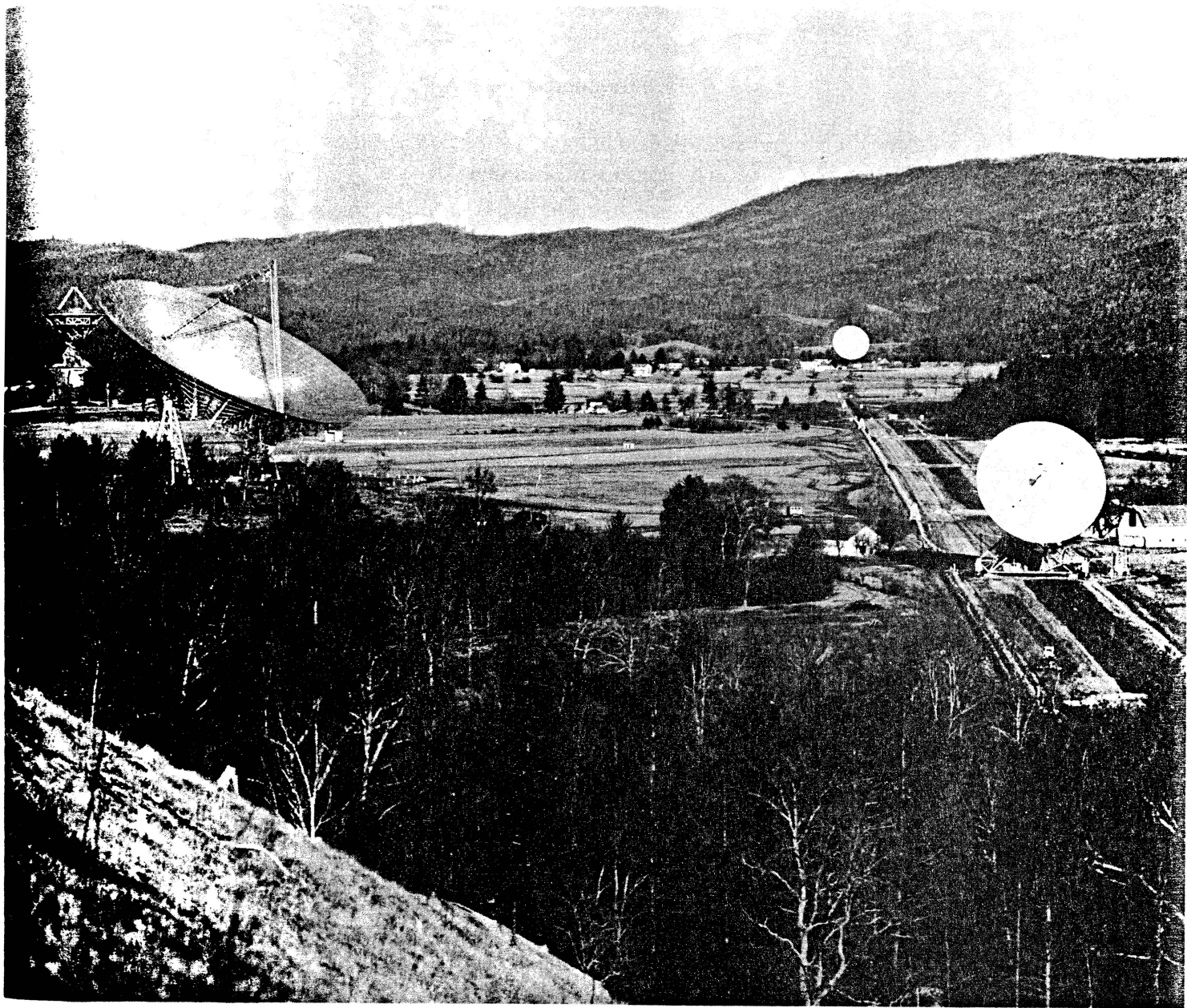


The O B S E R V E R

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Cover Picture:

The photograph of the telescopes at NRAO shown on the front cover of this month's Observer are available for purchase through the Recreation Association. An 8 x 10 black and white copy costs \$1.00. Anyone interested and not yet contacted see Carl Davis or call Ext. 229.

AUI RETIREMENT PLAN

There have been several requests for additional information about the Observatory Retirement Plan. Two of the more prominent questions asked by employees have been:

Based on current rates, what level of benefits can a typical employee expect to achieve during a career of participation in the retirement plan?

How long does it take for a retired employee to recover his individual contributions once he begins receiving his retirement income?

As background for answers to these questions, it may be helpful to review the main features of our plan, which is carried with Teachers Insurance and Annuity Association (TIAA) and College Retirement Equities Fund (CREF):

PARTICIPATION. You begin to participate in the plan after three months of full-time employment and attainment of age 30.

CONTRIBUTIONS. Your contributions and those made by the Laboratory are determined as a percentage of salary, and are sent to TIAA-CREF each month to be applied to your individually owned annuity contracts. The rates of contribution are as follows:

Salary	You Con- tribute	NRAO Con- tributes	Total Con- tributions
first \$3,000 of salary	2-1/2%	7-1/2%	10%
next \$1,200 of salary	5	7-1/2	12-1/2
salary above \$4,200	7-1/2	7-1/2	15

IMMEDIATE FULL VESTING OF BENEFITS. You own all retirement benefits as you earn them. If you leave NRAO before retirement, you take your annuity with you, including all benefits purchased by Observatory contributions. If you join another of the 1,300 institutions having TIAA-CREF retirement plans, contributions to your annuities will be made under the provisions of the new

plan. Otherwise, you may make payments to the annuities on your own, or you may leave them on the paid-up basis until you decide to begin receiving your annuity income. In order to keep the benefits intact for their intended purpose - a lifetime income - the annuities do not provide for loans or cash surrender (but see REPURCHASE end of article).

CREF PARTICIPATION. You may elect to have the total contributions applied to your TIAA annuity, or to have 1/4, 1/3, or 1/2 of the total contributions paid to CREF, which provides a variable annuity based on common stock investments. During retirement the dollar amount of the CREF annuity income changes from year to year to reflect the market value and dividend income of the Fund's investments. The accompanying TIAA annuity provides a fixed income, except as increased by dividends.

The purpose of the balanced TIAA-CREF system is to provide a retirement income that can be more responsive to changes in the cost of living than a fixed-dollar annuity alone and less volatile than a common stock annuity alone.

DEATH BENEFIT PRIOR TO RETIREMENT. If you die before retirement, the full TIAA-CREF accumulation, including all Observatory contributions and all investment earnings, is payable to the beneficiary you have named or to your estate. Several income options are available to the beneficiary.

DEATH BENEFIT AFTER RETIREMENT. Upon the death of an annuitant after he retires, the amount continued to his beneficiary depends on the income option chosen at the time he retired. All of the retirement income options but one, the Single Life Annuity, provide for continuation of an income to a beneficiary.

ANNUITY STARTING DATE. You may elect to begin receiving TIAA-CREF annuity income at any time after contributions stop. This may be earlier or later than the normal retirement age of 65, but may not be later than age 71.

ADDITIONAL PAYMENTS TO YOUR ANNUITY.

You may make additional payments to your annuities at any time, either through the Observatory's salary-or-annuity option" or by direct payment to TIAA-CREF.

BENEFIT ILLUSTRATIONS. The benefit illustrations in Tables I and II have been prepared in response to the two questions mentioned previously. The benefits shown are based on participation in the Observatory Retirement Plan from our entry ages to 65, and assume that salary increases occur in accordance with the following hypothetical salary scales:

Attained Age	Salary Scale A	Salary Scale B	Salary Scale C
30-34	\$5,000	\$ 6,000	\$ 6,000
35-39	5,500	7,000	9,000
40-44	6,000	8,000	12,000
45-49	6,500	9,000	15,000
50-54	7,000	10,000	16,000
55-59	7,500	11,000	17,000
60-64	8,000	12,000	18,000

Table I shows illustrative retirement incomes for a person entering the Observatory plan at the ages shown and retiring at age 65. The assumptions used are shown at the bottom of the table.

TABLE I

Yearly Single Life Income at Age 65 (Male)

If Entry Age Is	Yearly TIAA Income	Social Security Primary Amount	Total Income	Per Cent of Final Salary
<u>SALARY SCALE A (\$5,000 to \$8,000)</u>				
30	\$4,812	\$ 1,500	\$ 6,312	79%
35	3,897	1,500	5,397	67
40	3,057	1,500	4,557	57
50	1,612	1,500	3,112	39

If Entry Age Is	Yearly TIAA Income	SS Primary Amount	Total Income	Per Cent of Final Salary
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SALARY SCALE B (\$6,000 to \$12,000)

30	\$6,873	\$1,500	\$ 8,373	70%
35	5,718	1,500	7,218	60
40	4,585	1,500	6,085	51
50	2,500	1,500	4,000	33

SALARY SCALE C (\$6,000 to \$18,000)

30	\$ 10,225	\$ 1,500	\$ 11,725	65%
35	9,069	1,500	10,569	59
40	7,545	1,500	9,045	50
50	4,052	1,500	5,552	31

ASSUMPTIONS.

1. That all contributions are made to TIAA rather than to TIAA and CREF. In effect, this assumes that CREF experience will parallel that of TIAA.
2. TIAA rate basis: current Minimum Rates plus dividends on the 1964 TIAA dividend scale, which may be increased or decreased in the future and are therefore not guaranteed.
3. Single life benefits are shown for TIAA. If the joint and 2/3 to Survivor option were chosen by a man and wife both aged 65, the TIAA incomes would be about 12% less than those shown.
4. The Social Security primary benefit is shown. If the man has a dependent wife, also age 65, there is an additional Social Security benefit of \$750 or a total of \$2250.

Other illustrative figures based on different salary and age assumptions may be calculated from the table at the back of the TIAA-CREF booklet, YOUR RETIREMENT ANNUITY. Or TIAA-CREF's individual counseling department will be glad to prepare personal illustrations for you, based on your own assumptions as to salary, retirement age, income option, etc.

Table II shows illustrative death benefits for a person entering the Observatory plan at age 30. The assumptions used for Table I have also been used for this table.

TABLE II
DEATH BENEFIT PRIOR TO RETIREMENT
FOR EMPLOYEE ENTERING PLAN AT AGE 30

If Death Occurs At End of	Death Benefit (Salary Scale A)	Death Benefit (Salary Scale B)	Death Benefit (Salary Scale C)
1 years	\$ 7,199.34	\$ 9,389.30	\$ 10,992.87
2 years	19,904.15	27,203.62	38,394.81
3 years	40,956.42	57,792.07	85,494.71
5 years	55,883.71	79,821.38	118,743.65

YEARS TO RECOVER EMPLOYEE CONTRIBUTIONS.

In the Table I illustration, an age 35 entrant under Salary Scale B would contribute a total of \$15,975 during his 30 years of participation, and the Observatory would contribute \$21,375. The accumulated value of the employee's contributions would be \$28,034 at age 65, and his TIAA annuity income \$5,718 a year. It would therefore take slightly less than five years of payments, or until age 70 for him to recover the accumulated value of his own contributions. The annuitant mortality tables used by life insurance companies and the federal government (for taxing annuities) are based on experience showing that the average life expectancy of a male annuitant aged 65 is now approximately 16 years; for a woman aged 65, approximately 20 years.

REPURCHASE. Employees who terminate within five years from the date their TIAA-CREF annuities are issued may have their contracts "repurchased" if they are not transferring to another institution having a TIAA-CREF plan. Upon repurchase, TIAA-CREF pays to the employee a single amount equal to the portion of the accumulation arising from his own contributions, and the Observatory recovers its proportion of the accumulation

FINAGLE'S LAWS (or why nothing in Research and Development happens the way it should)

In Experiments

The first four laws are the only ones dignified by number. Note the beauty and simplicity of the First Law. Also note the remaining three laws refer to men's reactions to Nature--not to Nature itself.

First Law: If anything can go wrong with an experiment, it will.

Second Law: No matter what result is anticipated, there is always some one willing to fake it.

Third Law: No matter what the result, there is always someone eager to misinterpret it.

Fourth Law: No matter what occurs, there is always someone who believes it happened according to his pet theory.

The Law of the Too Solid Goof: In any collection of data, the figure that is most obviously correct--beyond all need of checking--is the mistake.

Corollary I -- No one whom you ask for help will see it, either.

Corollary II -- Everyone who stops by with unsought advice will see it immediately.

A further series of rules--or really advice to experimenters--has been formulated. They are a natural consequence of the first four laws reduced to day-to-day practice.

Experiments must be reproducible--they should all fail in the same way. First draw your curves--then plot the readings. Experience is directly proportional to equipment ruined. A record of data is useful--it indicates you've been working. To study a subject best, understand it thoroughly before you start. In case of doubt, make it sound convincing. Do not believe in miracles--rely on them. Always leave room to add an explanation when it doesn't work. (This open door policy is also known as the Rule of The Way Out.)

Human Foibles

The remaining rules outline the human problems that follow. To some extent they represent man's reaction to Nature and, even more aptly, man's reaction to man.

Laws of Revision (Often lumped into the Now They Tell Us Law)

First Law: Information necessitating a change of design will be conveyed to the designer after--and only after--the plans are complete.

Corollary I-- In simple cases, where one obvious right way is opposed to one obvious wrong way, it is often wiser to choose the wrong way right off. This is one step ahead of choosing the right way, which turns out to be a wrong way, which has to become a right way.

Second Law: The more innocuous the revision appears to be at first, the further its influence will extend and more plans will have to be redrawn.

Third Law: If, when the completion of a design is imminent, field dimensions are finally supplied as they actually are--instead of as they were meant to be--it is always simpler to start all over.

Fourth Law: Even if it is impossible to assemble a part incorrectly, still a way will be found to do it wrong.

Corollary I -- It is usually impractical to worry beforehand about interferences--if you have none, someone will make one for you.

The Law of the Lost Inch: In designing any type of construction, no over-all dimension can be totaled correctly after 4 P.M. Friday.

Corollary I -- Under the same conditions, if any minor dimensions are given to 1/16 of an inch, they cannot be totaled at all.

-----continued on next page-----

Corollary II -- The correct total will be self-evident at 9:01 Monday morning.

Deliveries that normally take one day will take five when you are waiting.

When adjusting (or drawing or computing, etc.) remember that the eye of the chief inspector engineer, draftsman, etc.) is more accurate than the finest instrument.

After adding two weeks to a schedule for unexpected delays, add two more weeks for the unexpected unexpected delays.

In any problem, if you find yourself doing an unending amount of work, the answer may be obtained by inspection.

Finagle's Creed: Science is Truth--don't be misled by facts.

Finagle's Motto: Smile--tomorrow it will be worse.

THE FINAGLE FACTOR

A mathematical notation of Finagle's work has also been developed. Here, however, there seems to be some confusion, because two other names enter the picture: "fudge" and "diddle" factors are also used to considerable advantage by scientists and engineers.

Years ago--when the universe was relatively easy to understand--the Finagle factor consisted of a simple additive constant (sometimes known as a variable constant) in the form:

$$x' = K_f + x$$

where any measured variable, x , could be made to agree with theory, x' , by simple addition of the Finagle factor, K_f .

Later difficulties couldn't be solved so easily and so a fudge factor, K_b , was added.

$$x' = K_f + K_b x$$

Powerful as this adjustment was, World War II studies in servo theory indicated a need for a still stronger influence. The diddle factor, K_d , was born and made to multiple the quadratic term.

$$x' = K_f + K_b + dx^2$$

It is felt that, at least at present, reality can be made to conform to mathematical theory with reasonable agreement on the basis of these three factors.

However, John W. Campbell feels there is a difficult basic structure behind the Finagle, fudge and diddle factors. The Finagle factor, he claims, is characterized by changing the universe to fit an equation. The fudge factor, on the other hand, changes the equation to fit the universe. And finally, the diddle factor changes things so that the equation and the universe appear to fit, without making any real change in either.

For example, the planet Uranus was introduced to the universe when Newtonian laws couldn't be made to match known planetary motions. This is a beautiful example of the application of the Finagle factor.

Einstein's work leading to relativity was strongly influenced by the observed facts about the orbit of Mercury. Obviously a fudge factor was introduced.

The photographer's use of a "soft-focus" lens when taking portraits of women over 35 is an example of the diddle factor. By blurring the results, photographs are made to appear to match the facts in a far more satisfactory manner.

To our knowledge, this is the first clear enunciation of the scientific method. All our vast sum of human knowledge has been derived with these as the basis tools. By having them in writing for the first time, perhaps our children can build even better futures than the best we envision today.

TO ALL NRAO EMPLOYEES:

NRAO BASKETBALL GAMES

PLAYED AT CASS SCHOOL GYM, EACH THURSDAY EVENING AT
7:00 PM.

ATTEND THE GAMES, AND RECEIVE YOUR TICKET (MAY BE THE
LUCKY ONE) TOWARDS A BEAUTIFUL PRIZE.

THE PRIZE SELECTION NOT DEFINITE AS OF THIS PRINTING, BUT
MAY BE:

ELECTRIC KNIVES
ELECTRIC MIXER

ELECTRIC BLENDER
WAFFLE GRILL

DRAWING WILL BE HELD DURING THE PLAY-OFF GAMES, APRIL
8, 1965.

MUST BE PRESENT TO WIN.

PASS THE WORD AROUND TO YOUR FRIENDS, NEIGHBORS, FELLOW
EMPLOYEES.

SEE TWO GOOD GAMES EACH THURSDAY EVENING
FOR A DIME

THE HIGHS OF NRAORA BASKETBALL GAMES

The NRAORA basketball season is past its mid mark with nine games played, five remaining, with The play-offs scheduled for April 6th and 8th. There are many highs found from the nine games played, such as John Cassell leading with an individual high score of 231 points or 25.66 points per game. Jim Simmons leading the pack in foul shot shooting with 24 for 32 attempts or 75 per cent. Then Basil Gumm leads in games missed (seven). Del Cassell leads in personal fouls committed with 29 or 3.2 fouls per game with Jim Ryder his runner up with 27. (This shows who the aggressive players are on the floor.) Del Cassell also leads in the amount of playing time spent laying on the floor. Someone should clue him in that basketball is played on a basketball court, but not in the horizontal position. complaints are at an all time high with Waslo now wearing invisible ear muffs each Friday morning. Injuries are at a high also with three ankles sprained or broken. The band-aid box is now at an all time low, or you can reverse this and say it's the most band-aids used. Dr. Smith's Thursday night calls are at an all time high.

All joking aside, many good basketball games have been seen the past nine weeks or so. The play making of Monk, Howell, Smith, and [unclear] is something to see. Dr. Smith who played little or no basketball has really surprised us all. Maxie Gumm and Jim Ryder certainly are showing their stuff this season with some good shooting. The Blue team coached by Gene Crist is leading the league with 7 wins and 2 losses. Coach Jamie Sheets is not worried with his present team standing of 1 win and 8 losses, for he has Bill Lowman returning in March and this will make the play-off very tight and interesting. Also Walt DeBoard is improving every game. Coach Grandon and Coach [unclear] who at present have identical win and losses at 5 and 4 are looking forward to a winning playoff. One has Brown Cassell with his fine angle shot, and the other has John Cassell with his lay-up shot.

140-ft TELESCOPE

Installation of the declination drive package and brakes has been completed and the 140-ft is now fully on its own power. What a sight. Rotation of the polar and declination axes in all positions is great to watch. The most impressive I believe is in the service position where the lower edge of the dish is just above belt level. Great..... Simply great.....

Pacific Crane & Rigging Co. is closing out their work this week and clean-up is going at full speed. Various crafts have been departing over the past several days and with each departure a void is left to be filled. Friends which we've known over the past 2-1/2 years are leaving and we are looking forward to the time when we will meet and chat with them again.

Bob Martin is expected to be one of the last to leave. He is driving from here to Florida. His next assignment with PC&R will be at Cape Kennedy where PC&R was recently awarded a contract for equipping the Saturn towers which are now being built for the U.S. moon shot.

Max and Moo Small are on a three week vacation trip throughout the southern U.S. They will journey as far as Galveston, Texas and return toward Green Bank by way of New Orleans (during Mardi Gras time) and Florida. Happy journey to a couple of really swell people.

Dick Grabe, his wife, and daughter Sarah are travelling to North Carolina this weekend where Sarah is to be interviewed preparatory to her entrance into graduate school at the University of North Carolina.

Peter Good is in New York where the narration and sound is being added to the construction movie of the 140-ft. We've had a call from him and he said everything is going well. Before he left we had suggestions for the music. Some preferred the music from "Summer Place" and others preferred music from "Never on Sunday". We don't know what it will be -

Your consideration of the problems confronting a Board of Directors at the start of a New Year will be appreciated when ballot casting time arrives.

At the February meeting of the Board of Directors, a motion was made and passed that a Guest Register be placed at all major recreation activities. Guests will be signed in by a responsible employee-member at the time of use of each major facility. The registers will be placed at different locations in the near future.

COMPUTER GROUP

Mr. William Ogden and Mr. W. Weller have joined the Computer Group. Mr. Ogden graduated from the University of Kentucky, and Mr. Weller will receive his doctorate in Astronomy from Northwestern in June.

We would like to thank all of those that helped us get the Observer together this month.

Administrative Services Office