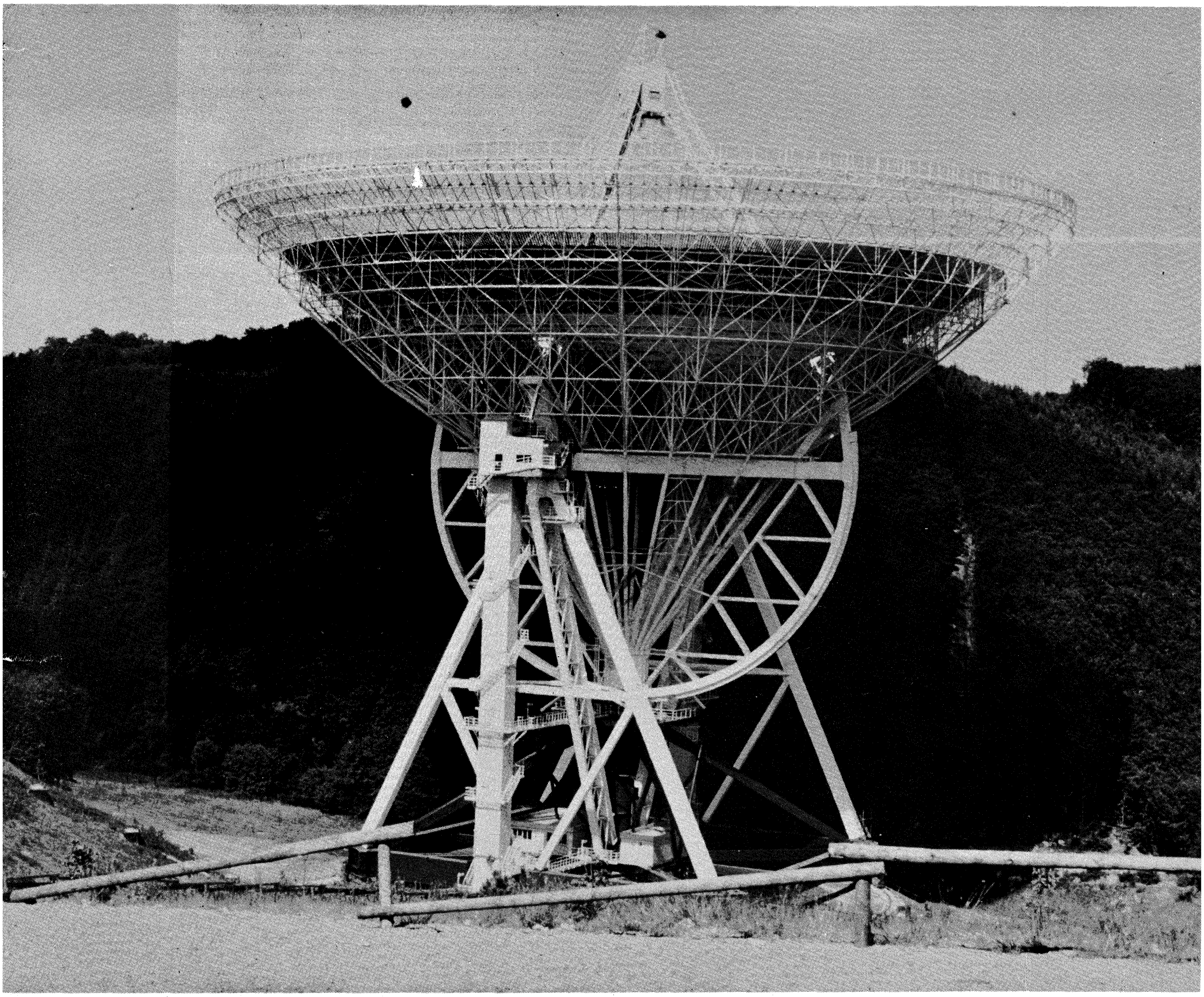
Der Beobachter

oktober 1974



Eine Grosse Antenne
und Kleine Quellen

seite 3

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The *OBSERVER* is a bimonthly publication of the National Radio Astronomy Observatory, P. O. Box 2, Green Bank, West Virginia 24944.

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A special thanks to all of those who helped assemble the *OBSERVER*.

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This may well be the last Shostak cover, as Seth ended his employment with NRAO in September. Good luck Seth. Thanks for helping us with the *OBSERVER*.

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THE BONN 100-METER TELESCOPE*

Ivan Pauliny-Toth

The traveller driving southwest from the German capital of Bonn makes his way along winding roads flanked by forests, fields and meadows. Some 25 miles from the capital, having passed through several quaint villages, he will see on his left a metal quadrupod disturbing the pastoral scene. A mile further, a road sign points the direction of the 'Radioteleskop Effelsberg'; turning and driving on a little further, he will see the white bowl nestling in a valley in the distance. Passing through the little village of Effelsberg and taking the approach road, he comes to a futuristic-looking pavilion on a hillside, from which, for the first time, he can enjoy a full view of the impressive antenna, with its colorful red and blue support structure. If he has chosen to come on a summer weekend, he will enjoy his view with hundreds of other visitors, for the telescope has in the last two years become a major tourist attraction. For this reason, the pavilion was put up last year: in it, the visitors may listen to talks and see films explaining where their tax money is going.

The telescope was constructed by the firm of Krupp who have turned their ingenuity into more innocuous channels than those with which the U. S. public may generally associate it. Although the mechanical work on the telescope was essentially completed in late 1970, considerable work on the cabling, the receivers and the Argus-500 control computer remained to be done. Some trouble was experienced at that time with oscillations of the structure when the dish was tilted; these were, however, removed by simply disconnecting two of the four drive motors and are no longer a problem. Thus it was not until mid-1972 that the telescope became available for observations. As the picture shows (see cover), the telescope is of the 'alt-azimuth' type: that is, it tilts about a horizontal axis, like the 300-foot, but in addition can be turned about a vertical axis on trolleys riding on a circular steel track.

The inner part of the dish, amounting to a little more than half of the surface, is constructed of solid panels, the outer part of fine mesh panels, the idea being to use the whole surface at wavelengths longer than 3 cm and only the inner part at shorter wavelengths. The telescope can be used in two modes: either for prime focus or for secondary focus observations. In the first case, the radio waves reflected from the dish enter a feed mounted at the focal point directly. For secondary focus work, a sub-reflector, some 25 feet in diameter, reflects the waves towards receivers mounted near the center of the dish. The arrangement is not, however, of the Cassegrain type, as the 140-foot will be, but of the 'Gregorian' type (see Figure I, page 4): the sub-reflector is concave rather than convex and is placed behind the prime focus feed, so that it does not have to be removed for prime focus observations.

A further difference is that the 140-foot telescope is a rigid structure and is constructed to fight the inevitable deformations from the ideal parabolic shape, which occur as the dish is tilted, by a massive structure. The 100-meter telescope, on the other hand, makes use of Sebastian von Hoerner's principle of 'homologous deformation'. That is, the telescope is allowed to deform as it is tilted, but the structure is designed in such a way that the shape remains a paraboloid. Thus the edges of the dish move by as much as 20 cm (8") relative to a perfectly rigid structure as the dish is tilted towards the horizon, but the shape remains parabolic to an accuracy better than 1 mm. This method of construction saves metal and hence money: the telescope cost about 5 million dollars (at the 1970 rate!) which makes it a bargain as telescopes go. A price is paid for this saving: although the dish remains parabolic as it is tilted, the position of the focal point and the direction of the electrical axis of the parabola moves with respect to the prime focus cabin. The whole prime focus assembly, including receiver, feed and the sub-reflector must therefore be moved by 10 to 20 cm (4 to 8"), both in the direction of the axis and at right angles to it, as well as tilted, as the dish points in different orientations. These adjustments are now made routinely by the control computer.

The telescope is operated by the Max Planck Institute for radio astronomy, directed by Professors O. Hachenberg, P. Mezger, and R. Wielebinski. The Institute is one of many, in different fields of science, belonging to

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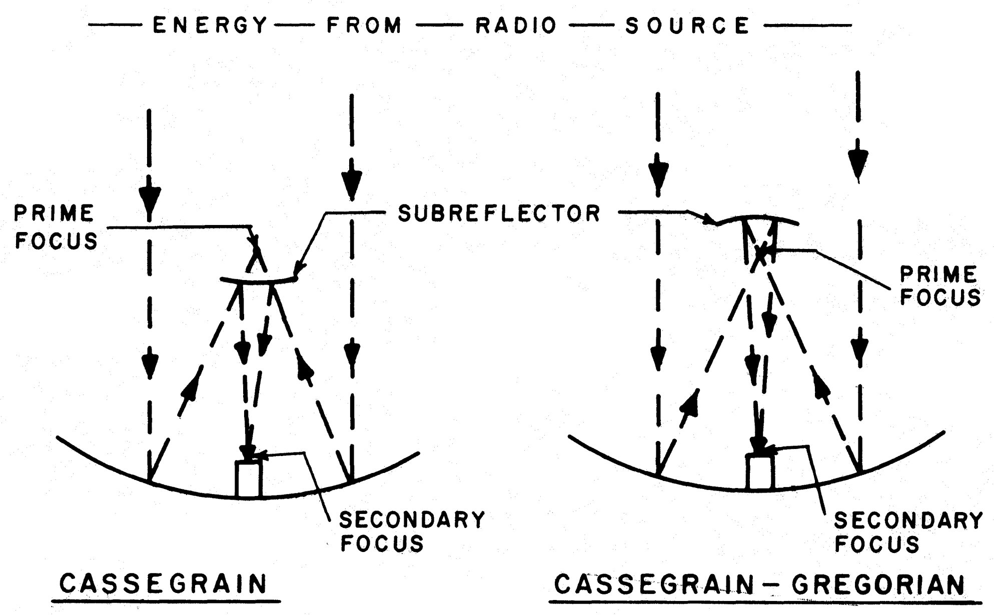

Figure I. The difference between a Cassegrain system and a Cassegrain-Gregorian system

the Max Planck Society, an organization somewhat similar to, but more comprehensive than, AUI. The Institute is based in Bonn and has a staff of about 250, some 50 of these being astronomers (that is rather a large number per instrument, even considering the surface area!). The organization of the Institute is similar to that of NRAO: a telescope division, under Dr. Grahl is responsible for telescope operations; the electronics division, under Dr. Zinz, for the receivers; and the computer division, under Dr. Stumpff, for data processing and fundamental astronomy. An elected observatory council attempts to steer the directors along the right path.

In mid-1972, the full computer control of the telescope and the first cooled receiver, operating at 11 cm, became available, thanks to the perseverance of Johann Schraml and Nigel Keen, both familiar figures at NRAO. A small committee of astronomers then conducted an extensive series of tests of the instrument, first at 11 cm and later in the year at 2.8 cm. To the delight (or perhaps relief?) of all, the telescope was found to perform very well indeed: a pointing accuracy of 3 to 4 seconds of arc was achieved and the efficiency of the antenna showed very little change as the dish was tilted, even at angles as low as 20^{o} from the horizon. This showed that the 'homologous' design was indeed successful. These test measurements provided the pointing corrections required by the control computer to enable it to track radio sources accurately. They also provided the information about the movement of the feed assembly required to keep it at the focal point of the dish. The excellent performance at 2.8 cm indicated that the telescope should still be usable at shorter wavelengths. Preliminary tests last winter at 2 and 1.2 cm showed that this is indeed the case. It is in fact at these very short wavelengths that the telescope is unique and should provide the most interesting results, once good receivers are available.

The telescope having been shown to be good, it became important to decide how to share the observing time among the (by then) data-starved astronomers. Although the Institute is not strictly a National Observatory, about 40 percent of the time is supposed to be available to outside observers. A committee of 6 was created to review all observing requests: 4 are members of the MPI, elected by secret ballot; one is from the Astronomy Department of Bonn University; and one is an outside astronomer. The committee

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meets at intervals of about 3 months under the chairmanship of the assistant to the directors, Dr. Schwartz. It judges the requests on their scientific merit and decides what fraction of the requested time should be granted. The detailed scheduling is then done by Dr. Schwartz. Disappointed observers may (and sometimes do) appeal to the directors.

Since 1972, new receivers have come into use: apart from the cooled 11 and 2.8 cm receivers, good receivers at 6 and 21 cm are available and others, for use at 18, 3.3, 2 and 1.2 cm are on order. An autocorrelation receiver of the NRAO type has been built, as well as a pulsar back-end and a Mark II VLB recording system has been acquired. For continuum observations, a digital back-end provides a very versatile way of handling the data. The on-line computer gives the observer an almost unlimited choice of ways to map a region of sky.

Observations made in the last two years have covered a field too wide for anything but a brief mention here. In the continuum, observations of the flux density and polarization of radio sources have been made at several wavelengths, as well as maps of regions of our galaxy and of the Andromeda galaxy. Radio observations of stars have been made, and closer to home, measurements of the satellites of Jupiter and high resolution maps of the Sun. Several sets of VLB observations together with telescopes in Sweden, South Africa and the USA have been carried out. Pulsar studies have included work on the shapes and spectra of the pulses, as well as on the absorption by hydrogen in the line of sight. Last but not least, spectral studies have been made of recombination lines from a number of ionized hydrogen clouds in our galaxy and in the galactic center and of the 21 cm radiation from our galaxy.

As the number of receivers available has increased, outside observers have come to use the telescope to a greater extent, frequently in collaboration with members of the staff. It is likely that such cooperation will increase in the future, particularly as the potential of the telescope at the very short wavelengths has not yet been realized.

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* 328 feet

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LITTER, LITTER EVERYWHERE

G. L. Verschuur

It's disgusting!

During my recent visit to Green Bank, I went cycling first to the Rec Area and later thru Green Bank itself. I was appalled by the number of beer cans and other metal containers that littered the roadside. Since my bicycle had those baskets on the back, I filled them with empty containers and spent some time thinking about the types of people who throw cans out of car windows. Do they not think at all? Do they really not care about where these cans will end up. Somewhere they will become an eyesore, usually just where they throw them. Why do they do it? Are there types around that deliberately throw trash out of their car windows so that they can get a cheap laugh from a companion?

I did notice one thing. There were more cans of Struh's Bavarian Beer consumed by the idiots who litter the road than anything else. I had never heard of that beer, but perhaps there was just this one person out on a Struh's beer orgy who spread these cans all over the Green Bank area. Clearly he (I don't even suspect a she in this case) uses the Rec Area and may or may not be on the staff of the NRAO. If he is, or if someone knows about types who throw cans out into the roadside, perhaps we could hear from him and learn just whether it is done in a fit of absent mindedness, whether it is perhaps a protest against society or whether it is done to impress someone else with his recklessness.

Another aspect of this is that for some enterprising children, there is money lying along the roadside. Besides the cola bottles worth ten cents each, the aluminum cans now bring ten to fifteen cents a pound at most scrap places and I filled a large garbage can with cans and bottles and there was some useful pocket money for someone in there.

Three years ago I cycled around here quite a bit too, and I do not remember that there were as many cans along the local roads. There were on the road to Cass, but perhaps now the level of pollution is simply rising so that the cans become more noticeable here. Also, someone seems to think it appropriate to dump large quantities of junk by the roadside just before you reach the bridge on the way to the

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Rec Area. Why does someone do that? Does he or she think that those cans and broken bottles will mystically disappear from sight, into the stream perhaps?

I think it is disgusting the way Americans pollute their countryside. It is such a beautiful country and yet the common man treats it with such disdain. For some reason no one is taught to respect the environment, especially in those areas where the environment is most beautiful. Why not? It would be great if some polluter would reply, anonymously perhaps, and let us know why he or she does litter the world with so little respect for the present and the future.

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IMPROVING THE HOME OIL BURNER CAN SAVE YOU MONEY

An estimated one-quarter of the nation's oil-heated homes have oil burners so inefficient they waste about 4 million gallons of heating oil a day, according to a study by a faculty member at Stevens Institute of Technology, made with the aid of students. Yet the home oil-heating installation, he said, can be a far more energy-efficient method of delivering heating comfort that either gas or electric heating. Using data collected in tests of 1260 home-heating plants, largely in Greater Boston, Lubomyr Kurylko, associate professor of mechanical engineering, found that some oil burners use as little as 48 percent of the available chemical energy fed to them, and waste the rest.

About 15 percent of oil burners, on the other hand, were found to be operating close to optimum, with efficiencies above 80 percent. The remainder suffer from four common causes of poor energy utilization. A leading cause of inefficiency is that some oil burners are so old as to be obsolete and should be replaced with better-designed modern units. A second common fault is overfired furnaces in which the oil burners generate more heat than the furnaces can absorb. The excess heat is wasted up the chimney, often at temperatures above 1000 degrees. The upper limit for an efficient plant, Kurylko said, is 500 degrees.

Improper mixtures of oil and air are the next most important causes of fuel-oil waste, the Stevens researchers found. If too little air is drawn into the furnace to mix with the fine oil mist the burner sprays into it, incomplete combustion results and unburned oil with smoke and soot are forced up the chimney.

Finally, when too much air is drawn into the furnace, it is first heated, then ejected up the chimney, taking the heat with it without helping to warm the house. But its place is then taken by cold outside air, and this reduces the indoor temperature and keeps the oil burner working overtime needlessly to bring it up to the thermostat setting. Often, only simple adjustments of the oil burner and its controls are needed to cut fuel-oil bills substantially. But Kurylko warned against homeowners attempting to make the adjustments. Improper burner setting, he said, may result in the generation of soot, unburned hydrocarbons, and poisonous carbon monoxide, which may leak into the house through faulty flues. "Oil burner mechanics equipped with proper instruments can make these adjustments very quickly," he said.

"A 10 percent improvement in efficiency--from 70 percent to 80 percent, for example--cuts annual consumption by 13 percent--a savings of about $75 a year at today's prices," Kurylko said. "Even when an oil burner is so inefficient it has to be replaced entirely, the homeowner gets back his investment in a few years in the oil he saves. Meantime, he enjoys cleaner heat and reduces air pollution.

--Mechanical Engineer/August 1974

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HOW MANY?

Here's a short quiz on the number of permanent employees in each of the six groups of employees that make up NRAO. Can you come within 15% of the number of people in each group?

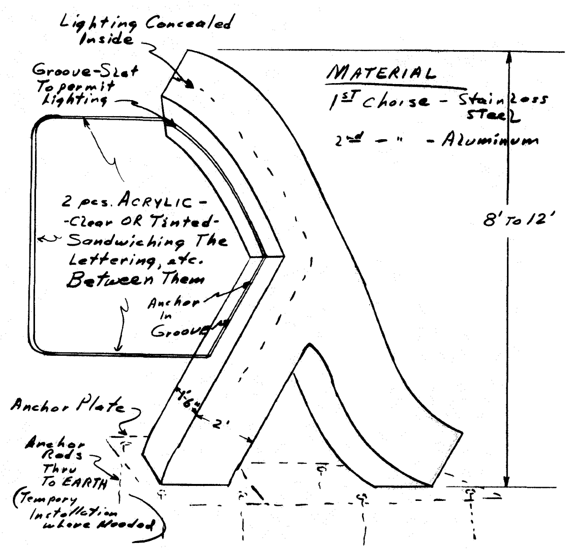
GROUP	NO. EMPLOYEES
CV	a ______
VLA-CV	b ______
VLA-NM	c ______
GB	d ______
VLA-GB	e ______
TUCSON	f ______

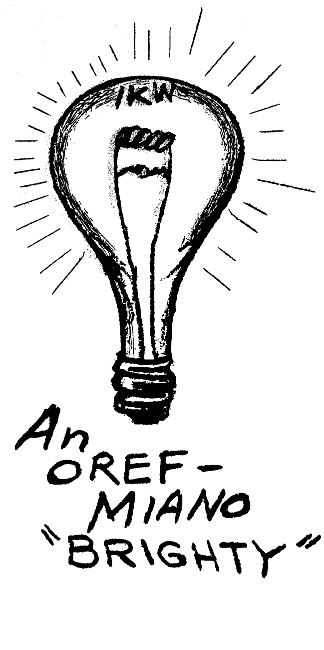
Answers on page 16.

*****

WHY NOT "LAMBDA"?

Isn't Lambda symbolic of Radio Astronomy? Lambda is wavelength---To the past, to the future, (the VLA configuration is coincidentally "GREEK"!). Standard "Sign-Posts" for the Observatory are the suggested following. Your criticism or confirmation for the proposed symbolic "Lambda Sign-Posts" will be welcome - or can you suggest a better symbol?





TRANSMISSIONS FROM AIRCRAFT AND SATELLITES - A GROWING THREAT TO RADIO ASTRONOMY

W. E. Howard

One of the major criteria used in selecting sites for radio astronomy observatories in the past has been the desirability of nestling the telescopes in a valley surrounded by high mountains which would shield the observatory from interference from terrestrial radio transmitters. Indeed, this type of terrain, plus the presence of the National Radio Quiet Zone, has made the NRAO Green Bank site perhaps the best location in the United States for centimeter- and decimeter-wave radio astronomy. Radio interference in Green Bank is now about one-half of what it would be if the three major Green Bank telescope systems were located just outside the Quiet Zone.

Unhappily, a step was taken at an international conference on radio frequency allocations in 1971 that threatens to disturb the high sensitivity observations which radio astronomers are now making throughout the world, and threatens to remove the protection afforded by our secluded valley sites. This 1971 World Administrative Radio Conference authorized satellites to transmit high intensity signals right next to a number of the frequency bands that are heavily used by, and are exclusively allocated to, radio astronomy. While it is incredible to think that over 100 national administrations could have taken such action without realizing the detrimental long term impact on the radio astronomy service, it is even more incredible that the radio astronomers did not become aware of the implications of the action until the conference actually convened, at which time it was impossible to influence the outcome. Unfortunately, a historic lack of communication between the radio astronomy community and their national administrations brought about this situation and it has its roots in the fact that the active users of the radio frequency spectrum have little understanding of, or experience with the methods, techniques, instrumental capabilities and research goals of the passive users, the radio astronomers.

The accompanying table (page 9) shows how bad the allocation situation really is on each side of the exclusive radio astronomy bands, and it summarizes both the spaceborne allocations (underlined) and the airborne allocations (not underlined) that currently exist. Even a quick glance at the table shows the threat to our service from these allocations. It should be pointed out that radio astronomers share a few other bands with other services and that a few of the more recently discovered molecular lines enjoy footnote status in the allocation table. Similar threats exist there, too.

Once allocations are made internationally, a spectrum user still cannot use a frequency until a specific frequency assignment is made, usually at the national level. This means that, although the radio astronomy service may have lost the allocation battle, we may still be able to influence the specific frequency assignments. Unfortunately again, the HEW/NASA ATS-6 satellite, now broadcasting at our 11 cm band edge, and the NOAA/Commerce/NASA SMS-1 satellite, now broadcasting near the OH band, were already in such an advanced stage of planning that the radio astronomers were unable to influence their frequency assignments. Before the ATS-6 satellite was launched into orbit, members of the radio astronomical community requested NASA to insert a filter into the transmitter which would have reduced the spill-over signal to a level that would be harmful only if the satellite beam were to be pointed at a radio astronomy antenna. Since we were told that those broadcasts would be directed toward Alaska and the Rocky Mountains, it appeared that only a few antennas near the West Coast would be affected and filter insertion would minimize interference for users of the 11 cm radio astronomy band elsewhere in the nation, particularly on the East Coast. NASA did insert the filter.

However, about 16 months prior to launch, HEW and NASA requested permission of the Interdepartmental Radio Advisory Committee (the IRAC) to beam satellite broadcasts into regions near the East Coast. Without consulting the radio astronomy community, disregarding the fact that these East Coast transmissions would broadcast into the National Radio Quiet Zone (which the IRAC and the FCC had originally created), and taking no steps to inform the radio astronomers of their action, the IRAC granted permission for the broadcasts. The radio astronomers learned of this decision quite informally nine months later, only seven months before the launch date. Tests were set up to determine how badly the 11 cm satellite transmissions spill-over into the radio

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SUMMARY OF SPACEBORNE (Underlined) AND AIRBORNE (Not Underlined) ALLOCATIONS
ADJACENT TO EXCLUSIVE RADIO ASTRONOMY BANDS

LOWER ADJACENT ALLOCATION		RADIO ASTRONOMY EXCLUSIVE BAND	UPPER ADJACENT ALLOCATION	
21.75 - 21.85 MHz	Fixed	21.850 - 21.870 MHz (13.7 m band)	21.870 - 22.0 MHz	Aeronautical Fixed Aeronautical Mobile (R)
1350 - 1400 MHz	Radiolocation	1400 - 1427 MHz (21 cm band)	1427 - 1429 MHz	Space Operations (Telecommand) Fixed Mobile (except Aero)
2655 - 2690 MHz	Broadcasting Satellite N.B.: The ATS-6 satellite is now operating here. Fixed Fixed Satellite (Earth-to-Space) Mobile* (Except Aeronautical Mobile	2690 - 2700 MHz (11 cm band)	2700- 2900 MHz	Aeronautical Radionavigation Radiolocation (secondary) Met aids
4700 - 4990 MHz	Fixed Mobile	4990 - 5000 MHz (6 cm band)	5000 - 5250 MHz	Aeronautical Radionavigation (Aeronautical Mobile-Satellite Service; Satellite-to-Land-Mass Links) N.B.: Proposed microwave landing system (MLS) under discussion for this region.
10.55 - 10.68 GHz	Mobile Fixed* N.B.: Radiolocation* is a secondary service.	10.68 - 10.7 GHz (2.8 cm band)	10.7 - 10.95 GHz	Fixed (Domestic public-point-to-point microwave; local TV)
14.5 - 15.35 GHz	Fixed Mobile Space Research	15.35 - 15.4 GHz (2 cm band)	15.4 - 15.7 GHz	Aeronautical Radionavigation (Aeronautical Mobile-Satellite Service; Satellite-to-Land-Mass Links)
22.5 - 23.0 GHz	Fixed* Mobile*	23.6 - 24.0 GHz (1.3 cm band)	24.00 - 24.05 GHz	Amateur Satellite Amateur*
31.0 - 31.3 GHz	Space Research (secondary) Fixed Mobile	31.3 - 31.5 GHz (9.5 mm band)	31.5 - 31.8 GHz	Space Research (no direction noted)
84 - 86 GHz	Broadcasting Satellite Fixed Mobile	86 - 92 GHz (3.4 mm band)	92 - 93 GHz	Fixed Mobile Fixed Satellite (Earth-to-Satellite)
122.5 - 130 GHz	Inter-Satellite Fixed Mobile	130 - 140 GHz (2.2 mm band)	140 - 141 GHz	Fixed Mobile Fixed Satellite (Earth-to-Satellite)
220 - 230 GHz	Fixed Satellite (no direction noted)	230 - 240 GHz (1.3 mm band)	240 - 250 GHz	Radiolocation

* A non-satellite, non-airborne allocation.

astronomy band, with the result that ATS-6 was found to interfere inside our 11 cm band with a signal level 20 times the harmful interference level set by the radio astronomers.

The situation with the SMS-1 satellite is just as unfortunate. This satellite was launched on May 17, less than two weeks before the ATS-6 launch. Aware of possible interference with the radio astronomy service in the OH band (1660-1670 MHz), NASA made a calculation that was both numerically and conceptually incorrect and concluded that there would be no interference to the radio astronomers. The calculation was made without consulting the radio astronomy community, who found the errors only after launch. Again, tests were set up to determine the extent of interference in the OH band, and the results showed that the satellite broadcasts in the OH band with a signal level 17 times the harmful interference level set by the radio astronomers.

The harmful interference limits alluded to here are practical, operational ones based on actual observations now being made on a regular basis with low noise receivers operating in the allocated radio astronomy bands with reasonable integration times. These limits were published many years ago in Report 224 of the CCIR (International Radio Consultative Committee) which provides technical input to the World Conferences mentioned earlier. The harmful interference limit is the interfering signal strength in a radio astronomy band above which observations by radio astronomers will become untrustworthy, even when the radio astronomy antenna is pointing far away from the satellite.

What problems do we face in the immediate future? First, a microwave aircraft landing system will be finalized in the spring of 1975 that will likely cause interference at our 5000 MHz band edge unless effective measures are taken to design the system to minimize harmful interference to radio astronomers. Second, the SMS-1 weather satellite will be joined in orbit by another in the same series by the end of 1974. Later, the USSR, the Japanese and the ESRO organization will launch similar weather satellites that will give world-wide coverage. Improper design of these satellites may soon affect the radio astronomy OH band elsewhere in the world. Third, the ATS-6 satellite may return to Western skies for an indefinite period of time in the summer of 1976 after spending a year in the Eastern Hemisphere. Fourth, the explicit wording that now affords interference protection to the National Radio Quiet Zone from ground based transmitters needs to be modified to include airborne and space-to-earth transmissions as well. Fifth, other satellites or airborne systems, of which we are not now aware, may be currently under design or construction that will threaten other radio astronomy bands, or specific spectral lines now under study. And finally, the radio astronomy service needs more effective national representation at those crucial times when critical decisions are being made that will affect the future of radio astronomy.

Where do we go from here? If we simply extrapolate from past experience, the prospect of getting our point across to the allocators seems none too good. There remain a very large communications gap, a lack of both appreciation and understanding on the part of the active spectrum users for what is being accomplished by the radio astronomers, and a strong tendency on the part of those people responsible for frequency allocations to deal with our problems only when they arise, rather than to anticipate them. Some frequency managers are talking in terms of solutions that appear to be impractical, such as reducing transmitter power, limiting the sensitivity of the radio astronomy receivers, or time sharing the spectrum. But these steps treat only the symptoms; they do not cure the disease. By far the most practical solution, it seems, is to have the major administrations agree not to assign frequencies near the radio astronomy band edges from now until the next World Administrative Radio Conference in 1979, at which time the 1971 allocation damage can be corrected. Let us hope, for the future viability of our science, that such a reasoned approach will be taken and that it will be successful.

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CREF Unit Value for July $31.71
CREF Unit Value for Aug. $29.09

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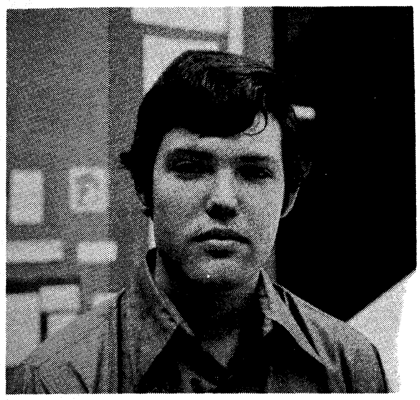
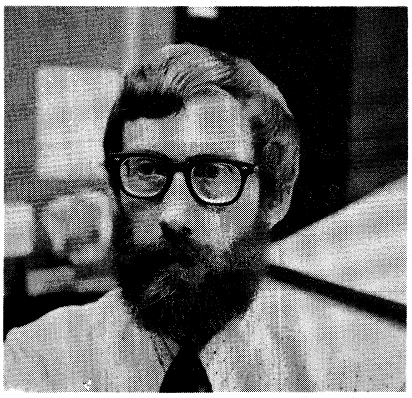
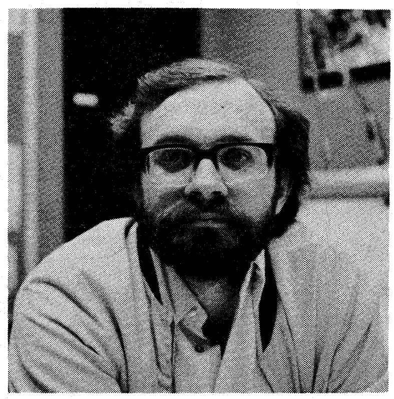
NEW EMPLOYEES



Jon R. DiMarco
Advanced Technician
VLA - CV

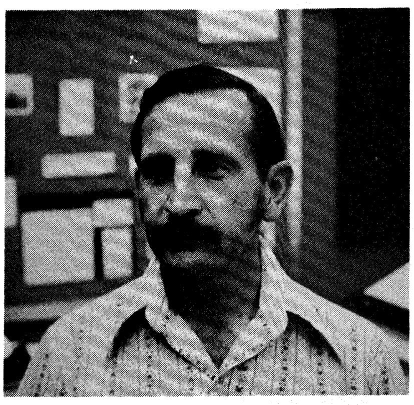


R. Marcus Price
Associate Scientist
Basic Research - CV

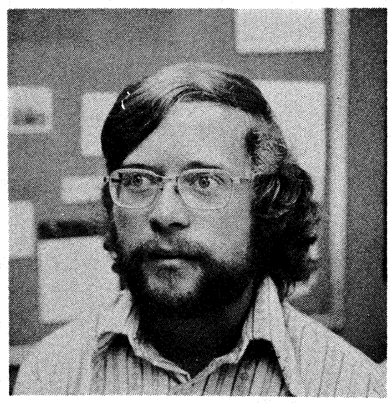


Gareth C. Hunt
Scient. Prog. Analyst
VLA - CV

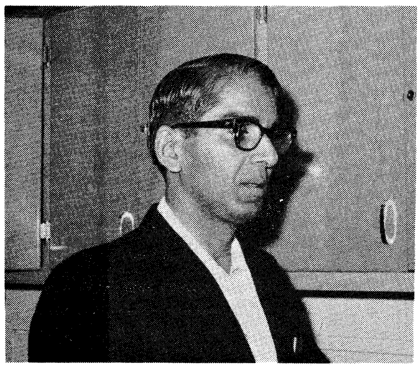
Nancy R. Vandenberg
Mathematician
VLA - CV



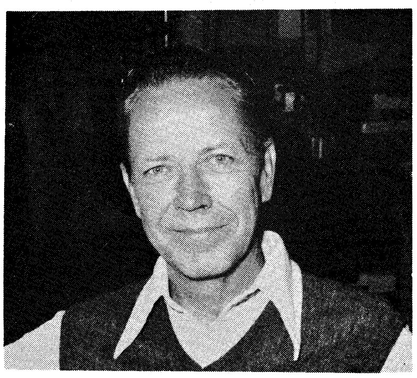
Philip M. Dooley
Tech. Specialist
VLA - CV



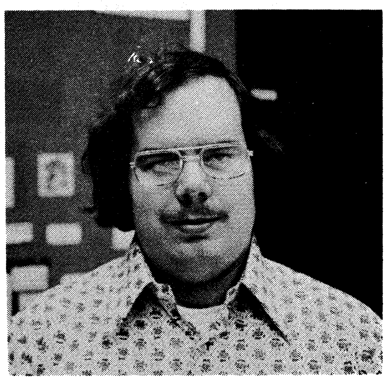
Stephen W. Wisely
Int. Technician
VLA - CV



Thuppalay K. Menon
Visiting Scientist
Basic Research - GB



Robert K. Moore
Business Manager
Adm. Services - GB



C. Thomas Wilkes
Co-op
Scient. Services - CV

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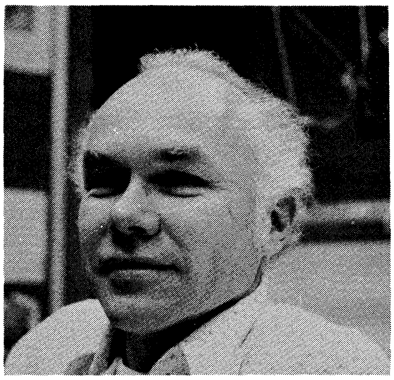
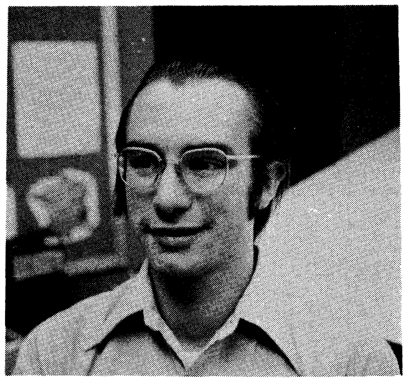
New Employees (cont.)

Photo Not Available

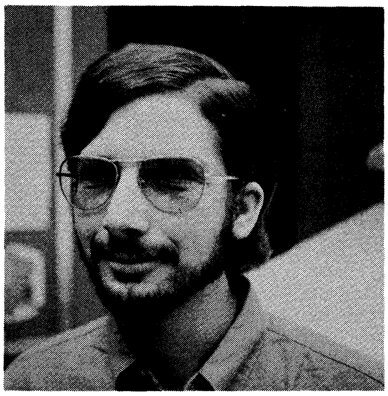
Robert G. Stidstone
Antenna Erection Eng.
VLA - NM



Lewis E. Somers
Applied Physicist
Computer Div. - CV

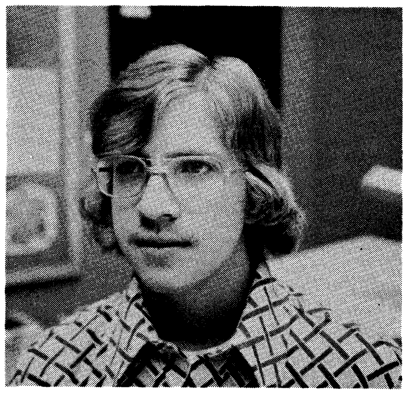


Larry R. D'Addario
Research Associate
Basic Research - CV

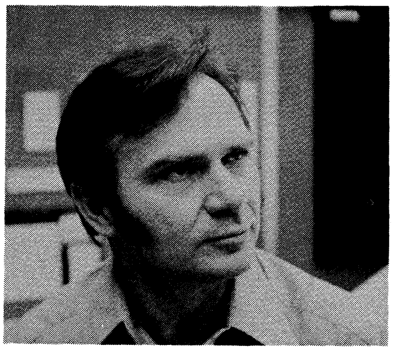


Lawrence Rudnick
Research Associate
Basic Research - CV

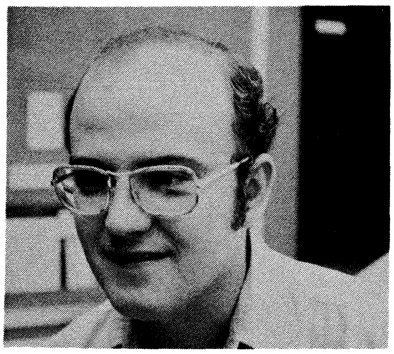
Mary R. Purifoy
Library Assistant
Scient. Services - CV



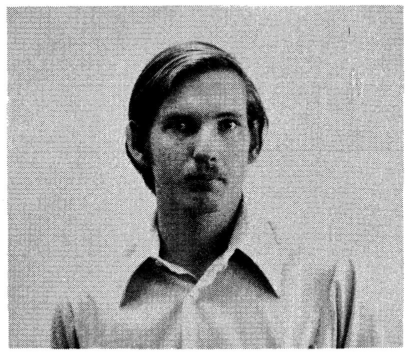
Kenneth C. Kern
Co-op
Scient. Services - CV



Ted J. McKenna
Systems Analyst
Computer Div. - CV



Robert A. Stobie
Jr. Comp. Operator
Computer Div. - CV



Kent M. Harmless
Int. Technician
Elect. Div. - Tucson

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ON LEAVE OF ABSENCE

Michael Balister	Electronics Division - CV
Richard A. Sramek	Basic Research - CV

RETURN FROM LEAVE OF ABSENCE

Jean P. Ray	VLA - CV

TERMINATIONS

James J. Condon	Basic Research - CV
Charles E. Creager	VLA - CV
Joseph H. Greenberg	Scientific Services - CV
Peter Henderson	Basic Research - CV
Earl R. Herndon	VLA - GB
Shirley L. Huang	Computer Division - CV
John E. McBrian, Jr.	Electronics Division - Tucson
Ellen Z. Mufson	VLA - CV
Alan deS. Parrish	VLA - GB
Floyd W. Peterson	Basic Research - CV
Josephine T. Sheatsley	Scientific Services - CV
G. Seth Shostak	Basic Research - CV
Mary E. Stutzman	Business Office - CV
Geoffrey D. Thompson	Electronics Division - CV

We are sorry to report the death of Ed Wilson, who died 8 September 1974. Ed joined NRAO's Fiscal Division 3 October 1960 and worked in that division until his retirement on 31 December 1971.

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Your living is determined not so much by what life brings to you as by the attitude you bring to life; not so much by what happens to you as by the way your mind looks at what happens. Circumstances and situations do color life, but you have been given the mind to choose what the color shall be.

--John Homer Miller

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REVOLUTION IN THE CHINESE UNIVERSITIES

George Miley

In this second of five articles, Dr. Miley describes how he found the universities after the Cultural Revolution.

One morning in the summer of 1966, a group of students at Peking University nailed up a wall poster attacking the bourgeois attitudes of the President of the University. Thus began the movement known as the Great Proletarian Cultural Revolution which convulsed China for nearly three years. Chang, my interpreter, was a student in Peking during this period and gave me a vivid description of how it affected him personally.

"First of all we had endless discussions, questioning every aspect of society. Two rival groups were formed, the moderates and the ultra lefts. The polarization grew so extreme that spear fights broke out, resulting in several injuries and one or two deaths." Chang, who was a moderate, described how the ultra left faction "carried away by patriotic emotion" burnt down the British Embassy. "After this, whatever sympathy that had previously existed for them evaporated and the leaders who incited the burning were arrested. Most students felt ashamed that Chou En-lai had to apologize on their behalf to the government of an imperialist power."

Afterwards Chang spent 1½ years on a farm in Hunan "learning to live like a peasant". The whole English department of his college was ordered to take over this farm. "When we arrived everything was very primitive. We had to build all the dormitories from scratch, but were often assisted by the local peasants. Sometimes the daytime temperature approached 110° F and it was difficult to sleep at night. Initially, several comrades were struck by malaria." Chang admitted that the ordeal must have been difficult for the older professors although "we usually found them relatively easy jobs". "It was a hard but worthwhile experience", said Chang. "I learnt to appreciate the warm-heartedness of the typical peasant."

The colleges and universities have now reopened. In the previous article I pointed out that one of the main aims of the Cultural Revolution was to eradicate the deep seated snobbish attitudes of the intellectuals. It is therefore not surprising that the aspect of Chinese society to have been most radically altered is the university system, the training ground for future intellectuals. During visits to Nanking and Peking Universities, I was shown several ways in which the gap between the universities and the factories and communes has been narrowed.

At Nanking University, I was greeted by a delegation which included the Vice President Professor Kao Chi-yu, the Professor of Astronomy, and several technical and student representatives of the Revolutionary Committee (governing body) of the university. For the inevitable 'preliminary briefing' we entered a comfortably furnished room and refreshing mugs of tea were served. After some introductory greetings, Professor Kao launched into a description of Nanking University. The Vice President is a chemist, aged between fifty and sixty, whose build and facial features closely resemble those of Mao Tse-tung. Although he spoke some English, he preferred to address me through my interpreter.

"Nanking University", he began, "was founded in 1902. After the liberation, the number of students increased from about 1400 to 6000. No new students were enrolled between 1966 and 1971, but last year the university was reopened. About 2400 students have so far entered under a drastically modified system. Three aspects of the university have undergone major changes - the system of enrollment, the length of the courses and the teaching methods.

First the enrollment. Before the Cultural Revolution students went directly from school to university and rarely had any contact with workers or peasants. After graduating, the students knew little about the aspirations of working people and tended to form an intellectual elite. Some of them grew to despise workers and peasants. These attitudes were encouraged by Liu Shao-ch'i who wished to model our universities on those of the Soviet Union. Now, in accordance with the teachings of Chairman Mao, we recruit our university students entirely from the ranks of workers, peasants, and soldiers. Every prospective student must spend at least two years working in a factory or commune. They can then apply for a university place, but admission is no longer made on the basis of examination alone. The student's application must be supported by the masses." I asked

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what this 'support of the masses' means in practice. "Well, suppose there is a factory where two workers want to apply but only one application can go forward. Then the leaders of the factory will solicit the opinions of the other workers. We believe that the masses are best able to judge which of the two is most qualified to receive a university education." "Does this mean in effect, that the authorities of the communes and factories are the arbiters of who can go to university?" "Yes, the revolutionary committees make the decision as to which applications are supported by the masses. For students from rural areas the final recommendation is made at county level and for city dwellers at district level. In another change to the enrollment system we now accept students who have previously had no education beyond junior middle school at fourteen years and although education in China is now practically universal, there are many isolated areas which have no senior middle school. Peasants from such areas should not be deprived of a university education. These changes to the system of enrollment ensure that new students are representative of our workers, peasants, and soldiers."

"The second aspect of our universities to be revolutionized", continued Professor Kao, "is the schooling period. Before the Cultural Revolution courses lasted for five or six years. Their length has now been set experimentally at three years (four for theoretical physics). This shortening of the courses has required a drastic revision of curricula. Many of the topics previously taught to the students were superfluous and never used by them after they left the university." I pressed for some examples. "Take science", he said. "Of course we still teach all the fundamental theories but nowadays we omit much of the history." "But surely", I argued, "the history of science helps us to understand how scientific discoveries are made." "We still teach some history", he replied, "but we believe a student can better appreciate the methods of science by practical experience."

"This brings me to the third change in the system. We have radically altered our teaching methods. Before the Cultural Revolution, students took notes at their lectures and subsequently repeated them in parrot-like fashion." I interrupted that this sounded familiar. "In Ireland", I ventured, "we used to define a lecture as the transferrance of material from the lecturer's to the student's note book without either understanding the content." Professor Kao laughed. "Precisely. Well, to combat this, we now place less reliance on lectures and try instead to develop the student's initiative. Our aim is to teach him how to study." I said that this approach to teaching was now followed in many progressive Western universities. "Here we also place far more emphasis on practical application", continued the Vice President. "Both students and their teachers must spend at least twenty weeks every three years working in factories. There they can directly apply what they have learned in theory at the universities. Students of arts and literature should take society as their factory and several of them spend this time working for newspapers or in other related jobs."

"Is there much research done at your university?", I enquired. "Yes indeed, teaching is not our only function. Chinese universities have very important roles to play in research and production. We carry out a great deal of research in this university, both pure and applied. Most of the programs are directly related to industry as we are very conscious of the importance of research to increasing productivity. Some research projects are commissioned by the central or provincial governments and we select others ourselves. One branch of medicine into which we are currently putting a great deal of effort is acupuncture. We know that acupuncture works, but nobody is quite sure why." I asked how much time a teacher could devote to research work. "At the moment the shortening of our courses has meant that teachers must put a great deal of work into preparing new curricula but we hope that eventually they will spend about one third of their time doing research. Besides teaching and research within the universities, we have several functions in society. You must realize that at present only a tiny proportion of our people can hope to attend university. We therefore spend considerable effort in organizing educational facilities in the factories and communes."

Throughout our conversation, Professor Kao emphasised the experimental nature of the new system and stressed that several aspects

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of it were still being vigorously debated. I asked him which features were most controversial. "We have already begun to question whether three years is long enough for an adequate university training. A short course has several advantages. More university graduates can be produced than before. Also, because the students are away from their factory and commune for a shorter time they feel more of a responsibility to study and do so with more enthusiasm. But the three year course also places a great burden on the students. They must study very intensely." I enquired about the failure rate under the new system. "What do you mean by failure?", he replied. "We have abolished the old examination system. Since the educational level of the incoming students varies greatly, some fall behind in their studies, but we do not regard them as having 'failed'. Last year about twelve out of a thousand fell seriously behind. For these students, we have intensified tuition and reduced requirements. When they graduate they may not reach the same academic level as the other students. But even so, they will have benefited considerably from their university education."

Time permitted only one more question. I inquired how Chinese university students were financed. "All tuition fees and accomodation are free", said Professor Kao. "In addition, the student receives a normal salary from his factory or commune."

In Peking University I had similar conversations and was shown further examples of how the universities were integrated into the general life of the community. There are several small factories within the grounds of the university. The one that I saw produced more than thirty types of drugs. Students and teachers from the biochemistry department worked there, side by side, with full time factory workers. Several new medicines which had been developed by the university biochemists were being produced in the factory. This was cited as one more way in which the university reform is helping the 'struggle for production' and keeping the students in close contact with the working classes.

Although sympathizing with any attempts to demolish the ivory towers, I cannot help wondering what effect the revolution in the universities will have on the future economic life of the country. Six years without the production of qualified engineers and technicians is bound to leave its mark. The Maoists recognize this but argue that the social dividends of university reform will outweigh the short-term economic costs. Looking at the social divisions which exist in our own society, can we say that they are wrong?

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1974 - 75 BOWLING SEASON

Dick Hiner

The Green Bank bowling team rounded out the 1973 - 74 bowling season with a STEAK DINNER COOK OUT at Old House Run Picnic Grounds on US Route 250 near Bartow, WV. A good time was had by all and everyone enjoyed the steaks prepared by Chef Don Hovatter. Horseshoe pitching was the sports event of the evening. Champion honors went to Bill Radcliff in the singles.

September 3 started the new bowling season which continues for thirty-six weeks, with a probable break at Christmas and New Year's. The following bowlers will bowl the first half of the season: Jon Spargo, Jim Gibb, Gerry Valencia, Bob Vance, Richard Hiner, Russell Poling, Wendell Monk, Claude Williams, and Herb Hanes. We bowl at the Elkins Recreation Center, 6:30 PM Tuesday League against D & E College, Wilmoth Auto, Bata Shoes, Tomblyn Funeral Home, Butch Grocery Store, West Virginia Wildlife, Weese Electric, McQuain Excavator, Cheat River Inn, Frito-Lay, and Crystal Springs Market.

As of September 24, we had 11 wins and 5 losses. Jon Spargo is high bowler with 1524 pins, and a high series of 572 pins, scratch.

Any male employee wanting to bowl should contact any of the above bowlers.

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ANSWERS TO QUIZ ON PAGE 6

a 70 ; b 45 ; c 5 ; d 156 ;
e 1 ; f 21 .

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"REFEREEING A PAPER" ISN'T WHAT IT USED TO BE...
PUBLISH
REJECT
PUBLISH
ALBAUGH '74

REPORT FROM THE MOUNTAINTOP: II. THE FOUNDING OF LICK OBSERVATORY

Bruce Balick

"The train from San Francisco came to a shuddering halt in the San Jose station. At the end of the platform a small group of men began to solemnly transfer a flag-covered coffin to a waiting horsedrawn wagon. Within minutes, the vehicle pulled out into the crisp winter day, to begin its long, slow trip up nearby Mount Hamilton. Many hours later this curious procession reached the top, there to be met by a large assemblage of some of the most prominent men in California. They had come to pay homage to the man whose body lay in the coffin; they had come to bury James Lick in the base of the largest telescope in the world."[1]

All observatories have a distinguished history. Some are more distinguished than others. In this, part 2 of a series on optical astronomy, we explore perhaps the most unusual story behind any observatory. The emphasis here is not on which telescopes we built on what dates; rather, we shall see how science 100 years ago was funded, and how things have changed since. Also, we shall explore the vibrant personalities involved in the history of this particular observatory.

James Lick's unusual burial was a fitting conclusion to an unusual life. He left his birthplace of Fredericksburg, Pennsylvania after a broken romance with a miller's daughter in 1817. At the age of 25 he arrived in Argentina, and took up piano making. He moved to Chile and then Peru taking his trade with him. In 1847, at the age of 52, he set sail for California after hearing of its imminent statehood. Seeking reclusion and prosperity, he entered San Francisco Bay in January, 1848 on the deck of the *Lady Adams*. With him were his only two possessions: a massive work-bench and a chest containing his life savings of $30,000 in Peruvian gold doubloons. Within years, he turned his savings into a 10,000% profit.

Lick was the right man in the right place at the right time. Seventeen days after Lick arrived in the muddy, dingy town of San Francisco, John Marshall dug a nugget of gold out of the dirt near Sacramento, and within months, most everyone in San Francisco had set out in search of the yellow metal. In their wake was James Lick, who invested his $30,000 in the lots ($16 each) that the miners sold in a hurry in order to buy mining equipment. Within a year, Lick owned half of San Francisco plus a huge tract near San Jose, and his fortune amounted to $1,000,000.

Soon afterward, Lick began to "diversify". He built the extravagent "Lick House", San Francisco's finest hotel. He wrote to his old friend in Lima, Ghiardelli, who was a chocolate maker in Lima, and helped him open a shop in San Francisco. The hotel was destroyed in the earthquake of 1906, but famous Ghiardelli Square in San Francisco, one of the busiest modern tourist attractions in the city, remains in the site of his friend's factory.

Lick was a well known eccentric. For example, he lived for almost twenty years in a shack alongside a stream in San Jose, where he slept on an old mattress which sat atop an old grand piano. Next to the shop was an opulent $200,000 mill constructed entirely of imported mahogony. Stories of his eccentricities are endless. At the age of 77, in 1873, James Lick began a search of a suitable monument to himself. His final selection, after considering projects as grotesque as an enormous pyramid (larger than Cheops) in downtown San Francisco (at 4th and Market Streets), was the construction of the world's largest

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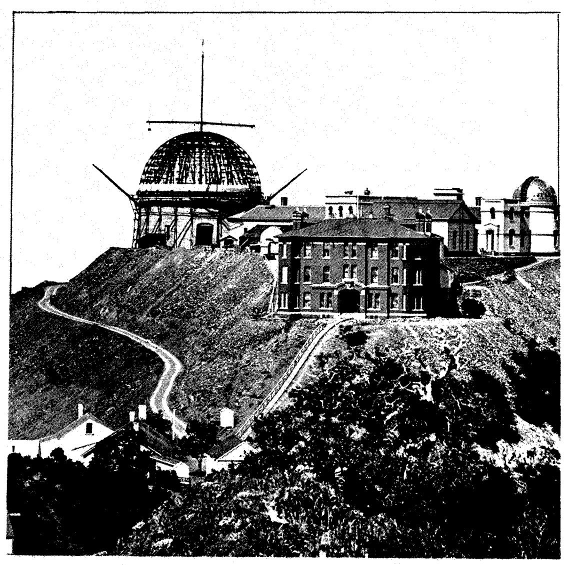
telescope in which he was later to be buried.

By 1873, Lick owned Catalina Island off of Los Angeles, property bordering Lake Tahoe, ranches, etc. worth over three million dollars. In July 1874 the people of California, who followed the eccentric life of Lick much as we now follow Howard Hughes', were astonished to learn that the entire fortune of the "Miser Millionaire" was being given to the state of California. In addition to his bequests for public baths, an orphanage, statues, a school of mechanical arts, and the founding of the California Academy of Sciences, the largest bequest was to be spent for the construction of the world's largest telescope. This was particularly strange since Lick had little or no known interest in astronomy.

Lick was not eager to "hide" his showpiece. His first choice for the telescope site was atop a tower at 4th and Market Streets. He was talked into a mountaintop location (thankfully) on his property near Lake Tahoe. However, he soon changed his mind and instructed that a site visible from San Francisco be found. By 1875, Mount Hamilton, just outside San Jose and 60 miles from San Francisco was chosen, provided that the county of Santa Clara would build a first class road to the summit. They agreed immediately. (The resulting road, with all of its original curves, is still used today. The last 15 miles take some 45 minutes to drive. Even the NRAO shuttle drivers, who can drive U.S. 250 with their eyes shut, couldn't do better than 40 minutes on this road.)

Lick died in October 1876. Lick had, it is thought, responded favorably to the suggestion by his most trusted aides, Thomas Fraser and Captain Richard Floyd, that his remains be placed in the base of the telescope that bore his name. In January 1887, some eleven years later, the telescope pedistal weighing some 2½ tons was bolted down with Lick's casket inside. A bronze plaque still explains "Here Lies the Body of James Lick".

Actual construction of the Observatory was begun in 1879. A few interesting stories are still heard of this period, although most of the construction went about as one might expect. For example, it took 2½ years for Chinese laborers to level the mountaintop by carrying stones and dropping them over the edge (today, a small golf course is built on part of the boulder field.) Captain Floyd, a former sea captain in the Confederate Army, was in charge of the project, and brought a sense of formality and organization into the operation. In charge of the mountaintop construction was the unschooled and untiring Thomas Fraser. Fraser's devotion and inventiveness were sorely needed as the project became delayed by unanticipated problems such as weather and geography. Simon Newcomb, the director of the U. S. Naval Observatory, came west to layout the design of the telescope and to oversee its construction. At the age of 28, Edward Holden was chosen to become director of the Observatory. Alvan Clark and Sons were chosen to grind the lenses. The size of the main lens, or "objective", had been chosen, after careful consideration, to be 36" in diameter, some 5" larger than the next largest telescope then in existence. The high quality of the work of Alvan Clark was widely known, and the trustees at Lick were not to be disappointed.



The dome of the 36-inch reflector was the last unit of the main Observatory building to be completed. The 3-story brick building in the foreground was a dormitory which was severely damaged and replaced after an earthquake in 1911. The photograph was taken in 1887.

By the end of 1886 the lens was finished

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and on the mountain. Mounting the lens went slowly and took an extra year. On New Year's Eve, December 31, 1887, the trustees of the observatory expectantly assembled for the first observation. However, a gale raged for 3 nights, and the dome over the telescope froze in its tracks. Finally, on the night of January 3, the slit in the dome was opened, and stars could be seen through clear patches in the clouds. The first look was awaited with great anticipation as the telescope was pointed toward the star in the eye of Taurus (the Bull).

Only a blur was seen. It became clear that the telescope tube was six inches too long for the lens. Warner and Swasey of Cleveland, builders of the tube, quickly hacked two inches off the tube, and the eyepiece was pushed in four inches. By then, and for the next 4 days, it remained overcast. Finally, the great nebula in Orion was observed through the slit in the still frozen dome. The excellence of the image quality was thrilling. Later another spectacular view of Saturn was afforded.

The next 10 years saw political battles and great discontent among the staff of the observatory. Holden was forced to resign as director, and personality clashes hampered the efforts to do astronomy. Although a number of spectacular discoveries were made within five years of the start of the observatory, Alvan Clark's sons had finished a 40" objective and the Yerkes Refractor became the world's largest telescope. (The 40" lens had initially been built with funds from businessmen in rival southern California for USC. It was later sold to Chicago magnate C. T. Yerkes after business disasters hit the Los Angeles market in 1890.) Keeler and Holden at Lick also began research into reflecting telescopes which use large mirrors instead of lenses, and before too long 60" and 100" telescopes were built on Mt. Wilson in southern California. In the early 1930's the 200" telescope on Mt. Palomar was built. The second largest telescope, until recently, was the 120" at Lick Observatory, built in the mid 50's. In 1973, the 158" at Kitt Peak began operation, and others of that size are planned or under construction in Chile, Australia, and Hawaii. The Russians are also at work on a 236" telescope.

Compare the differences in the history of the NRAO and a place like Lick. Although both are now entirely funded by governmental money, this type of funding is relatively new at Lick. Although both places have had notable personalities on their staff, those at Lick have often been extremely reclusive (and sometimes bitter, though this is certainly not the case today); in fact, many astronomers had to be virtually dragged off the mountain when the headquarters moved to Santa Cruz almost a decade ago. Although both institutions rank at the top of their respective fields today, their budgets now differ by a factor of ten (the NRAO's being the larger). Finally, there are interesting stories in the history of both observatories, but only Lick Observatory had the likes of James Lick as its inspiration, and for that NRAO can breathe a sigh of relief.

This account of the history of Lick Observatory is taken almost entirely from excellent articles by Michael Chriss which appeared in two issues of Mercury magazine in the summer of 1973. Mercury is on file at both the Green Bank and Charlottesville libraries. Mary Shane, herself a retired astronomer at Lick, provided complimentary information.

On clear days the snowy peaks of the Sierra may be seen along the eastern horizon of Mount Hamilton. This view, taken from near the Observatory, shows Half Dome and the Yosemite Valley at a distance of 120 miles.

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[1]Michael Chriss, 1973, Mercury, July issue, P. 10.

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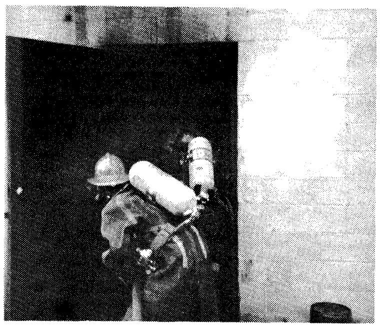
FIRE PREVENTION WEEK, OCTOBER 6 - 12

Bill del Giudice

Each year in October we observe National Fire Prevention Week, this year October 6 - 12. But this is not a fire prevention message - you have probably seen and heard enough of those in the last couple of weeks. What I will comment on is the importance of reacting properly if you are confronted by a fire situation at home or work. Perhaps you have read news accounts of death by fire and you wonder how it is possible for people to be trapped in a burning house. After all, it is not unusual to see supertelevision heroes dash about in a burning building as huge beams, chandeliers, and miscellaneous chunks of architecture crash down about them. Well, that's not the way it is.



Some of you may have read Professor Howard Emmons article in the July Scientific American describing how an entire room or building can flash-over--that is, due to a relatively small fire, the building's interior temperature exceeds the ignition point of the contents and suddenly everything will burst into flame with explosive speed. This happens long before the beams begin to fall. The interior temperatures will be between 1200 and 2000° F. Even John Wayne would have trouble with that. What really happens? It is, of course, impossible to tell exactly what happens when the only witness is dead but you have read accounts of would-be rescuers describing the extreme heat or unbelievable speed of fire spread. To understand this, tests have been run under controlled conditions with trained observers and the results are surprising only to those who have never been involved in a serious fire.

First, let me point out that few people are burned to death, but burned *after* death due to some other cause. What cause? If you are exposed to a given concentration of carbon monoxide for a period of time you will collapse and die. This collapse will occur when the product of the concentration and the time equal 4.5 ($K_{CO} \ x \ t = 4.5$). Likewise, you cannot survive if the concentration exceeds 1.28% or if the oxygen level falls below 10% or if the temperature at breathing level exceeds 300° F. In addition, plastics, so common in the modern home, produce huge quantities of noxious gasses. One additional factor studied was visability. If smoke obscures vision, escape will be hampered.

The test I will describe involved tests by the National Research Council of Canada where several houses were burned to simulate typical accidental fires. The primary object was to determine survival times for persons in a second-floor bedroom due to a fire originating in a first-floor living room. The previously described factors were monitored remotely and some of the results are tabulated below, giving the time from start of fire to limit of human tolerance.

A little study of the following data will show that having a closed door between you and the fire will buy a great deal of time - time you can use to find your way out of a window or other alternate escape route. The data indicates that your nicely panneled plywood walls, combined with open doors, can lead to such rapid creation of a lethal atmosphere that a sleeping person's senses will not awaken him in time to escape. (For

LIMITING TIMES OF SURVIVAL (MINUTES)

Building No	Wall Lining	Bedroom Door	$K_{CO} \ x \ t = 4.5$	1.28% CO	10% O_2	300° F	4-Foot Visability
4	Non-combustable	Closed	14.8	14.8	21.0	16.5	5.2
3	Combustable	Open	5.0	2.5	2.3	1.7	1.5

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this reason I have installed ionization type fire and smoke detectors in my home.) But I said back in the beginning that I was going to comment on how to react after you discover the fire.

If you suspect a fire on the other side of a closed door, feel the door; if it is hot, go out the window. If not, brace your foot against it and open it a crack. If there is fire on the other side there will be a differential pressure between the rooms that will tend to push the door open or hot gasses will be felt pouring in through the open crack. If so, close it and use the window; if not, open the rest of the way and, crouching low, make your way out. Go to the nearest phone and call the fire department or fire brigade. If you find a small fire, you should still call the fire department, then if you can fight the fire with little or no risk, go to it, but if you do not have it under control in the first few minutes, get out.

If you don't know how to report a fire from your home or office, find out. Write the number down and fasten it to your phone. In Green Bank your first action should be to call the Observatory Fire Brigade by dialing 299 (6-2299 at home in Arbovale - Green Bank). In Charlottesville it is 296-5161.

Each year 12,000 people die by fire and many thousands are burned out of home or job. Try not to be one of them.

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HAVE YOU CHECKED LATELY?

Monroe Petty

After several years of trying to make a go of it, John and Marsha finally decided to call it quits. The divorce went smoothly and John was sure he had taken care of every detail. Two years later, John married Edith. John and Edith were happy, except that Edith frequently drove John to distraction. In fact, John was so distracted one day that he failed to see a train approaching.

Edith waited for word from the insurance company for many weeks. Finally she called and received the disappointing news that Marsha, who was touring Europe, had collected on John's life insurance. John had forgotten to change his beneficiary.

The characters in the above story are fictitious, but the story isn't; it's happened many times, though fortunately not at NRAO. Family situations sometimes change so it's important that you periodically review your beneficiary records to be sure you have the right persons designated.

In selecting beneficiaries the employee normally designates two classes--a primary beneficiary (usually the spouse), who is first in line to collect the death benefits; and a contingent, or secondary, beneficiary (usually his children), who is entitled to collect if the primary beneficiary has died before or at the same time as the insured employee.

Oftentimes the first-born child is listed by name as the contingent beneficiary. A second child comes along but is not added to the beneficiary listing. Under such circumstances, if the employee and his primary beneficiary were to be killed simultaneously, the first child would receive everything, the second child nothing.

To ensure that something like the above doesn't happen, the employee can make the multiple designation, "my children to share equally", even if he has only one child. This automatically covers any future additions to the family.

Records of your group life insurance and retirement plan beneficiaries are kept on file at the Personnel Office. If there's been any change in your family since you first came to work at NRAO, and if you're not positive as to your current beneficiary listing, you would be wise to give Personnel a call to check the record. It only takes a minute, and it might help to avoid a sticky situation.

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PRE-SCHOOL PLAYGROUP

David Kellermann

We started again, every Tuesday and Friday from 9:30 till 11:30, and we pay 25 cents a day to buy toys, juice and cookies. For more information, please call my mother - 456-4954.

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