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NAAPO Coordinator -- Philip E. Barnhart,
Department of Physics/Astronomy, Otterbein
College

MARC ABEL - OFF TO THE WESTERN HAVEN OF PHYSICS

The Radio Observatory has sent another volunteer into the real world with a twinge of regret. Marc Abel is beginning a college career at Cal Tech this month. His intention to study physics shows that he learned well the lesson that "... if you know physics, there is nothing you can't do, including engineering."

Marc came to the project while he was still in Middle School in Upper Arlington. With only a slight hesitation, Bob Dixon agreed to let him in on the programming side of the operation and Marc became proficient and has done much of the software development for the 11/23. There are still a few quirks and corners that he is the only one presently who knows what lies there-in.

We at the Radio Observatory will miss having Marc around to tease and learn from. Our best wishes go with Marc and we hope to see big things out of him in the next

few years. We hope some of them will be aimed at the Radio Telescope.

NAAPO Headquarters
c/o Dr. Philip E. Barnhart
Dept. of Physics/Astronomy
Otterbein College
Westerville, Ohio 43081

(614) 898 1516

NOVEMBER TRIP TO PUSH NAAPO

Early last week the Coordinator received a call from Gordon MacIntosh of the Physics Department at St. Vincent's College, Latrobe, Pennsylvania. It seems Gordon is a graduate of U. of Massachusetts (the Five College Consortium Radio Observatory) and he is interested in the operation at Big Ear.

As a result we have made plans to visit St. Vincent's in November and will try very hard to convince some of the physics students to push for undergraduate research experience at Big Ear. It will also be good to have another professional radio astronomer aligned with our program.

More on this new contact as things develop.

SYNTHESIZER INTERFACE MODIFICATION WORKS !!

In the last issue of NAAPOnews a request was made for 4N33 Optoisolators to replace the marginally functional units in the synthesizer interface cards. When no rush to supply said items became apparent the decision was made to purchase them. Jim Bolinger and Ron Huck now report that the boards are operating ". . . beautifully." This brings us one step closer to throwing the switch.

COORDINATOR'S CORNER

Another year has passed. It is difficult to point to specific gains we have made during this time though some are shortly coming to a point of completion. Preparation of the 11/23 to go into operation at the radio telescope is very nearly complete. Actual moving will hopefully occur in the next six to ten weeks.

General clean-up around the observing site is progressing well. This in spite of the fact that your's truly set fire to Delaware County during one session -- bringing about a general ban on open fires in Liberty Township for the duration of the dry spell. Regrowth of grass has almost totally eliminated any evidence that we burned an acre of mowed grass.

The focus room is now ready for installation of the newly constructed equipment. Though some concern is being raised about the condition of the wiring all over the observatory site we will most likely move in and take our chances until we get enough money to do a thorough rewiring.

Design and engineering on the horn cart drive control system is going on. The cart moves with some difficulty so ways will be sought to make the motion more even and predictable. Cable slipping seems to be a recurrent glitch. The scissors arm displays a bit of wobble and the tendency to sag has been relieved a bit.

Security on the site continues to be a problem. So far, nothing but nuisance visits have occurred, but the worry is still there that some one nay develops a malicious streak that we can not afford. Continued false fire alarms have caused us to tell the alarm company to ignore the fire monitoring portion of their service.

Development of a microprocessor control and monitoring system is moving out of the design/planning stage and will be operating along with the 11/23 when the move to the focus room is made. We will also move in with a new 6 channel thermal strip chart recorder that is being donated by Gould, Inc. They are also donating a large supply of chart paper so the feeding and maintenance of the recorder will be greatly subsidized.

The astonishing thing is that most of us who are working on this project are doing it in a modest amount of SPARE time that we break loose. We pay very little in the

form of wages to skilled technicians -- most in the form of minimal hourly compensation. Every one who takes part in the operation does so with pride and a feeling of satisfaction when tasks turn up completed. Our decision a year ago to drop off the air and devote full time to the job of getting the new equipment ready to go was a very difficult one to make. It was deemed too costly in very limited manpower to devote the time necessary to stay on the air and operate a complete observing program at the same time we worked to complete the extensive task of tooling up for the grand turn-on of this fall. We took a little longer than anticipated to complete the job, but now that we are almost there, we are generating the excited anticipation of that day when the signals from Big Ear again produce an output to a line printer or a chart recorder.

ACADEMIC YEAR IS UPON US

Now that classes have begun it is time to start planning the special events of the school year. Keep in mind that NAAPO offers sometimes informative lectures for student groups or regular classes. It is generally helpful if considerable lead time is given so that arrangements to be away from our classes can be made.

Also, keep in mind that a field trip to Big Ear is a very good use of department travel funds and can provide a meaningful experience for college students and faculty. We will be very happy to coordinate your plans. Just contact NAAPO Headquarters, (614) 898 1516.

Flag of Earth - Will it Wave?

Next month Bob Dixon travels to England to lend a hand in an effort to promote the "Flag of Earth" to the British space enthusiasts. To enlighten the readers of NAAPOnews as to the story behind the flag we hereby reprint a Columbus Dispatch article of Sunday June 14, 1987 written about the Flag of Earth creator, James W. Cadle of St. Joseph, Illinois.

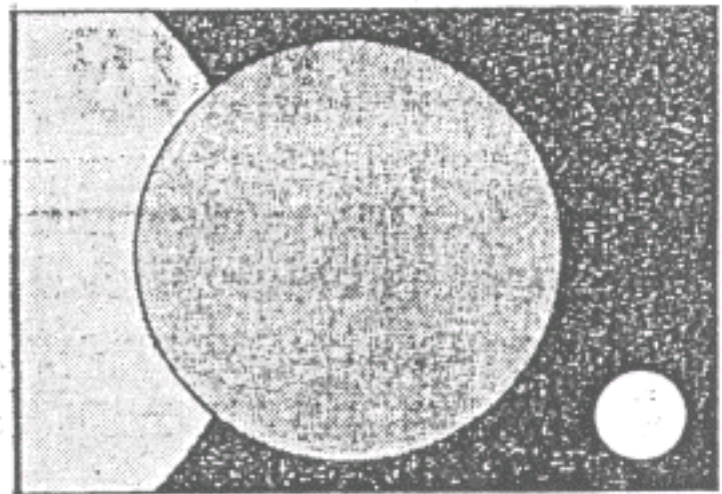
The Columbus Dispatch

SUNDAY JUNE 14, 1987

It's Flag Day today, and the land is festooned with banners bold; there are flags for all nations, flags for states and cities and even special flags to fly over burger joints. Not to mention corporate flags, school flags, clan flags, ship flags, and belligerent Stars and Bars, don't-tread-on-me flags.

All of which seems terribly boastful and parochial in the shadow of James W. Cadle's graceful standard, the Flag of Earth.

HERE WE have a flag that tingles the mind, lifts the spirit and clutches the throat. It is just three spheres against a field of black; the beautiful blue Earth and its silvery moon riding tandem through the heavens in golden lap of the sun. "Its anthem is the wind in her trees and the waves of her seas," writes Cadle. It's enough to make even the most logical Trekkie extend a quivering salute.



A closeup of the flag

You'll find the Flag of Earth flying over the Ohio State University radio telescope at Delaware, which is part of the national search for extraterrestrial intelligence program, known as SETI.

And it has flown, rain or shine, for the last 17 years over the 13-room farmhouse outside of St. Joseph, Ill., where Cadle lives with his dog, cat and four chickens.

"It's my IRA," said Cadle. "It's taken all my money for the past 17 years. It's an incredible obsession, and that's why I've hung on so long."

As befits a man who creates his own flag, Cadle is a direct sort who harbors some rather complex ideas.

In his youth, he got a degree in broadcast journalism but found he couldn't afford to raise a family on radio pay. Today, the 50-year-old Cadle, divorced, works on an assembly line, making window sashes and thinking about the theories of chaos. "I'm abnormally obsessed with science, especially as it deals with chaos theories and fractals (mathematical curves)," he explains. "It's all going against quantum mechanics, and my interest has been investigating science along with studying the brain."

CADLE GOT the idea for the Flag of Earth about the time of the Earth Day environmental demonstrations in 1970, one year after the Apollo 11 landing on the moon.

"I got up one morning ... and the idea came to me that this planet really needs a flag," he said. A trip to the So-Fro fabric store, a few stabs with the needle and his creation first caught the breeze on May 17, 1970.

Clumsily sewn, tacked to the top of a rural power pole, it was the most beautiful flag Cadle had ever seen. "I can't describe the feeling I had that this was right," he said.

Now, flags have been around since the ancient Egyptians tacked streamers to their battle poles to attract the favor of the gods. But Cadle thinks mankind is ready for a planetary pennant.

"The astronauts said it well enough; they saw the Earth as just a ball, all alone. You'd be surprised how all alone we are, so we have to have a symbol that stands for the whole planet," he said.

"And how do you communicate with these others, if there are others? You have translation problems. My flag would tell them we have a yellow sun, a blue planet. and that we're the only planet in the system with one, over-large moon."

CADLE'S FLAGS pop up at science fiction and space conventions and never fail to stir interest. They are shipped out from St. Joseph and are passed along like balloons on the wind; one supposedly reached President Reagan; another reportedly was presented to astronaut Neil Armstrong; and a third is being taken by an enthusiast to China to fly over the Chinese Space Station. "Things go on out there with the flags that I don't even know about," Cadle said.

Despite the lack of any advertising or marketing program, Cadle estimates he's sold about a thousand flags to those people who hear about it and have the tenacity to track down the maker.

"I never approach people," Cadle said. "They always approach me."

Cadle said he'd like to promote the flag but can't afford to.

"I haven't got the money to do it," he explained. "I've got to build windows; I was unemployed for 2 1/2 years. I heard tell they want me to go to a SETI conference in Hungary this September, but I told them I'd have to get my expenses paid. Poverty tends to humble one.

THE FLAGS are made of nylon by a local tent-maker. "I fly mine 24 hours a day, through blizzards and everything," Cadle said. "On the planet Earth itself, there is no protocol at all; you can use it to light your trash. But if someday you're sitting on a lawn chair on some planet light years away from here, you'll want to take care of it."

It's a flag for the future, but even today, he suggests, it is a symbol of life and hope in a universe that may harbor neither spark.

"It's a very positive statement," Cadle said. "It says we won't have a nuclear war, that we are going to survive and go into space. Kids love it because it gives them a psychological counterpoint to the nuclear threat."

Cadle's flag has never been officially adopted by any state or group, and the creator prefers it that way.

In fact, he says he has never encouraged the National Aeronautics and Space Administration to use the emblem. "With the Department of Defense connection to the shuttle, I wouldn't want that at all," he explains. "It would blemish the flag. That's the fight I've had: to keep it clean."

One group that has unofficially used the flag from time to time is the Planetary Society, the Pasadena, Calif.-based group organized by astronomer Carl Sagan to promote public support for space exploration.

"I THINK it's a terrific symbol, and I think the motives behind it are terrific," said Louis Friedman, executive director of the society.

"Whether we need a planetary flag or not is a matter that should be discussed," he said. "And we should discuss it at the point where there is worldwide involvement in the SETI project, or the exploration of Mars or some similar global effort."

But Friedman thinks any such flag must be developed in the same way that the United Nations -- and its flag were adopted: through a process of international dialogue.

"Excuse the pun, but to come up with something made out of whole cloth by a few people - however well-meaning they may be - is not the way to go about it," he said. "But suppose NASA and the Russians and the IAU (the International Astronomical Union) wanted to get together and create a flag; then I think this would be terrific."

Cadle disagrees, saying symbols aren't created by committees. Even within the Planetary Society, he said, there has been wrangling over use of his flag.

"I heard there was a big to-do involving Carl Sagan because all his peers wanted him to back the flag," Cadle said. "Now Sagan's brilliant, but he has an ego problem; he thinks the flag is a good idea and all, but it wasn't his idea."

Cadle thinks a flag, like a poem, can arise only from one creator's inspiration.

"How else?" he said. "No committee, no group of nations would ever agree. It has to be one person, one brain, to act and then sneak up on the planet."

Here and There in the Universe

*A long time from now,
The Flag of Earth will whisper
of a planet
Where once you could stand naked
under a warm sun.
Where you could swim in water
that stretched
as far as eyes could see,
And walk the very ground
that grew your food.
A planet where it rained.
Home.*

James W. Cadle

The Flag of Earth comes in three sizes: 2' by 3' (\$22), 3' by 4.5' (\$41) and 4' by 6' (\$65). To order, write James W. Cadle, Flag of Earth Co. International, St. Joseph, Ill. 61873.

"SPACE WORLD" GIVES DIXON AND BIG EAR AUGUST COVERAGE

The August 1987 issue of "Space World" carries an article about Bob Dixon and the SETI program at Big Ear. In this issue of NAAPOnews I will reprint the narrative of the Dixon section and next issue, will reprint the remainder of the coverage. For those who wish to see the photographs that accompany the article I suggest you get to your nearest issue of "Space World" and feast your eyes.

Ohio State's "Big Ear" heads into its fourteenth year of listening for extraterrestrial signals.

by Maura J. Mackowski

"You want to ask me about Bob Dixon? You mean The Spaceman?"

The voice on the other end of the line was that of Martin Solomon, director of the Instruction and Computer Research Center of Ohio State University, and *ergo* boss of the spaceperson in question.

Many phone calls later, a picture emerged of the man behind the country's longest running SETI (Search for Extraterrestrial Intelligence) project, Ohio State's "Big Ear." Tales of long hours crunching data, testing equipment, mentoring budding cosmologists and heading "save the telescope" marches in his "E.T." t-shirt led to the conclusion that in the person of Robert S. Dixon, the world of astronomy had someone who was well-rounded.

Dixon, a bearded 48-year-old - "I was born in 1939 but I stopped keeping track of how old that makes me" - took some time out of his busy schedule to expound on SETI research in general and the Big Ear project in particular.

"There's an analogy I use when people ask me why we should be conducting SETI research right now, when our means of searching for intelligent life is relatively limited," Dixon said. He was responding to the comment that some skeptics question the whole idea of SETI research, noting that alien life forms could be communicating through many other media beside radio signals - including gravity

waves, tachyon messages or neutrino modulations - but that Earth's scientific capability is too infantile to pick up such signals.

"Suppose that when Christopher Columbus was proposing his voyage of exploration to the New World," Dixon said, "the crew had refused to go, saying `We're not sailing in any leaky old boats. In another 450 years there'll be jet planes; we'll go then.'"

Dixon acknowledged that, while an occasional unexplained phenomena has been detected by the telescope, E.T. hasn't placed a person-to-person call to anyone at Ohio State. That alone, though, is not necessarily cause for grave disappointment, he believes.

"Even though we haven't picked up the signal we're hoping for yet," Dixon admonished, "we're still advancing the state of the art in SETI research."

"The Ohio State project is the longest-running SETI experiment in the world," he added. "In fact, Harvard is the only other facility with an ongoing program. One of OSU's biggest accomplishments is that we've been able to keep going for so long. If we continue to receive NASA grants and they come here with their million channel analyzer we expect to keep on going forever."

NASA is planning field tests in the future of a signal analyzer that can disseminate on the order of a million channels at once, and is strongly considering placing one of the units at OSU. Currently Big Ear can sift up to 3000 radio channels in its search for signal patterns.

Dr. Bernard Oliver of NASA's Ames Research Center acknowledged the quality and longevity of the Ohio State work and lamented the agency's lack of cash to better finance Big Ear and other SETI projects.

"The SETI project is just so poor," Oliver commented.

"We hope to go forward with a new initiative in SETI research," Oliver said. "We're proposing a ten-year SETI search project and are designing the equipment for it now. At the end of the ten years, if we have not found anything we would then have a basis for going to Congress and requesting a bigger antenna. If we don't conduct a

thorough search with what we have now, and put in a request for more powerful equipment, which is what I think we really need. Congress will ask how we know we can't find anything with what we've got."

"We're keeping our fingers and toes crossed for the funding," he said.

Big Ear is a mostly volunteer program, and as such is continually strapped for funds. The project's income, roughly \$15,000 per year from NASA plus whatever additional money is donated by science-minded individuals, is spent on a few graduate student stipends and technical expenses. The personnel to run the program are provided by a consortium of colleges and universities who each contribute a faculty member and recruit students to serve in volunteer posts. The volunteers take care of literally everything from mowing the lawn to analyzing the data.

The project has been limping along on not-exactly-state-of-the-art equipment, relying mostly on the kindness of strangers. Digital Equipment Corporation (DEC) has donated computer equipment on two occasions, although one student worker confessed that keypunching cards for a machine only two years younger than himself left something to be desired.

The story of how SETI research found a home at Ohio State begins with a look at some early research by the now retired John D. Kraus, former professor of electrical engineering and astronomy.

Kraus, the author of many texts on radio astronomy and electromagnetics, penned an autobiography in 1976 titled *Big Ear*. The book describes, in a readable style, the history of the Ohio State radio telescope and its entry into the field of SETI.

Big Ear is not a dish reflector, like the receiver at Arecibo, Puerto Rico. Rather, Martin Solomon described it as "a monstrous thing, the most massive set of bedsprings you've ever seen in your life." Imagine a giant Serta Sleeper measuring 100 feet in height and 300 feet in length, or roughly the area of three football fields. Now imagine it tilting up and down to follow the Earth's rotation.

Work on the mammoth reflector began in 1956, but it was 1961 before the basic telescope was completed and actual celestial observations could commence.

Just to get Big Ear built, Kraus had to fence with funding and the lack thereof, design problems - the winch used to raise and lower the reflector was based on Kraus observation of a Ferris wheel - uncooperative weather, sporadic part-time student labor and the discovery of oil practically underfoot.

Once the telescope was operational, the team faced an ongoing series of hurdles, including the small matter of the Big Ear array toppling to the ground.

"There are all kinds of transient events going on in space that go unnoticed ... we need to be able to just sit back and observe, looking at the whole sky at once."

Electromagnetic interference from a wide array of sources periodically fouled up the works, requiring canny detective work, engineering ability and much political savvy to resolve. Air Force nighttime test drops of chaff, radar from nearby airports (and even the Highway Patrol), interference from the ignition wires of nearby farm tractors, would-be TV stations petitioning to erect new towers, extra high-voltage transmission lines and synchronous satellites broadcasting close to Big Ear's frequency all usurped precious research time.

In the early 1970s, Dixon spearheaded the dedication of Big Ear to the task of SETI.

Kraus described Big Ear's initiation as a SETI instrument in his book.

"Friday, the seventh of December, 1973, the search began," he wrote. "There was no fuss or fanfare; switches were set, recorders started and the data began to flow."

"Our Big Ear was now listening for other men on other planets circling other stars who might have built beacon stations to announce their presence."

Though the Big Ear researchers have not yet found that which all true space believers know in their hearts must surely exist, Dixon is confident that it is only a matter of time. How long a time is anyone's guess.

He's already working on another generation of radio telescopes which he hopes will broaden the search. A working model of the Mark I is now being constructed, with

the Mark II and Mark III already on the drawing board.

"You could call everything that's been done up to now 'telephoto astronomy'," Dixon explained. "Observers can only look at a tiny fraction of the sky, for a small time and in a narrow frequency band. For all we know, extraterrestrial visitors have sailed right by, waving at us. and we haven't seen them."

"This new radio telescope will be like a 'radio camera'. It will be able to look everywhere at once, much like a fly's compound eye can see in almost every direction, while human eyes are much more limited."

"The technology is very difficult," Dixon acknowledged. "With greater computer power at lower costs becoming more available, though it is quite feasible and will revolutionize radio astronomy. We hope to have it operational by December."

"There are all kinds of transient events going on in space that go unnoticed," Dixon continued, citing the chance discovery of a supernova by an astronomer who just happened to be looking in the right place at the right time. "We need to be able to just sit back and observe, looking at the whole sky at once."

"Astronomy needs that capability. The Earth needs that capability."

Maura J. Mackowski is a freelance writer from Florissant, Missouri. Her last feature article, about safety on the Space Station, appeared in the March 1987 Space World.

NAAPO WORKING SESSION

SEPT 19, 1987

A brief working/work session convened at 10 am. Those present included Dixon, Backus, van Horn, Bolinger, Huck, Barnhart and visitors Mark and Linda Mitchell, Tom Huff and Katrina Timpson.

Announcements included:

1. Word has been received that Gould, Inc. is seeking to donate a 6-channel thermal recorder with large quantities of chart paper to the radio observatory. Projected

delivery date is in early to middle October. This gift is being arranged by an Otterbein graduate who read of our recorder woes a year ago.

2. We have received an inquiry from Gordon MacIntosh, a radio astronomer just graduated from U. of Mass and the Five College Consortium, regarding the possibility of using the Radio Telescope for undergraduate field trips or research. [Have we got a deal for him?] Barnhart is pursuing the follow-up and will try to encourage his joining the consortium.

3. Dixon is off to England to stump for SETI, Flags of Earth and recognition of computers as legitimate objects of professional application. He will be gone from October 10 through Oct 24. During his absence it will be necessary for Barnhart and Bolinger to coordinate the Marcon open house at the radio observatory on Oct 18.

4. A few more overlays have been ordered. Some back orders have turned up in the files, so there is activity in this area again.

5. Frank Drake has requested an article from Dixon concerning the SETI program and progress at BIG EAR. This will tie Bob down for some of his valuable time. Also the Astronomical Society of the Pacific is putting together some slide sets about SETI which requires some slides of our operation.

6. There will be a work party October 26 to remove the crane from the ground plane to allow clear area photos to be taken. This will also provide an opportunity to assure the crane still runs and keep it tuned up.

7. It will be necessary for us to call a general instruction meeting to have Kraus present a workshop on "Moving the Flat Reflector". Arrangements will be made following Dixon's return from England.

STATUS REPORTS

1. Horn Cart System -- Huck strengthened and braced the scissors assembly to eliminate the sag that is occurring. Wheels have been added at the outrigger and the center of the scissors. It seems they are a bit small and should probably be replaced by pneumatic wheels of somewhat larger radius. The asphalt under the ground plane has become pocked, making smooth operation of the horn cart very difficult. More

engineering and bright ideas are needed.

2. 11/23 -- Software. A number of short, necessary programs need to be written. As Marc Abel is now on the west coast, these programs will need to be written in Dixon's spare time. This also places a strain on deadlines. Dixon spare time is a commodity in very short supply.

3. 11/23 -- Hardware. Ave is now testing the various components. Bolinger and Huck have completed the modifications to the synthesizer interface cards and report that the 4N33's recently purchased are "working beautifully". There is still work to complete on the synchronous detector.

The meeting adjourned to the ground plane for a variety of tests and tasks.

The next meeting is October 3 at 10 AM at Big Ear.

MicroGroup MOVES ON CONTROL PROJECT

After some months of struggling with the problems of piecing miscellaneous parts and personnel together, the decision has been taken to go for a DASCION I (from MetraByte Corp.) Analog, and Digital I/O Interface Board to operate on IBM PC or compatible computers. The board is backed by a large quantity of software which will accomplish in a much shorter time the desired functions we had set out to do in monitoring, control and recording.

The hardware is now available and the programming is beginning this coming week. First on the agenda will be the implementation of the strip-chart recording and data logging programs. The environmental monitoring and control functions will then be developed. The plan is to have the system installed at the same time the 11/23 is moved into the focus room.

We will continue to include progress reports in NAAPOnews.

PROJECT LIST

For those who would like a modest development project, a minor problem arose at the focus room following the Work Session last Saturday when one of the staff inadvertently left the power to the cart drive turned on. This was not a serious slip because the cart was anchored and the clutch not engaged.

The problem could have been prevented if there had been a small monitor panel beside the alarm box indicating the status of all circuits in the focus room. This could be a simple low voltage LED display indicating the ON or OFF (and possibly STANDBY) condition of the various circuits in the room.

Send your suggestions and preliminary layouts to NAAPOnews, c/o P. E. Barnhart, Department of Physics and Astronomy, Otterbein College, Westerville, OHIO 43081.

BOOKS AND ATLASES AVAILABLE AT COST FROM NRAO

Serendipitous Discoveries in Radio Astronomy, ed. Kellermann and Sheets - \$7.00

The Search for Extraterrestrial Intelligence, ed. Kellermann and Seielstad - \$10.00

Synthesis Imaging, ed. Perley, Schwab, and Bridle - \$10.00*

A 1400 MHz Sky Atlas, ed. Condon and Broderick - \$10.00**

Cometary Radio Astronomy, ed. Irvine, Schloerb, and Tacconi-Garman - \$10.00*

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Designed by Jerry Ehman

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