recent divergent values for the age of the universe, since its age cannot be less than the age of the oldest white dwarfs in M4,*" said team member **Howard Bond** of the Space Telescope Science Institute in Baltimore, MD.

A white dwarf contains most of the original mass of a star, but has contracted to an extremely dense and

faint object about the size of the Earth. A golf ball-sized piece of a white dwarf would weigh more than a ton. Because of its small size, high density, and initially hot temperature, it takes billions of years for a white dwarf to radiate all of its residual heat into space.

Located 7,000 light-years away in the direction of the constellation Scorpius and visible in a pair of binoculars, M4 (*the fourth object in the Messier catalog of star clusters and nebulae*) is the nearest globular cluster to the Earth. Globular clusters like M4 were born early in the history of the Milky Way, and today are veritable stellar retirement communities. M4 is so ancient (*estimated to be 14 billion years old*) that all of its stars that began with 80% or more of the Sun's mass have already evolved to become red giants, followed by a collapse to a white dwarf. (*Our Sun will not become a white dwarf for another five billion years.*)

Details of the M4 study will be published in the *Astrophysical Journal Letters* in September. Other participants in the research are Gregory Fahlman, Rodrigo Ibata, and Georgi Mandushev (*University of British Columbia*), Roger Bell (*University of Maryland*), Michael Bolte (*University of California, Santa Cruz*), William Harris (*McMaster University*), James Hesser (*National Research Council of Canada*), Carlton Pryor (*Rutgers University*), and Don VandenBerg (*University of Victoria*).

HERB JOHNSON'S REPORT

I took a week's vacation in August to visit the Observatory from New Jersey, just in time to see the "environmental damage" at the radio telesope, as well as to review the old records to better interpret the 1976-1983 **SETI** program. I thank **NAAPO** for their support of the living quarters in Delaware, and the Observatory for their access and cooperation.

Getting "the dirt" on the Observatory?

Apparently some environmental folks at the University decided there was some contamination at the site, alledgedly from minor constitutients in old paint used to protect the antenna. Russ Childers and I reviewed their unauthorized and VERY expensive digging — a shallow trench longer than the 400-foot length of the telescope. Russ pointed out a "benchmark" originally used to build and align the antenna, which was a concrete cylinder buried many feet deep — now clearly out of alignment and useless for recalibration. I took photos of the site and provided them to the Observatory. Fortunately there is no damage to the telescope.

Archives provide calibration data for WOW! signal

In better news, I found a number of theses and student reports in the Archives that provide reasonably clear measurements of important features of the telescope over a 20 year period from the mid-60's to 1980.

They include a description of the manual methods used to conduct the "Supplement 2" re-survey of analog chart data for the Ohio Survey in 1975, done just before the **SETI** program began. This continuum chart data at 1415 MHz is virtually identical in process and equipment to the analog charts made during the **SETI** survey. Even the digital version of the continuum survey done within **LOBES** today can be analyzed in this fashion, and I recommend a reading of this thesis by Rinsland for anyone reviewing the analog or digital records. Clearly, maintaining a continuum channel provides for a long-term comparion and calibration of

any other data concurrently collected.

I should also note I reviewed the 1985 work of Marc Abel and found it very helpful. Marc and others (*including myself*) worked in that year to process the **SETI** data and produce with Bob Dixon the various reports, charts, and graphs on the survey. Marc's "**SETI** Manual" and notes clearly identifies the process of establishing the "5 sigma" criterion for **SETI** Survey search strategy "hits" as based on their distribution above the Gaussian distribution that fits the values below 5 sigma. I will investigate this matter further in discussions and data analysis.

I also found a 1980 undergraduate report by Debbie Cree that measured the response of the system to the continuum signal from Cassiopeia A, a 2400 Jy source. This report is quite thorough and I have asked Russ to review portions of it carefully, particularly as it reports system temperature and calibrated sidelobe detections.

I have reported a summary of this and related reports to the Observatory, and I am discussing the findings and follow-up work with Russ Childers and others. Russ noted to me that the **SETI** survey analog charts are in good shape and he had been reviewing them carefully. I myself took a chart and located some continuum sources on it, obtaining results similar to the Rinsland thesis process. I anticipate we will have good evidence to establish a calibration for the **SETI** Survey data for the whole period, and most notibly for the **WOW!** signal.

The "Challenge" met: Archived data expanded to 3000 channels!

I discussed some of my early findings with Bob Dixon, Russ Childers and Phil Barnhart during my visit, and noted my "challenge" grant proposal (*published in* Signals *last month*) to again archive ALL the channel data from our current **LOBES** survey, just as we did (on paper) from the **SETI** Survey fifteen years ago. After discussion of the technical issues, Russ recommended a 25-day cycle of data collection, tape storage, and archiving to CD-ROM that would require about 500 MBytes; Phil Barnhart offered a **NAAPO** grant to purchase the necessary equipment, and Bob approved it. This will provide current and future researchers with narrow-band data for the remaining 45% of the **LOBES** survey. It may offer a key to both the thousands of "search strategy" narrowband events from the previous survey; and to the kinds of events we may see with the 4 million channels of the **Serendip** reciever currently under test.

Until recently, retaining and archiving this data would be expensive: now a 500 MByte hard drive is the SMALLEST drive you can buy! I thank **NAAPO** and the Observatory for their recognition of the value of this new archive. I encourage those who supported this effort to offer $20 to **NAAPO** for a tape or writable CD-ROM to hold a month's data. I provided various bits of hardware to support the new drive, and a computer monitor for another system.

CALTECH OBSERVATORY SEES START OF NEW SOLAR SUNSPOT CYCLE

The first sunspot in the new sunspot cycle was identified on Saturday, August 12, by astronomers at the **California Institute of Technology's Big Bear Solar Observatory** in Big Bear City, California. The new sunspot marks the end of the sun's quiescent period and the beginning of a new surge of sunspot activity.

"*This makes us happy*," said **Hal Zirin**, professor of astrophysics at Caltech and director of the Big Bear Solar Observatory. "*The sun is a lot more interesting to study when things are going on.*"

Sunspots are relatively dark spots that typically appear in groups on the surface of the sun. They are associated with strong magnetic fields and with solar flares, and follow an approximately 11-year cycle of increasing activity followed by a slow decline into a quiescent period. Early in the cycle, sunspots appear rarely and at relatively high solar latitudes around 30 to 35 degrees, then increase in frequency and appear at lower latitudes until they reach sunspot maximum. After this peak in activity, the number of sunspots slowly declines, and they appear ever closer to the sun's equator until they reach a relatively quiet phase called sunspot minimum.

There is typically some overlap between successive sunspot cycles. As the last sunspots of one cycle appear near the equator, at latitudes of about 7 degrees, the next cycle starts again with sunspots near 30 degrees, but with the magnetic polarity of the new spots reversed.

That's exactly the point the sun is at now; it has been in a quiescent period through much of 1994 and this year, with a few spots showing up near the equator. The new sunspot photographed on Saturday appeared at a solar latitude of 21 degrees, and its magnetic polarity is opposite to that seen over the last decade, a key to identifying it as the manifestation of the start of a new cycle.

This new sunspot appeared a bit earlier than astronomers expected. Typically, as a solar cycle winds down, late bursts of sunspot activity will appear near the equator before the new cycle starts. Scientists had seen these late pulses of sunspots in 1984, but saw little late activity this time and therefore expected an early beginning to the new cycle, but not this early.

Sunspots have effects far beyond the sun itself, so while solar astronomers are excited by this news, people in many other fields are keenly interested as well. Solar flares often occur above sunspots, and can disrupt radio communications on earth and sometimes even cause widespread power outages. Flares also cause the colorful celestial displays known as the northern (*or southern*) lights, and cause unusual behavior in satellites, such as increased drag and disabled orientation. Sunspots in the new cycle should rapidly become more common and reach a high level of activity in 1998 or 1999.

SETIQuest MAGAZINE

SETIQuest Magazine Volume 1, Number 4 is now available. *SETIQuest* is the publication of **SETI** and bioastronomy research. Subscription information follows.

Issue 4 contains the following articles:

Can We Talk? - Editorial by Larry Klaes
A Letter from the SETI League, Inc. - H. Paul Shuch, Ph.D.
Communication with Alien Intelligence - Dr. Marvin Minsky
The Fifth International Symposium on Bioastronomy - Dan Werthimer
The SETI Potential of Open Star Clusters - Henry Cordova
Justifications for Professional and Amateur SETI - Dr. Stuart A. Kingsley
Columbus Optical SETI Observatory Improvements - Dr. Stuart A. Kingsley
Publications Watch - Larry Klaes
Books in Brief - Larry Klaes
Periodicals - Larry Klaes

SETIQuest Vol. 1, No. 1 is available for FREE by sending your *postal* address to the following net address: sqinqnet@pixelacres.mv.com. It contains subscription information. Or write to the following: *SETIQuest Magazine*; Helmers Publishing, Inc.; 174 Concord Street; Peterborough, NH; 03458-0874. Tel: 603-924-9631. Fax: 603-924-7408.

Larry Klaes; Editor of SETIQuest Magazine.

UNIVERSITY GETS ITS SHARE; and ours too!

Part of the negotiations for termination of the ten-year renewable lease for the radio telescope site seemed to involve a buy-out sum payable to the University providing the site be vacated at some time short of the lease term — like three years. It had been suggested that the money from this settlement would be made available to help construct the infrastructure for the Argos Project at the new site (yet to be selected).

It now seems the University jumped very quickly on the suggestion of arsenic contamination in the vicinity of the old dump site and called an environmental clean-up of the top several inches of that site. The assumption was made that it was the Observatory that was responsible for the contamination even though extensive dumping has occurred in that area since the observatory personnel stopped using it as a dump and in fact had cleaned up much of the materials placed there in early years of the observatory operation.

Cost of the clean-up has been reported to be in the range of $60,000 to $80,000, but the University has now claimed the total settlement amount to pay for the clean-up. This amount is reported to be well in excess of $100,000. Furthermore, just think, the low bid for the repainting and continued ten year lease on the property was $160,000. What price progress?

RO Volunteer -- Ron Huck Dies

Longtime volunteer and telescope engineer, Ron Huck died last week at Riverside Hospital in Columbus. Ron maintained and operated the 50 channel receiver and build a number of the circuit boards in use on the instrument today.

Our sympathy goes out to Ron's family in their untimely loss. Ron will be greatly missed at the R0.

Just a Thought --

For a donation of $50 or more, NAAPO will send an 8 x 10 photo of the radio telescope — taken from the air while listening to a steady beeping in the cockpit — to the donor. A $100 donation will prompt a framed copy of the photo. Why not be the first on your block to own one of these mementos?

Send your donation to:

Dr. Philip B. Barnhart
Dept. of Physics/Astronomy
Otterbein College
Westerville, OH 43081

All but $8 of your donation will be tax deductable.

New Aerial Photos of Big Ear
by Phil Barnhart

Ange Campanella flew two missions to carry yours truly on aerial surveillance of the radio telescope for the purpose of obtaining modern photographs of the instrument. We have bad requests form various people for photos of the installation which we could not honor for lack of clear, glossy prints of any kind.

The first flight early this fall was calm, early morning and somewhat cloudy. The second flight was clear, turbulent and a distinct white knuckle flight for the photographer. It is about 5 minutes from Don Scott Field, favorite tie-down for Ange and his mighty Mooney, to the site of Big Ear. Thus the whole operation involves about 10 minutes in the air.

Taking off was routine until reaching the midpoint of the runway. An alarm buzzer began to beep just as we lifted off. Without panic and clearly in control of the entire situation, Ange performed successively the tasks of raising the landing gear, checking and tapping every meter and switch on the control panel (no less than 6 times), circling the radio telescope 4 times, heading back to the field by way of two other sites to be photographed — all the while listening to an ever more strident "beep . . Beep . . BEEP . . BEEP . . BEEP . . ". Immediately after touchdown Ange commented, "I've never heard THAT before," and "If it keeps going after we shut everything down we are in deep trouble!"

We taxied to the parking space, Ange cut the engine and we were serenaded by "BEEP . . BEEP . . BEEP . . etc.". My first thought was " . . get the camera well away from the plane before it blows up!" My seat belt kept me from getting out too fast. In fact, my size 14 feet kept me from getting out at all. While I sat there waiting for the local bomb squad to come decontaminate the luggage compartment, Ange, now listening in

a quiet cockpit quickly tracked the noise to an alarm clock he had mounted at the side of the instrument panel some years back so he would not have to wind the original equipment clock mounted in the instrument panel. While fiddling with the instruments awaiting my arrival, he had inadvertently set the alarm, which dutifully went off as we were lifting off the runway.

I promised Ange not to mention this incident to anyone. If he asks, you didn't hear it from me.

0SU is moving closer to unplugging 'Big Ear'

By David Lore
Dispatch Science Reporter

Columbus Dispatch
September 2 1995

Ohio State University has taken the first step toward abandoning its "Big Ear" radio telescope south of Delaware, Ohio, university officials said yesterday.

Robert Haverkamp, assistant to the vice president for business and administration, said the university has signed a 10-year extension of its current lease but expects to terminate the lease by January.

"This is a renewal for the full renewal period, but nobody intends to go through with that," Haverkamp said.

The university leased the 24-acre telescope site in 1985 from Delaware developers Richard and Mary Farr to prevent the giant instrument — as big as three football fields — from being demolished. Built in the 1950s by electrical engineer John Kraus on property owned by Ohio Wesleyan University, the telescope was threatened after Ohio Wesleyan sold the property to the Farrs and their business partners.

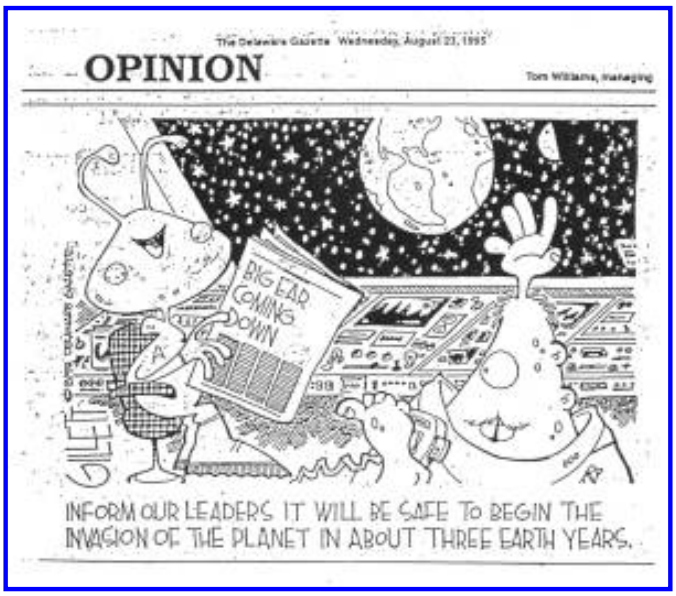
OSU's 10-year lease with the developers expired July 31, but it allows for one 10-year renewal — through 2005 — providing Ohio State agrees to a rent increase and to a paint job for the telescope superstructure.

OSU, however, decided to abandon the telescope rather than commit to painting it, which could cost $285,000 or more. The currrent extension involves a rent increase — from $9,000 to $31,188 a year — but doesn't require painting as long as a termination agreement is signed by Jan. 31, 1990.

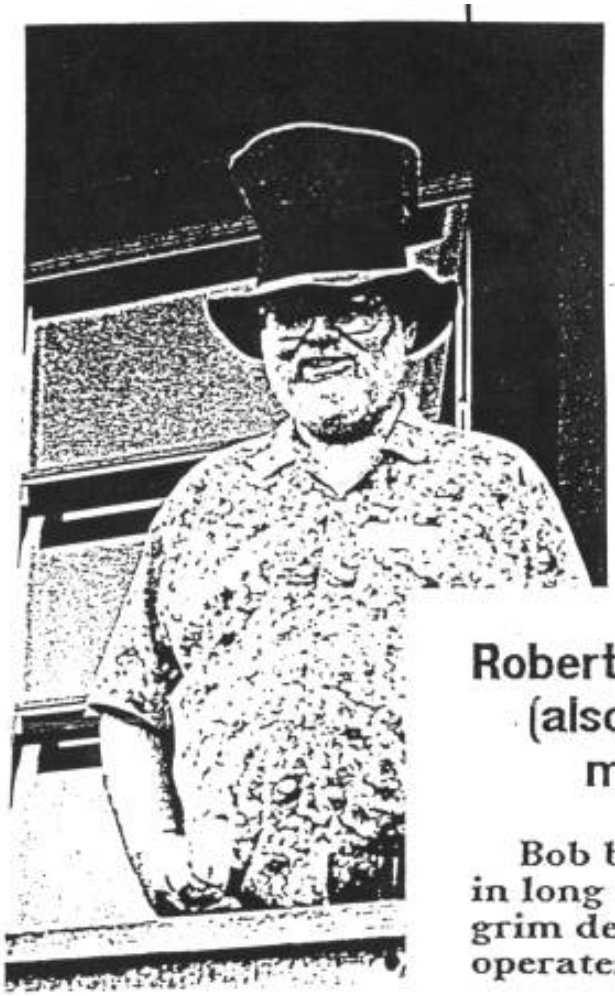
Radio astronomers and OSU officials have discussed building a new telescope in central Ohio to continue "Big Ear's" mission of mapping stars and other extraterrestrial radio sources. Since 1973, the telescope also has monitored the heavens for any evidence of alien civilizations.

It now appears, however, that the telescope will be razed to make way for an expansion of the Delaware Golf Club course and nearby housing. Details of the project were announced last month by the developers, New Green Highlands Development Ltd. and Ganzhorn Enterprises.

[Note from webpage editor: The graphic below is a cartoon from *The Delaware Gazette* newspaper dated August 23, 1995. It ties in with the above article. Click the cartoon to obtain a larger version.]

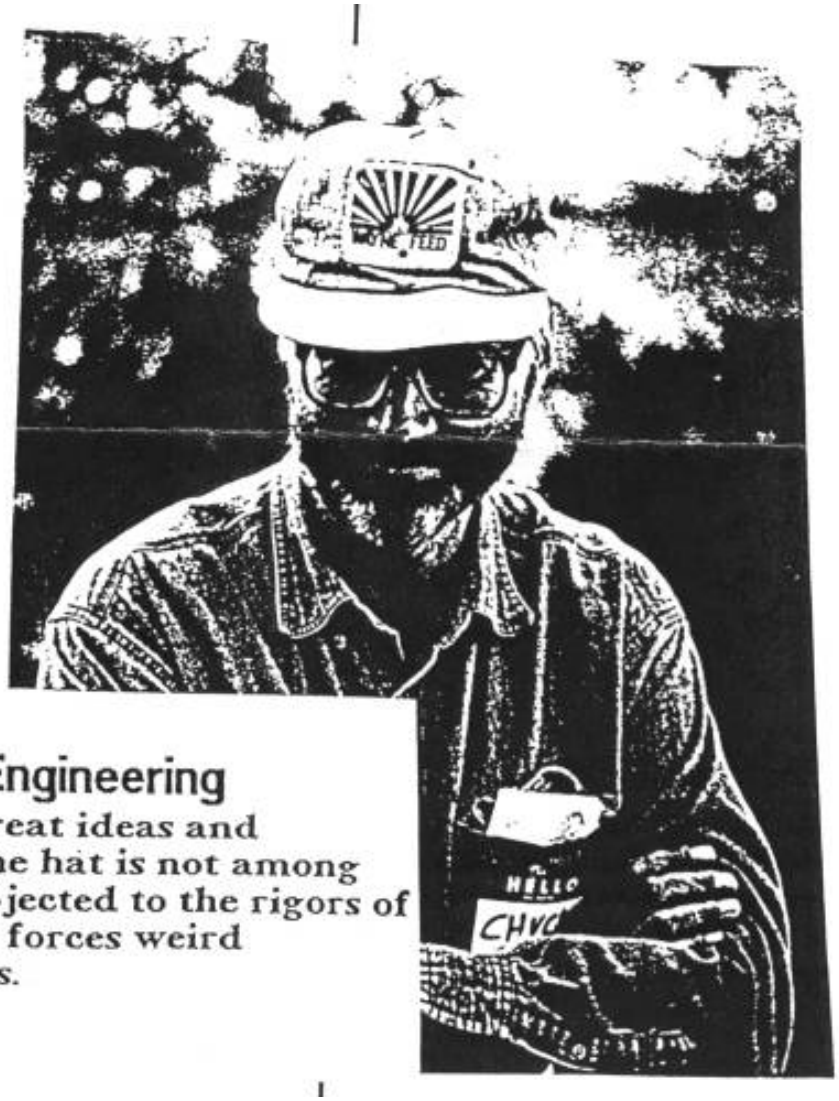


Centerfold Photos Obtained at Dixon's "WingDing"



Robert (Bob) Dixon; PhD Electrical Engineering (also known to users of the Palomar Overlay mats as the Had Matter)

Bob brings much to the group of volunteers -- often in long sagas of frustrated travel arrangements and grim details of how a smoothly running bureaucracy operates. (by definition: NOT smoothly!)



Chuck Klein; PhD Electrical Engineering

Chuck brings to our efforts great ideas and occasional graduate students. The hat is not among his usual accessories. He was subjected to the rigors of the latest Dixon WingDing which forces weird headgear onto innocent attendees.

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E-mail Webmaster

Designed by Jerry Ehman
Last modified: April 2, 2004