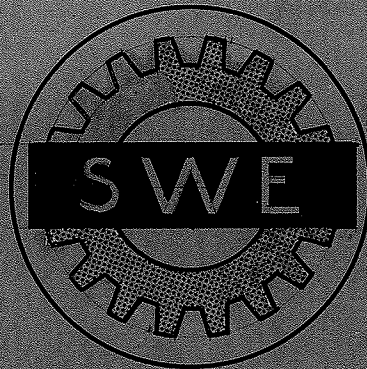


WOMEN ENGINEERS
AND
SCIENTISTS



SOCIETY OF WOMEN ENGINEERS
UNIVERSITY OF ILLINOIS STUDENT SECTION

She's An Active Emeritus

By ANGEL MYERS
News-Gazette Staff Writer.

Whether Grace Wilson, professor emerita of engineering at the University of Illinois, really is an engineer could be questioned.

But the inspiration she has given to countless women in the UI College of Engineering cannot.

Actually Prof. Wilson is an architect, but she was in the last class of architects to graduate from the College of Engineering before architecture became part of the College of Fine Arts. And she started as a teacher's assistant in engineering drawing more than 30 years ago when World War II veterans flocked to the College of Engineering in such great numbers that classes were overflowing.

She has become so much a part of the college that each year the Grace Wilson Award is presented to the outstanding woman student in the College of Engineering.

Although only 10 percent of the students in the college are women even now, this is more than there were when Prof. Wilson started college in 1925. In her freshman architecture class she was one of only six women students.

But Prof. Wilson did have a lot of encouragement. Her father was also a professor of engineering at the UI, and her brother became an engineer.

Her mother was a

homemaker, she said, "But back when she was in high school, much to my amazement she took manual training."

When Prof. Wilson entered Urbana High School she was not sure what she would study. She was sure what she would not study. She did NOT like home economics, she said emphatically, and always swore she would never teach.

Her interest in architecture developed while she was doing a physics project in which she designed a heating plant for a house. She had to draw her own house plan and place the heating units in it. She enjoyed the project so much that her father suggested she study architecture.

But when she graduated from college she discovered there weren't many jobs for a woman architect. While she was in school the country had entered the Depression.

"I had two strikes against me," she said. "One, I am a woman. And two, there were very few if any jobs available. That was the worst one, and that was the one the men had against them too."

As the economy improved she worked as a draftsman and architect and taught in Champaign High School. During World War II she served a hitch as a PFC in the Air Transport Service because, she

said, "I thought I had something to contribute."

She was working on the Small Homes Research Council at the UI when she was asked to join the staff of the College of Engineering, becoming a teacher in spite of her resolutions to the contrary.

Although Prof. Wilson said she never experienced any real difficulties because she is a woman architect, she has seen many social changes take place in the years since her graduation. Now, she said, women who conduct themselves professionally are recognized as engineers, not just as women engineers.

At first, she admitted, women were too often hired simply to fill quotas. But now, "They are beginning to recognize women as engineers and they are hiring them as engineers instead of as women."

And they CAN succeed, she said, if they are willing to accept the responsibility that comes with this recognition.

She noted however that she is still a little irked by the fact that in professional organizations the office women engineers most often fill is that of secretary.

Prof. Wilson makes it plain that she is very much against stereotyping of anyone, men as well as women. Changing attitudes brought about by the women's movement have al-

lowed more men and women to explore their real interests and talents instead of filling a role that society has selected for them. These changes have been good for everyone, she thinks, and particularly for women.

That Prof. Wilson has encouraged many women to start or continue engineering careers is undeniable. From the young high school student who was encouraged to take drawing because a woman was teaching it and went on to become an architect to the women who have competed each year for the Grace Wilson award, all have been inspired by her example.

And Prof. Wilson is, in turn, inspired by the women she sees competing for the award that bears her name.

"This year there were about 10 girls and we interviewed about seven of them. They were just wonderful. It was very difficult to make a choice."

But a choice had to be made. The women are selected by a committee on the basis of their contribution to the school and community as well as scholarship. This year the award went to Paula Traynor, Rockford.

Prof. Wilson, now retired, continues to work in her small office in the Transportation Building. A drawing is attached to the huge drawing board that



News-Gazette Photo by Robert K. O'Daniell

PROF. GRACE WILSON
...still doing the work she loves after nearly 50 years

dominates the space before the south windows, and neat stacks of books and papers nearly cover the top of an oversized desk that fills most of the rest of the room.

One illustrated calendar hangs on the wall in front

of the drawing board and another hangs in front of the desk. The only other decoration is a plaque from the Ladies Auxiliary of the Champaign County Chapter of the Illinois Society of Professional Engineers awarded to her in

1973 for service to the Illinois student chapter of the Society of Women Engineers.

Still, after nearly 50 years of doing the kind of work she loves to do, Prof. Wilson is hard put to explain why she loves doing it.

"I don't know why I like it," she admitted. "Except that I can see something grow under my hands."

That could go for the former students whose careers she speaks of with such pride as well as for the lines of her drawings.

Northeastern to Aid Women Find Spot in Man's World

By IAN FORMAN

What is a woman's place in what still is—let's face it—a man's world?

This question has been getting a lot of extra attention recently, especially with new programs for "mature" women in local colleges, universities and adult education programs.

Now Northeastern University announces a new program it has been testing for nearly a year.

All these new programs—at Radcliffe, Brandeis, B.U., Harvard and so on—have their particular bent and thus, fortunately, complement each other rather than compete.

Northeastern's is aimed at putting women—"mature" or career or young or graduating from rearing children—into niches of industry or the professions where they're badly needed.

Unlike Radcliffe's, which is primarily scholarly, this program wants to give top executives more able "girl Fridays" to handle data processing techniques—a hot field in which there is a shortage of help, especially up and down on the Rte. 128 network of firms.

Northeastern's program is called the Continuing Education Program for Women.

Under the direction of Mrs. Ethel Y. Beall, program coordinator, three Greater Boston housewives and eight career women have already completed a "pilot" program under Mrs. Beall.

Starts In April

The first official course will begin in early April, running 10 weeks on a one-evening-a-week, 2½-hour basis for the convenience of both housewives and women already working.

Northeastern has taken a poll along Rte. 128 which definitely shows a great need for mature women as administrative assistants, and younger women for data processing.

"I don't feel that women should compete with men in industry and the professions," says Mrs. Beall, "but there are growing areas where women, especially mature women, are needed and wanted."

She says she is already get-

ting many phone calls from industry, asking, "Can't you send us an older woman who can help run our office as an executive secretary or administrative assistant."

Mrs. Beall feels that for too long, secretaries have been considered as mere clerical help, but now there is an opportunity for such women office workers to move up and assist with administration.

"Several women from our pilot course are now writing policy letters and communications for their firms, something which neither they nor their bosses considered before—and both like it."

She points out that many executives prefer mature women who would not be leaving any month or year to get married.

On the other hand, she says, young women, especially bright ones who have not come out

programming area."

Wallace, with whom Mrs. Beall has consulted, says women have qualities which often make them superior to men in programming.

"Their attention to detail in programming, where no step can be left out, makes them better. Their power of concentration, especially in detail work, is greater.

"Programming can be very complex and sophisticated work. Many electronics firms have numerous women now, from girls just out of college with math majors, to older women, perhaps whose children are grown, who have math and science backgrounds from college," he said.

In his firm, Wallace said, women hold such positions as manager of scientific programming, technical assistant to the director of marketing and technical assistant to the branch manager (she holds a PhD in math).

The two Northeastern courses given so far include "Effective Writing for Business," designed especially for administrative secretaries who have responsibilities for business communications.

Also, "Procedures and Methods in Mathematical Statistics" is offered women with a college-level mathematical back-

ing modern analytical methods to interrelating data and information gathered in industrial experimentation.

"A woman who successfully completes this course is in a position to assist scientific research men with data," says Mrs. Beall.

Other courses will be added as the program proceeds.

350 Ask Information

Mrs. Beall says she has already had some 350 inquiries from interested women. At present nearly 200 women's names are in her "active" file awaiting the availability of certain courses. A guidance program is also being developed.

Northeastern is also inaugurating next Fall two programs designed to encourage mature women to enter or reenter the teaching profession.

An undergraduate program will be offered in a special pilot course to adult women who have the background of at least two years of college.

Women taking the course, to be given in Northeastern's College of Education, will be able to arrange their courses on a flexible basis to fit in with family requirements.

A similar program in the Graduate School of Education will prepare former teachers for re-entry into the profession.



MRS. ETHEL BEALL
"Great Opportunities"

of high school well prepared, may easily find a good career in the expanding data processing field with some additional training.

At the same time, young women college graduates, who have mathematics backgrounds (even up to PhD's), can do even better in this area.

Cites Opportunities

Harold Wallace, director of education for Minneapolis-Honeywell Regulator Co.'s electronic data processing division in Wellesley, confirms what he calls "the very great opportunity for women in data processing, especially the pro-



CAREER WOMAN moves ahead. After taking Northeastern's course for mature women on "effective writing for business," Miriam L. Campbell, coordinator of school recruitment at John Hancock Life Insurance Co., has taken active part in writing company reports and other business communications.

Reprinted From . . .

An ENGINEER Special Feature:

The Woman Engineer

In your professional activities, have you ever bumped into a woman engineer? One may pursue engineering for years and never meet a female practitioner, for there are less than 5,000 among the nation's one million engineers. Each year, fewer than 200 enter the profession.

Should you come across an average woman engineer, she would be about 36 years old, employed by private industry and paid nine to ten thousand annually. She would have a bachelor's degree in engineering or one of the physical sciences plus some advanced training.

She probably graduated in the upper 10-15% of her class, but to get an engineering position, she had to persevere more than her male counterparts.

The average woman engineer is equally likely to be either married or single. If married, she has done so later in life than most women—often in her late twenties or early thirties—and has three children. Once married, she tends to remain that way. If her husband is a professional man—which he often is—her life is extraordinarily full.

Such is the statistical profile of the American woman engineer based on a recent membership study by the Society of Women Engineers and on an interview with the Society's recently elected President, Miss Aileen Cavanagh, an engineer with Bell Telephone Laboratories and senior member of the Institute of Electrical and Electronics Engineers.

Beyond the Statistics

Though revealing, statistics merely provide the framework for understanding the place of the woman engineer in the profession and in American society.

Although engineering career opportunities have improved considerably since the post-war years, the lady engineer still comes across many industries whose welcome mats have no place for high heels.

A few employers are still reluctant to hire females simply because of their sex. Confronted with a severe technical manpower shortage, however, such employers constitute a dwindling group.

No "Hard Hatted Hannahs"

Some industries, like steel, which in many areas require "hard hat" type operations, still will not accept women engineers in plant and field work for physical reasons. These same industries often will hire women for engineering work in their home office and research laboratories. This, says Miss Cavanagh, will seem like unfair discrimination to the women whose educational preparation, interests, and native talents have been directed toward plant operations and field work.

The likelihood of marriage and child rearing, of course, pose the most serious deterrent to their finding professional-level employment. This reason is the one most frequently cited, even though high turnover rates among male engineers should provide some counter-argument.

According to Miss Cavanagh, a geographical pattern of discrimination towards the woman engineer also exists. Resistance to ladies is strongest in the New England states where engineering partnerships and public utilities retain their conservative traditions. In the mid-West the woman engineer is more welcome, but often at less pay than her male colleagues. The Far West, where government monies support the salary structures of defense industries, offers an employment climate as bright as the California sun. In the East, Northwest, and the South, industry also welcomes the woman engineer with relatively wide open arms.

The Cultural Climate

All in all, one may summarize her difficulty as Career Selectivity. Engineering employment awaits her, but it may not be in the area, or industry or company of her first choice.

The woman engineer deserves much credit for strength and courage . . . as much as the woman doctor or lawyer. Our entire cultural atmosphere opposes women entering engineering, and singles out this incoherent as an "oddball". Our cultural stereotype maintains that a woman cannot be attractive, feminine, and an engineer—with the exception perhaps of 1961's Miss Universe, a German electrical engineer.

The consequence of this attitude is obvious—less than 0.3% of engineering's practitioners are women. Because there are so few, the woman engineer bears an additional burden: "professional loneliness". The Society of Women Engineers originated out of such loneliness and, in fact, provides an opportunity for women in the profession to develop rewarding friendships with colleagues of their own sex.

With the profession not entirely receptive

to her inroads, some employers still discriminating against her, and the cultural climate chilly, why does a woman choose engineering for a career?

According to Miss Cavanagh, any of three factors may contribute to a girl's interest in building bridges as well as a family: She liked the subject material after being introduced to it; she actually enjoys the additional challenge a hostile environment provides; or she never realized that unique obstacles did exist. Other observers have cited economic reasons in that engineering offers girls from lower income families a chance to ascend the economic ladder.

In any case, a girl must have the necessary aptitudes and interests for success and Miss Cavanagh and the SWE would warn away those who do not.

It is those girls with suitable aptitudes and interests that the SWE attempts to reach. One of the Society's primary purpose is to introduce these girls to the rewarding careers awaiting them in engineering. The Society is not attempting a mass conversion of the female population. In fact, Miss Cavanagh insists that it is unrealistic to believe that this could be done given present social mores.

Just because Russia's technical manpower is 30% woman-power, Miss Cavanagh continued, we should not necessarily strive to duplicate this percentage. We have our own cultural values

and family oriented ways to which we should be true, she said. "We still want all our career professionals, both men and women, to enter engineering because it is what they themselves want to do with their life energies.

"The SWE's concern is that engineering aptitudes and interests be cultivated and allowed to develop in any girl possessing them. And if she goes on voluntarily to prove her capabilities through scholastic achievement, she should have as fair an opportunity as do her male colleagues and fellow students to find career fulfillment in her chosen profession."

A woman can be almost as much at home with a slide rule as she is with her tube of lipstick, according to Alicia Hart's report on women engineers. It's another *NEWS* feature aimed at women's interests.



Cleveland

Jan. 5, 1955

Needed: More Women Engineers

BY ALICIA HART
NEA Staff Correspondent

WASHINGTON — (NEA) — If your daughter is a mathematical whiz and can handle a slide rule as deftly as any of the boys in her class, then there's no reason why she can't become an engineer.

Here is one field where a gal doesn't have to take a back seat to the stronger sex if she's bright and on the ball. There's a big demand in government and private industry for female engineers, according to a recent Department of Labor survey.

And the salaries in this business definitely put the ladies in the class A bracket. Starting incomes range between \$2500 and \$3000, and with five years' experience the average woman engineer earns at least \$5000 a year. Some make far more.

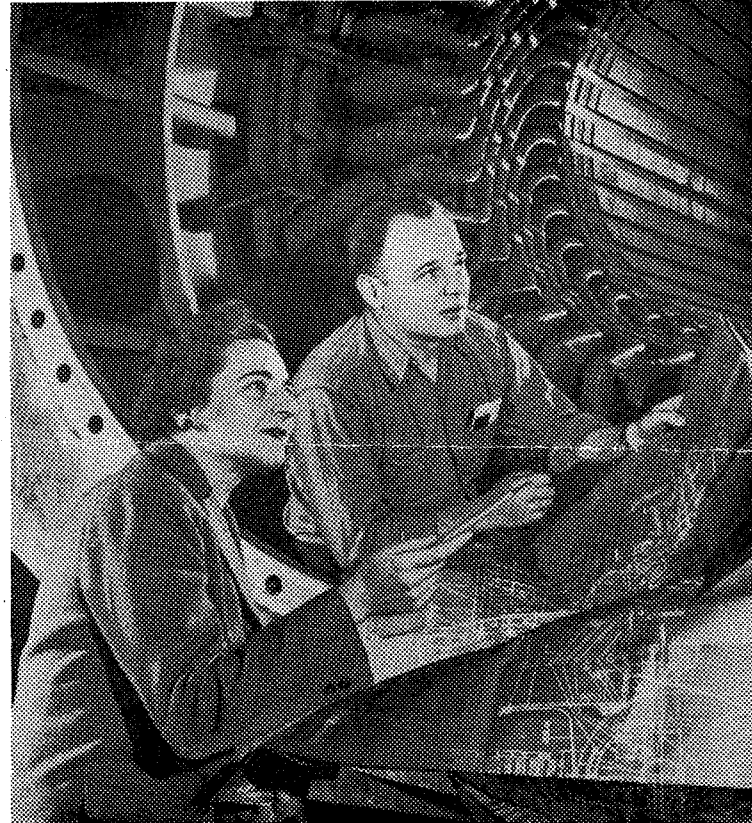
Last June's crop of engineering graduates fell 30,000 short of those needed by industry and the armed forces. A scant 30 women received degrees compared to roughly 20,000 men.

Today there are only 3600 women engineers with professional training or equivalent experience, and they comprise about 1.2 per cent of the total employment in the field.

"WOMEN engineers are in the same boat as women doctors were 50 years ago," says Katharine Stinson, president of the Society of Women Engineers. "Girls just aren't being made aware of the opportunities in engineering, and a lot of them are majoring in basic engineering subjects such as chemistry, mathematics and physics."

Miss Stinson is Chief of the Specification Division of the Civil Aeronautics Authority. A nice looking brunette with a slight southern drawl, she was the first woman to nail down an engineering degree at North Carolina University. That was back in 1941.

"They weren't too happy to have me there," she laughs, "but they had to make the best of it. Of course, I was surrounded by hundreds of men, which, I should mention, is a poor reason for any



Miss Emma Barth of Westinghouse Electric Corp., Pittsburgh, Pa., checks construction of a generator against her design.

girl to try and tackle engineering. You've got to be smart or you'll flunk.

"But brains aren't everything," she is quick to point out. "An engineering degree doesn't automatically guarantee a bright future. There are some weird characters who think they should become the president of a company just because they can work a slide rule. Besides having technical ability, you have to be able to get along with people."

Miss Stinson is acquainted with scores of women engineers, and she maintains they are no different from anyone else. "Why, when we had our convention a year ago, a lot of people came just to see what we looked like, and they certainly were disappointed. We're just ordinary people. A lot of the women are married and have children."

IT'S a sure thing you won't find any old fuddy-duddies among women engineers, for the 1950

census indicates their medium age is 31 years. This makes them seven years younger than the average male engineer.

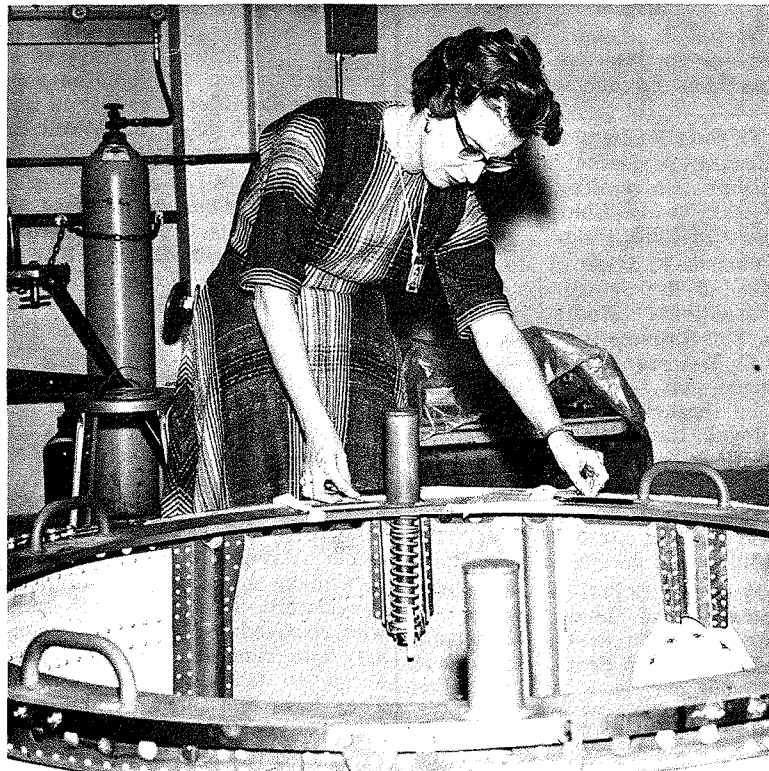
Furthermore, many of the lady wizards can catch the eye of a man, as well as compute. A good example is pretty Lucille Pieti who is a mechanical engineer in the Research Department of the Chrysler Corporation in Detroit, Mich.

A variety of jobs are open to women engineers. Aircraft companies, automobile industries, chemical and electronics manufacturers are all anxious to hire competent women.

Government officials feel women engineers are needed to bolster permanent manpower resources in this critically important profession.

And in case of war, they would be essential. According to the limited information that is available, Russia presently has more women engineers than any other nation, says Miss Stinson.

Engineering Career Is Happy Choice



Betty Lou Bailey

Although less than one per cent of American engineers are women, the front door is now open for girls eyeing such a career, and engineer **Betty Lou Bailey '50** urges them to walk in.

Betty Lou, who spoke at the annual meeting of the Engineering Alumni Council on campus this fall, is in the spacecraft department of the General Electric Valley Forge Space Technology Center.

She has to her credit a patent on a jet engine part and extensive experience in engine design.

She entered college determined to be an engineer—her father was chief engineer for the Chicago Bridge and Iron Co.—and now appreciates the fact that her U. of I. professors never singled her out.

"Once a properly qualified girl gets headed into engineering she should be left alone. After she graduates she has to perform to the same standards as anyone else and it wouldn't be fair to the girl to give her special attention in college," she told the alumni.

After Betty Lou received her degree in mechanical engineering as the only coed in an engineering class of 1,055, she went to work for General Electric at the large jet engine department at Evendale, Ohio.

In 1960 she was transferred to the staff of the Knolls Atomic Power Laboratory where she was a control mechanisms engineer on a project for the design and development of twin nuclear reactors for the Navy's first atomic powered destroyer.

At Valley Forge she is mainly concerned with the design of the Nimbus weather satellite, working on the adapter and payload separation system which goes between the Nimbus, a successor of Tiros, and its booster.

Besides providing mental stimulation, an engineering career gives, she says, a sense of physical accomplishment in producing "something which is real, and part of it seems yours."

America has so few women engineers, compared to Russia's many, she believes, because of poor counseling of girls who show aptitude in mathematics and science.

Kathie Miller, a metallurgical engineering junior from Fairfield who was guided by her high school counselor into engineering studies, also spoke to the group, which included many high school principals and counselors as guests.

Present too was **Grace Wilson '31, M.S. '43**, associate professor of general engineering, who is sponsor of the organization formed for the 31 coeds now in engineering at the U. of I.

Although devoted to engineering studies as an undergraduate, Betty Lou Bailey did not permit extracurricular interests to pass her by. She was associate editor of the Illio, a member of the Panhellenic Executive Council, on Illini Union committees and in the a cappella choir, and was elected to Pi Tau Sigma and Mortar Board honoraries.

Oct. 1959

Published Quarterly by the Engineering Experiment Station

WHAT ABOUT WOMEN ENGINEERS?

THE following appears in the 1959-1960 engineering college bulletin of a large southern state university:

The field of engineering has been thought of almost exclusively as a man's domain. In the past few years, however, increasing numbers of women have been entering this field and are taking their places in the profession on an equal footing with men. Women who are interested in an engineering career and who have aptitudes in mathematics and science are invited to confer with the Dean of the College with reference to choosing engineering as a profession.

Here is one of a few small but hopeful signs that a much neglected source of engineering recruitment is receiving attention.

President Lee A. DuBridge pointed out several years ago that "we have almost completely failed in the physical sciences and engineering to make use of the talents and services of women," going on to remark that "Junior science fairs have discovered some very able girl scientists."¹

In 1955, only 62 of 22,589 engineering graduates in the United States were women.² (This does not include the additional small number of women graduates in mathematics, physics, and chemistry who might become technical employees.) In the fall of 1958, 1,583 women were enrolled in engineering colleges for the first degree, 111 for the M.S. and 24 for the Ph.D. (or a total of 0.59% of the total engineering enrollment), but of 41,767 degrees in engineering conferred that year, only 133 were earned by women, or 0.32%, a very slight increase over 1955. Although the number of employed women engineers jumped from less than 750 in 1940 to approximately 6,500 in 1950, the percentage of women employed as engineers in 1950 was only 1.24% of the total of employed engineers.³ In the state of Washington the Boeing Airplane Company recruits women engineers and employs at present 94 women with engineering titles, 69 of whom perform actual engineering types of work. (These figures do not include engineering aides or "junior engineer" classifications.) The approximate number of employees with engineering titles (excluding aides and junior engineers) is 7500, showing that only about one per cent are women. Thus Boeing's recruiting efforts have resulted in a percentage less than the over-all U.S. average for 1950.

A very much higher percentage of women are being trained in science and technology in Soviet Russia, Poland, and Czechoslovakia, than in Europe, the U.S., or Canada; even Asia and South America, Australia, Thailand, Korea, have women engineers. Two women from Madagascar were studying aeronautical engineering at the time (1958) the United Nations Commission on the Status of Women conducted its survey on the participation of women in engineering, architecture, and law.⁴ However, we must remember that there are few other careers open to bright ambitious women in the U.S.S.R. and its satellites,⁵ and unusual inducements are offered to all scientists and technicians in those countries, equally to women and men. Great pressure is brought to bear on all students who show promising scientific aptitudes, so they may not be given much choice of profession. The U.N. survey also revealed that in 25% of the 40 countries concerned, women engineers meet with prejudice and opposition in seeking employment, and that "many countries have higher percentages of women among their engineers than the United States."⁶

While the population of the United States has doubled since 1900, the number of scientists and engineers has in-

creased ten-fold,¹ indicating a possible long-term future trend of an even larger fraction of our working force directed toward scientific pursuits. The percentage of women so employed should surely at least remain constant. What is preventing women with unusual aptitudes in mathematics and science from considering engineering as a career? Are the age-old prejudices against women in any type of professional career still deeply ingrained in our culture? Here are some examples frequently encountered.

Prejudices and Facts

1. "Women are inherently less intelligent than men and are temperamentally unsuited for any professional career, being too emotional and imaginative."

The hoary dogma of woman's mental inferiority has long been exploded. As for temperament, the woman who is highly emotional is not likely to be interested in science or engineering. On the other hand, imagination, in women as well as in men, when combined with quick perception and rational judgment, is the very essence of creativity in any field.

2. "Women are physically unsuited to engineering work." This idea might have been valid a couple of generations ago when the kinship between engineers and skilled mechanics was very close. Today, apparently, the public, parents, and even some engineers have yet to realize that "most professional engineering jobs are accomplished at a desk and require no more exertion than wielding the compass and slide rule."⁷

3. "Turnover of women technical employees is greater than that of men. Women leave their jobs for marriage and child-bearing. Efficiency, therefore, demands that preference and promotion be given to men." Yet a management executive of "one of our larger corporations" stated that "any organization needs a host of young engineers, male and female. The latter, during those early years before their home duties call them away from industry, could perform a magnificent service. In later years they could return and again perform a service. Why don't they do it?"⁸ And Leonard B. Landall of the Raytheon Manufacturing Company, which employs 32 women engineers, pointed out, at a conference on education of girls for careers in science and engineering, that "women are the nation's greatest untapped reserve of brainpower since they account for most of the two-thirds of the nation's top brain power that is not at present receiving college training."⁹

4. "Engineers resent women as co-professional workers and management fears that employee 'cohesiveness' is destroyed by introducing women engineers." This is a sweeping statement for which no substantial evidence appears ever to have been offered. Individual cases, probably among the older generation, can doubtless be found. On the other hand, numerous cases of dissatisfaction and enmity which threaten cohesiveness among all-male engineering groups can readily be cited.

5. "A married professional woman is likely to compete with her husband and thus upset the prescribed identity of the family social status."

In the first place, if a woman is temperamentally competitive, she will compete, whether on a professional basis or some other. In the second place, the "prescribed identity" is already being upset by the changing allover pattern

(Continued on page 32)

What About Women Engineers?

(Continued from page 1)

of modern marriage which includes such general aspects as the following:

a) The trend of the past ten years toward earlier marriages results in completing the period of child rearing at an earlier age.

b) Reduction of the time necessary for domestic duties and reduction of the number of working hours in industry have increasingly drawn married women into employment. Many established women engineers have even found it interesting and profitable to carry on part-time, free-lance, or "consulting" work from their homes, while their children were small.⁷ By this means, also, they contrive to keep up-to-date and have less need for refresher courses advised for those who resume their profession after a lapse of ten years or more.

c) "The companionate, equalitarian family is replacing the patriarchal, authoritarian family," to an extent that "the married career woman is finding greater cultural acceptance."⁸

Whether or not these changes will ultimately be for the better cannot be predicted, but they have undoubtedly arrived and we must face them. While acceptance of the woman professional engineer may lag a little, it, too, is on the way.

The Basic Obstacle

The superficial prejudices outlined here as examples, will, for the most part, be overcome after a little more time and experience. But they, as well as others, are unfortunately based on concepts older than civilization. President DuBridge notes that "social custom requires little girls to play with dolls instead of electric trains."¹ Today, from her infancy, influences and pressures are brought to bear on the girl to learn and value only the ancient culturally approved role of the housewife and mother.² Many mothers (and fathers) do not even know what a modern engineer does. In a recent series of 16 interviews with men and women of many occupations who were asked to define an engineer, the writer was repeatedly told that "he runs a locomotive" or "is in charge of the school furnace." On being asked who was responsible for their electric appliances, 75% of the women gave the company trade name, "G.E.," "Westinghouse," etc., and had apparently no idea that individual engineers, or research teams of engineers, were responsible for the design. Teachers tend to "relax intellectual standards for girls" and mass media "extoll the glamor girl."³ These ingrained social ideas often extend to the campus and prejudice administrators against encouraging women to enter the engineering profession.

A story is told of "one able and highly motivated woman who was originally refused admission to the engineering school of her home state, who . . . enrolled elsewhere, completed two years in one and returned—this time to be admitted. . . . Her work performance has been such that she has for some time headed the specifications staff in the Aircraft Division of the C.A.A."⁴ There may be others, just as gifted, but more easily discouraged who would find fulfillment and satisfaction in engineering and science training, and who would personally contribute to the world's balance and welfare even if they never performed a day's work as professional engineers.

However, few women graduates in engineering fail to follow their profession for at least a time. The University

of Colorado Engineer recently carried a survey of the 63 women engineering graduates from 1903 (the university's first graduating class, which included one woman engineer) to 1957. Forty-two of the 63 married; 30 of them married engineers; five were daughters of engineers. Only five did not work as engineers after graduation. Thirty-two were working or on leave of absence at the time of the report (March, 1958).⁵

Looking Ahead

If girls with aptitudes for science and mathematics are encouraged to enter the engineering profession and if professional taboos are gradually withdrawn, what will be the result?

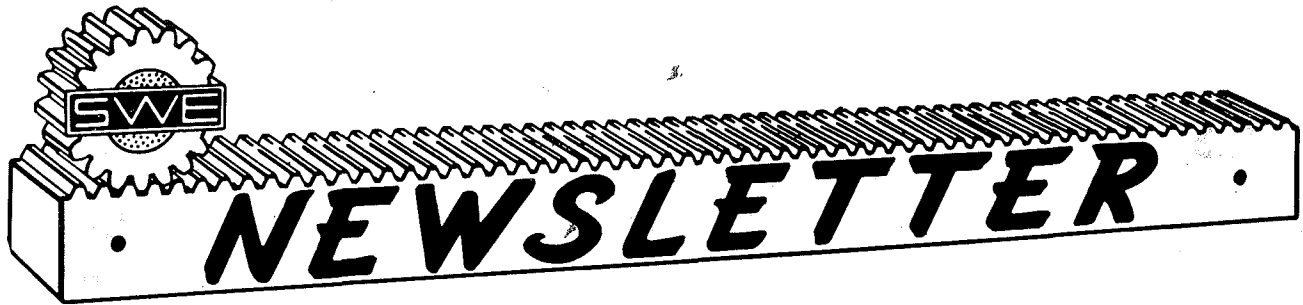
Under the most promising circumstances only a relatively small addition to engineering "man-power" will probably be made. There is little likelihood of the profession suffering a female invasion. After more than a century of medical training for women, in 1950 only 6% of the country's practicing physicians were women; yet "healing the sick" is generally held to be "more womanly" than designing a highway or a new type of rotor. Still, even a comparatively small number of trained women engineers would form a valuable reserve nucleus in case of emergency. During World War II the splendid response of women to fill the gaps in industrial employment left by men called to the service was beyond all expectations, and "Rosie the Riveter" has become a legend. Such encouragement during the war years, reflected in the peak numbers of women graduates at Colorado (nine in 1947, seven in 1948, eight in 1949), shows a sensitive response to public opinion. Unfortunately, after 1947 the number of women registrants in engineering dropped abruptly, with the result that only two were graduated from the University of Colorado in 1952 and 1953, one in 1954, and two in 1955, 1956, and 1957.

But the most important effect of encouraging women to specialize in science and technology, would be on the women themselves, those who wish to become engineers, physicists, or mathematicians because their talents and aptitudes, their curiosity and imagination, lead them in that direction. Certainly, the first step must be taken by the colleges and universities, to indicate whole-hearted approval of women engineers and to encourage qualified registrants, as several progressive institutions have already done. Then, as one writer has suggested, in conducting such a program of action, professional engineering societies can exert their influence and prestige to increase the likelihood of its effectiveness.⁶

Finally, if your small daughter says that she prefers a toy dump truck or an electric train to a Betsy-Wetsy doll for Christmas, why not give it to her?

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NEWSLETTER

VOL. 9 NO. 7

SOCIETY OF WOMEN ENGINEERS

MARCH, 1963

Participation of Women in United States Space Programs Explored

At the 1962 Air Force Association Convention and Aerospace Panorama at Las Vegas, Nev., in September, the important question of the role of women in the space sciences was discussed at a Special Space Symposium for Women.

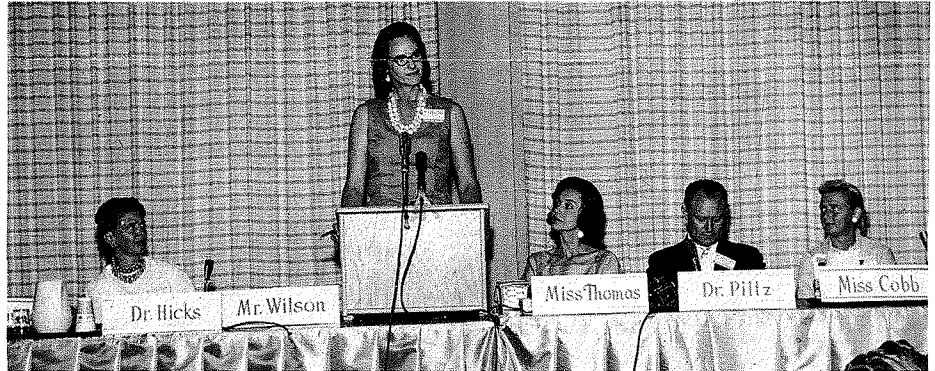
The program was moderated by Shirley Tomas, author of the "Men of Space" book series. Panelists included three SWEM: Laurel Van Der Wal Roennau, bioastronautics specialists, Space Technology Laboratories and a member of the Los Angeles Board of Airport Commissioners; Dr. Beatrice Hicks, president and director of engineering, Newark Controls Co.; and Jerrie Cobb, assistant to the vice president of Aero Commander, Inc. Dr. Albert Piltz, science specialist, US Office of Education, Department of Health, Education, and Welfare, provided a male viewpoint on the panel.

Other participants included Dr. W. Randolph Lovelace, II, aeromedical specialist and head of the Lovelace Clinic; and Gill Robb Wilson, publisher of "Flying" magazine, both of whom made introductory remarks.

Dual Role

The speakers covered several topics. Laurel Van Der Wal Roennau stressed her belief that the basic roles as a woman and mother are in no way compromised by an extensive schedule of professional and civic activities, that indeed activities beyond the home enhance and enrich women's lives.

"First of all, both in time and importance, I am a woman," she told her audience, "and I intend to keep on being more and more so for the rest of my life. Last year, I also became a wife. . . . There are any number of women who are wives and mothers in this room. . . . These factors, although of prime importance to the fulfillment of any woman as a person, should [not] and need not interfere in any way with a full and gratifying schedule of activities in the professional, civic, and cultural fields. The majority of people these days 'live' only about ten percent of the time; that is, they contribute about ten percent of their full potential to the society in which they live. . . . This particularly applies to women, who continue — even



Laurel Van Der Wal Roennau, SWEM, addresses the Special Space Symposium. The other panelists shown seated are (l. to r.) Dr. Beatrice Hicks, SWEM; Shirley Thomas; Dr. Albert Piltz; and Jerrie Cobb, SWEM.

in this space age — to drag around the Victorian chains which have limited the areas of 'acceptable' female occupations."

Curiosity and a willingness to learn are the keys to women's playing important roles in advancing space technology.

"We need your help in expediting America's space effort," she told her audience. "If I were to give you my advice, it would be this: Pursue the course of study which interests you most even if it has no immediate or obvious application in our current space efforts. Above all, be curious, be skeptical, be flexible and discriminating. . . ."

Manpower Shortage

Dr. Hicks told the Symposium audience that a devastating shortage of top-flight scientists and engineers will develop in this country if woman-power is not utilized.

"Women today comprise a vast reservoir of engineering brain-power. More than 130,000 women graduate from our universities and colleges each year but less than 200 women engineers are graduated annually in all of the United States. At a time when our nation is experiencing a chronic shortage of scientists and engineers, the best potential talent among women has been barely sampled and, more often than not, shamefully overlooked.

"Studies indicate that by the year 2000 one-half of our working population will be women. Further, the number of

engineers and scientists required per 1,000 working people has been increasing consistently. These facts bring out two important points with regard to women in the fields of engineering and science. First, every 1,000 women entering our working population must bring with them enough scientists to support their participation in our working force; and secondly, the percentage of these scientists is a constantly increasing factor. Not least among the fields causing this increased percentage is our growing space program and all of the sciences that support this program. As more women enter our working force, a proportionate number of women must enter the scientifically trained portion of that force.

"The alternative to this procedure would weaken our nation at a time when it must be strengthened.

"Engineering aptitudes do not exist in every college graduate. But they do exist in a significant portion of these graduates. Even modest estimates point out the inadvertent waste of graduating less than 200 women engineers per year.

"Very few college women are ever screened for engineering abilities. In many instances, they have never been advised that engineering is a profession open to them. Often, their scientific curiosity has been discouraged.

"If women are not actively encouraged to enter engineering, our nation will be weakened at a time when it requires new strength and vitality," Dr.

(Continued on page 6)

Space Programs Explored

(Continued from page 1)

Hicks asserted.

"Men alone cannot provide our ever increasing need for highly trained, truly creative scientists and engineers.

"American women are making important contributions to our space program — but in such small numbers that our total effort suffers. Women are represented from top-level scientists to testing technicians. New opportunities for women in engineering are opening constantly. They include research, design, development, production, and even sales for new projects and new products.

"Following World War II we were perhaps too tired and our efforts at progress too casual and relaxed. As strange as it may seem now, engineers were a glut on the market, more often than not, students were discouraged from entering the engineering profession.

"The Korean War and the continuing cold war served to re-awaken our need to develop all of our scientific capabilities. A drastic and almost chronic shortage of scientists and engineers developed. The results of such foolhardy actions are self-evident today. Now, we must redouble our efforts to develop and encourage students to become scientists and engineers especially women.

Dr. Piltz expanded on the themes of Mrs. Van Der Wal Roennau and Dr. Hicks and commented on the cultural attitudes that have barred women from strong participation in space activities.

"The common misconceptions of protecting women from rigorous activities, for example, of division of labor . . . 'the cheer leaders are the girls, the players are the men' sort of thing, must be eliminated," he said.

"This stereotype — of women relegated to doing 'women's' things — is deeply ingrained in our culture and with few exceptions will require the concerted efforts of parents, counselors, teachers, and friends to overcome. We may be slightly behind the USSR in our rocket

program, but there is an even greater lag in equality of the sexes. Tourists returning from abroad are invariably impressed with the great number of women doing 'men's' jobs — of course they are really women's jobs there. We are way behind in producing women scientists for our space programs. It is estimated that twenty-five percent of Russian space scientists are women. They are dominating the fields of astronomy, chemistry, and medicine, and are numerous in the areas of satellite tracking, computer work, and telemetry."

Need for Scientific Literacy

Dr. Piltz commented, too, on the vital need for scientific literacy among the people of America and offered some definitions:

"What do we mean by scientific literacy? We mean chiefly an understanding of what science is. Modern science is more than new knowledge. It is also a way of thinking and working. Modern science demands that students know how to solve problems. This means gaining an understanding of basic principles, the habits of curiosity, the skill of observations, the attitude of questioning and exploring, the knowledge of experimentation, the ability to work out relationships, the patience to test and retest, the persistence to try again and again when efforts fail. The students of modern science must realize that no matter how clearly the results of an experiment point to a conclusion, scientific problems are seldom conclusively answered. . . .

"The number-one requirement of scientific literacy is, therefore, for everybody. . . . For many, there are two other educational requirements in science in the space age. These are, first, specialized scientific training for those who will become scientists and technologists and, second, basic research and development for those who will discover new knowledge. . . ."

Meet Marie Owen

The national SWE convention scheduled to be held in Denver during June, 1963, is being planned under the direction of Mrs. Marie Weber Owen.



Marie, who is a native Coloradoan, is the daughter of retired consulting engineer, Eugene Weber. After graduation from East High School in Denver, she enrolled in the University of Colorado where she received a degree in architectural engineering. For a number of years, Marie practiced in several local architectural and engineering offices. In 1955-56, while on a tour of Europe with her family, she made an independent study of building materials and construction procedures in England. At present, she is taking advantage of her years of varied engineering experience and her professional engineering license to fulfill some personal ambitions and to do some specialized consulting.

Marie and her husband, Bryan, are the parents of five grown children and are anticipating the role of grandparents in the near future.

Her professional associations include A.I.A., C.S.C. besides S.W.E., in which she is a charter member and the first Chairman of the Denver section.

Final speaker at the Women's Symposium was Miss Jerrie Cobb, an advocate of feminine participation in space programs.

Carroll Prepares Book on Tunnel-diode and Semiconductor Circuits

John M. Carroll, managing editor of *Electronics* magazine and author of several well-known McGraw-Hill books, has prepared a new textbook which will be of interest to students, electronics technicians, engineers, and scientists. **Tunnel-diode and Semiconductor Circuits**, slated for publication this month, consists of 120 feature articles which appeared in *Electronics* during 1960, 1961, and 1962.

Unlike many collections of reprints, this book includes a comprehensive introduction of original material which serves to orient the reader. Mr. Carroll gives brief technical descriptions of all the new devices discussed in the articles.

The first eight chapters give thorough coverage to tunnel diodes—theory, basic applications, test equipment with which to determine operating characteristics, elementary tunnel-diode circuits adaptable to a wide range of applications, specific designs for tunnel-diode amplifiers and oscillators, large-signal tunnel-diode circuits suitable for digital computers and other pulse applications, and the use of tunnel diodes as memory devices.

Special features include a complete summary of semiconductor circuits applied to microminiaturization; two chapters on parametric amplifiers and voltage-variable capacitors; and information on four-layer diodes, silicon-controlled rectifiers, and unijunction transistors. Other articles deal with special two-terminal semiconductor junction devices; semiconductor devices utilizing the Hall effect; field-effect semiconductor devices and their circuit applications; use of semiconductor junction devices and thermoelectric circuits, especially those using the Peltier cooling effect; and industrial control circuits used in silicon-controlled rectifiers.

The articles are arranged for easy reference according to the broad category of application. Articles which explain theory are followed by articles giving specific applications. The illustrations have been redrawn, and most of the schematic diagrams give component-part values so that the reader can find a circuit that suits his needs.

The book will be helpful as a supplementary text in colleges and technical institutes, as well as valuable for self-study.

Mr. Carroll is the author also of

these McGraw-Hill books—**Transistor Circuits and Applications**, **Modern Transistor Circuits**, **Design Manual for Transistor Circuits**, and **Electron Devices and Circuits**.

Women in Engineering Technology

Each of the three young women shown here is a freshman this year in a two-year engineering technology program at New York City Community College in Brooklyn. In welcoming them, Professor Stanley M. Brodsky, head of the school's Division of Technology, said, "Opportunities for women in engineering technology are excellent now, and will improve. We are proud of these young women and pleased to see that they recognize the existing opportunities and are preparing to meet them properly. Women represent a major untapped national resource in engineering technology. Qualified people, regardless of sex, are vitally needed now as technicians. Employers of women technicians report great satisfaction on the part of both employer and employee."

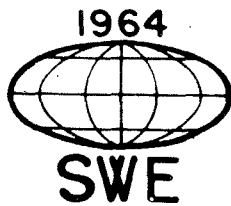
Esther Thompson, below left, is an 18-year-old construction technology major attending college on a Regents Scholarship. She is shown here examining the safety wheel on a large bandsaw. Barbara Lo Dico, below right, is 18 and majoring in mechanical technology. Here she is working on a problem in engineering drawing.



Gail Reese, above, takes sensitivity measurements with an r-f signal generator and oscilloscope and f-m receiver as part of her study of electrical technology. At 18, she is secretary of the college's Student Chapter of the Institute of Radio Engineers.

All three programs lead to the degree of Associate in Applied Science. In the 15-year history of the college, only five girls have graduated from the program in construction technology, one from electrical technology, and three from mechanical technology.



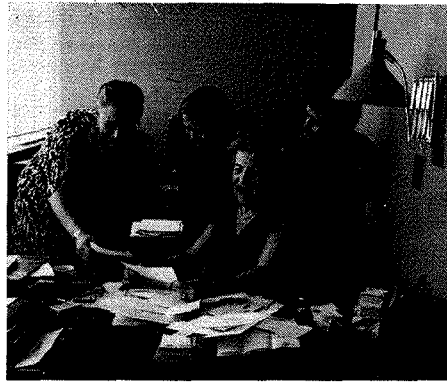


Conference NEWS

WOMEN ENGINEERS
and SCIENTISTS

FIRST INTERNATIONAL CONFERENCE • JUNE 15-21
at the UNITED ENGINEERING CENTER, NEW YORK CITY

WORLD CONFERENCE DRAWS 500 WOMEN IN ENGINEERING



Conference Registrations Exceed Expectations at SWE Headquarters. Ruth I. Shafer, Conference Chairman, shows Winifred D. Gifford, Executive Secretary, a check as Alva Matthews, N. Y. Section Chairman, and Christina E. Lambers, Finance Chairman, register delight.

SWE

The Society of Women Engineers is a non-profit, educational organization dedicated to making known the need for women engineers and encouraging young women to consider an engineering education.

Founded in 1950, the Society now has more than 700 members. Headquarters are in New York City at the United Engineering Center, opposite United Nations Park. The Society carries out these objectives:

1. To inform young women, their parents, counselors, and the public in general of the qualifications and achievements of women engineers and of the opportunities open to them
2. To assist women engineers in readying themselves for a return to active work after temporary retirement
3. To serve as a center of information on women in engineering
4. To encourage women engineers to attain high levels of educational and professional achievements.

Pauline Frederic, NBC Reporter to the United Nations, will be the Banquet Speaker, Saturday, June 20.

The largest gathering of women engineers and scientists ever to take place will convene during the week of June 15-21 at the United Engineering Center in New York.

Registration of delegates from more than 30 countries overseas and all 50 states is expected to top 500.

The First International Conference of Women Engineers and Scientists is being sponsored by the Society of Women Engineers. It seeks to call attention of educators and student guidance counselors to the engineering and science talent among young women that has been largely wasted in the past but is needed for the future.

Papers scheduled for presentation, many by engineers from abroad, will illustrate the diversity of engineering work being performed by women and help create public understanding of the important role of the engineer, Beatrice A. Hicks, Conference Director, said.

(*Technical Conference Prog.*, Pg. 2)

Conference preparations have shed new light on the numbers of women in professional engineering and where they are working throughout the world. Starting with only 40 names outside the U.S., the Committee has invited 1500 women.

USSR SENDING FOUR WOMEN TO CONFERENCE

Four women, representative of professional engineering in Russia will be attending the First International Conference of Women Engineers and Scientists from June 15 to 21. They are: Mrs. A. Dobrynin, wife of the Ambassador to the United States, who is an aeronautical engineer; Mrs. G. Frolova, attache at the Embassy in Washington; Dr. Galina N. Kadykova, an engineer on metals; and Dr. Zanaeda A. Filatova, Professor and Oceanologist at the Academy of Sciences, Moscow, who will present a paper on "The Role of Soviet Women in Research."

**WHAT WOMEN DO
IN ENGINEERING**

Miss Mattie F. McFadden — Manager in missile systems of Raytheon Company and responsible for materials, process engineering and preparation of specifications during the development and production of division's contracts, including Navy's Sparrow III and the Army's Hawk missiles. A former pilot, she was national president of the Women Flyef's of America from 1950-1954, a recipient of the Glen L. Martin gold wings in 1948, a member of Lt. General Doolittle's committee to commemorate the fiftieth anniversary of powered flight in 1953.

Miss J. Cicely Thompson, M.A., A.M.I.E.E., Senior engineer with The Nuclear Power Group, Cheshire, England, will present the paper on power, heat and light. Miss Thompson was one of the designer team that secured the order for Berkeley Nuclear Power Station, one of the first pair of commercial nuclear power stations built by this group.

Dipl. Ing. Ira Rischowski, VDI, MWES, a technical writer and the first woman to be admitted as a member of the Verein Deutscher Ingenieure, Germany's exclusive engineering organization. She escaped Hitler's Germany through Czechoslovakia.

Mrs. Laurel van der Wal Roennau — Recipient of the Society of Women Engineer's Achievement Award in 1961 for her work in space biology. Among other things she designed the space harness and instruments for the mice that preceded Sam the chimpanzee into orbit around the earth. She is a member of the Board of Airport Commissioners, City of Los Angeles.

Miss E'Lise F. Harman — Recipient of the 1956 Society Award for her work in component and circuit miniaturization, was responsible for the reduction of the control panel for the manned space capsule to approximately a hundredth of its original size.

Dr. Dorothy M. Simon — Vice president, Avco Corporation, and director of corporate research. Chairman of the Grants Committee of Society, she has held positions of responsibility at Oak Ridge National Laboratory, NASA, duPont, and was the principal research chemist for Magnolia Petroleum Corporation. An American, she has been a lecturer at the Imperial College, London, and at Cambridge University.

Sima Miluschewa Winkler — With RCA, contributed substantially to TIROS (meteorological) and RELAY (communications) satellites. Other work encompasses the complete preliminary design of a nuclear powered space vehicle, analysis of space rendezvous techniques, the analysis of space radiation, etc.

In 1963 presented a paper on "Detection of Nuclear Explosion in Outer Space."

Mrs. Lottie E. Miner — President, Miner and Miner Consulting Engineers, Inc., is a licensed engineer in western states, and handles major foreign work including technical assistance to Lebanon on power transmission for country wide village electrification and design as well as construction supervision of facilities to distribute power throughout the northern half of Pakistan.

Mrs. Magdalena A. Templa — First president and present director of Women Chemical Engineers in the Philippines. She produced a plastic molding powder from agricultural wastes, sugar cane bagasse, rice hulls, and coconut shells. Results of her research are widely published. During the war she developed food substitutes and had charge of their semi-commercial production.

Miss Margaret R. Fox — Program chairman of this conference. She is responsible for the management of the research and development laboratory, employing over 100 persons. Miss

**SCHOLARSHIP AWARD
WINNERS**

The annual award of the Lillian Moller Gilbreth Scholarship by the Society of Women Engineers to an outstanding woman student of engineering has been won by:

- 1964 Valerie R. Peterson, University of Wisconsin, Madison, Nuclear Engineering
- 1963 Kathleen Carol Stettler, Duke University, Durham, North Carolina, Electrical Engineering
- 1962 Mary E. Hinton, Auburn University, Auburn, Alabama, Mechanical Engineering.
- 1961 Frances Leone, Northeastern University, Boston, Massachusetts, Electrical Engineering (also apprentice engineer, guidance electronics of advance Polaris Missile System, Raytheon Company, Bedford, Massachusetts) (1964 Mrs. Maloney, on maternity-leave from Hughes Aircraft Company, second child)
- 1960 Judith Anderson, Northeastern University, Boston, Massachusetts, Electrical Engineering (also apprentice engineer, Missile Systems Division, Raytheon Company, Bedford, Massachusetts) 1964, Mrs. Atkinson, Engineer on Computer Work for Raytheon Company)
- 1959 Jane Grace Kehoe, Virginia Polytechnic Institute, Blacksburg, Virginia, Chemical Engineering (1964, Mrs. Cullum, candidate for Ph.D. in Applied Mathematics, University of California, Berkeley)
- 1958 Phyllis Gaylard, University of California, Los Angeles, California (1964, Project Engineer, Space Technology Laboratory, Los Angeles)

CONFERENCE OBJECTIVES

Dr. Jerome B. Wiesner, Director of Science and Technology, Executive Office of the President of the United States at the time the conference was announced, made these comments on the objectives of this International Conference:

"This era is unlike any that the world has previously seen. Through science and engineering, we have an opportunity never before equalled to raise living standards, to battle disease and disability, to explore the frontiers of knowledge and turn nature to man's benefit. The scientist, the engineer and the mathematician play major roles in this attempt to make life more meaningful and satisfying. These technological tasks such as economic development of new nations, feeding the hungry, meeting problems of environmental pollution, and preserving peace in a competitive world, require not only the expenditure of billions of dollars every year, but also the utilization of a vast amount of technical talent, everywhere."

Fox served as an Ensign, then Lieutenant in the Navy.

Mrs. Elizabeth J. McLean — Director of the Planning Section of the Bureau of Street Traffic, City of Chicago which works with the Department of Urban Renewal and other planning agencies in that city. She is an outstanding authority on traffic planning and urban renewal.

Mrs. Young Sun Lee — A textile expert was the first woman research engineer at the Research Institute of Tai Chang Textile Co., the first factory in Korea that wove and finished rayon, cotton and synthetic fibers.

Betty Lou Bailey — Engineer

The lone woman in a graduating class of 700 engineers, Betty Lou Bailey received her B.S. in Mechanical Engineering from the University of Illinois in 1950.

Miss Bailey has worked since graduation with the General Electric Company where she has held down a variety of engineering responsibilities



Most of her first ten years with G. E. were spent working at the large Jet Engine Department in Evendale, Ohio. She worked her first year in the G. E. Test program at Schenectady, N. Y. where she ran production tests on anti-aircraft gunsights. Miss Bailey also did testing work during that first year with the large System Turbin Department in Schenectady and the Switchwear Division in Philadelphia.

Since last year, Miss Bailey has been with G. E.'s Valley Forge Space Technology Center where she works on the design of the Nimbus weather satellite.

The daughter of an engineer, Miss Bailey first became interested in an engineering career while attending Chicago's Morgan Park High School.

She is a registered professional engineer in Ohio and New York and a member of the American Society of Mechanical Engineers and the Ohio Society of Professional Engineers. Holder of a patent on the design of an exhaust nozzle for the J-93 engine, Miss Bailey is also active in Altrusa, an international women's service club.

EDUCATION FORUM—

Women Engineers? Surely! Why Not?

By DR. BENJAMIN FINE

A 24-volume set of the modern reference authority, *Collier's Encyclopedia*, will be awarded to Miss Nancy Redenti, New Haven, Conn., for the following question:



BENJAMIN FINE

QUESTION—I will be a high school junior when school starts, and have given serious thought to my future career. For some time I have pondered the possibility of a career in engineering. But many questions arise. How do I know if I can achieve success in this field? Will I find a good job in a field that is mostly 'men only'? Would a good college accept a woman for its school of engineering? Any help you can give me will be appreciated.

ANSWER: More power to you! Of course, you may find some prejudice but that should not deter you. Engineering is an excellent field, and more women should enter it. Unfortunately, at present it is, as you say, mostly "men only." But it seems likely that with the need for trained personnel in engineering and technical fields growing, more women will be called on to take their place in these important areas.

Now for your questions: How do you know whether you will succeed as an engineer? No one can really foretell the future. You might take aptitude tests to determine your potential ability, but these are not conclusive. Discuss your career plans with your guidance counselor; he can be of help.

How good are your grades in the scientific and technical subjects, such as math, physics, science? This can be an indication of future success in college.

Will you find a good job in the engineering field? You mean, because you are a woman? Plenty of jobs are available. The nation needs engineers and technically trained personnel. I am convinced that you will find a job if you are qualified.

The Soviet Union encourages its women to go into engineering, medicine and other professions reserved for men in this country. And the Soviets have found that women do make good engineers.

Finally, you want to know if the colleges accept women students in their engineering schools? The answer is yes. If your grades are satisfactory, and if your record indicates that you will be able to carry the work, your application will get the same consideration as that of a male student.

Actually, some colleges would welcome more women engineering candidates. I wish you success.

Many colleges list fellowships for graduate students. These grants frequently are in the form of teaching assistantships, and help pay partial or even full tuition.

If you or any other reader would like a list of major fellowships and grants, write me, care of The Plain Dealer and ask for my bulletin on "How to get money for college," dealing with fellowships. Please enclose long, self-addressed stamped envelope, and 10 cents to cover cost of handling.

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SOCIETY OF WOMEN ENGINEERS
345 East 47th St., Room 305
New York 17, New York

Womanpower Boosted By Secretary of Labor



By W. Willard Wirtz

As Secretary of Labor I have the responsibility for studying and making recommendations on many facets of the labor market, both on the difficulties today and the likely problems of tomorrow. It particularly pleases me, and makes my task that much easier, when a publication such as **ENGINEER**, geared to such a large and important readership, shows an awareness of a national problem and makes suggestions as sensible as those contained in your recent article on "The Woman Engineer". For the members of my department and I all feel that it is essential that the nation adopt a more favorable attitude toward the presence of women in many traditionally male dominated professions, of which engineering is a prime example.

In National Interest

It is clearly in the national interest to encourage qualified young women to enter the engineering field. The facts about women's suitability for an engineering vocation are so often interwoven with threads of fiction or prejudice that it is first necessary to separate the fact from fiction. Let us examine women's potential in the context of the total engineering-manpower environment.

The shortage of engineers is one of the most serious aspects of our whole manpower picture. When President Kennedy sent his Manpower Report to Congress in March 1963, he said, "Manpower . . . is the indispensable means of converting other resources to mankind's use and benefit. How well we develop and employ human skills is fundamental in deciding how much we will accomplish as a Nation." This statement of the President applies in a very particular way to the engineering profession. If our goal of a higher gross national product is to be realized, the number of engineers, especially those employed in research and development, must be almost twice as high in 1970 as it was in 1959.

The National Science Foundation estimates that the number of

engineering graduates must total 72,000 each year during the 1960's to achieve the Nation's objectives of full employment and an adequate defense. Yet only 45,000 students earned engineering degrees in 1961 compared with more than 57,000 in 1950.

There is already a severe shortage of engineers. The Bureau of Employment Security stated in June that job opportunities for engineers were foremost among the vacancies reported by the public employment offices throughout the 150 labor market areas.

Women Are Qualified

It is alleged that engineering work is physically too demanding for women. The great majority of engineering jobs today are desk jobs requiring no more physical exertion than wielding the compass and slide rule. The old prejudice that women lack the "engineer's kind of mind" is not borne out by reports from employers and other sources that women have successfully demonstrated their ability as engineers. There is evidence that women studying mechanical and technical subjects make better grades than men who scored as well on aptitude tests.

Today there are approximately 7,500 women engineers—10 times the number in 1940; yet they represent only one percent of the profession. If more qualified women are to be attracted to this strategic occupation, encouragement and training must begin early—in high school. There is no lack of accredited engineering colleges which admit qualified women. Too often, however, young girls showing interest in and aptitude for scientific and technical subjects are not encouraged by parents and teachers. The failure to direct them to the prerequisite courses in high school forecloses their opportunity to enter the engineering curriculum in college.

Technicians Needed

The development of more sub-professional technicians to release professional engineers for more demanding responsibilities is certainly needed. Women should be encouraged to qualify for these technician jobs. However, if the training plan for women is limited to this objective, it will defeat the goal of making the best utilization of our manpower resources.

It has been said that only an individual person—not manpower in the mass—makes a discovery, conceives a product, or inspires a student. The brains, talent, and training of women as well as men are urgently needed in the many challenging engineering tasks of a technological society. The motivation of our qualified young women toward careers in engineering is a job for all of us — parents, schools, management, labor, and professional societies.

WHY DON'T AMERICAN WOMEN GO INTO ENGINEERING?



By **SIGRID MARCZOCH**
Staff Writer

Of all the principal professional occupations, that of engineering is lowest in the proportion of its members who are women. In 1940, less than 0.3 per cent of the approximately quarter of a million engineers in the United States were women, according to the U.S. Census. Only 730 women engineers were then employed. Although women pioneered in engineering as early as the 1890's, and although many were trained for work in engineering departments of war production firms during World War II, the number of women who qualified as engineers in the early 1960's is still only about 1 per cent of the national total in the profession.

According to statistics of the Society of Women Engineers, the average woman engineer in the United States is about 36 years old. She is equally likely to be married or single, and if married she has three children. She is employed by industry and earns a medium salary of \$9000 to \$10,000 a year. A college graduate, she has a bachelor's degree in engineering or one of the physical sciences and has either a graduate degree or has taken specialized training related to her work at the graduate level. She is a member of one or more technical societies. She is unlikely to be a licensed professional engineer, resulting in only 24 lady P.E.'s on the NSPE membership roster.

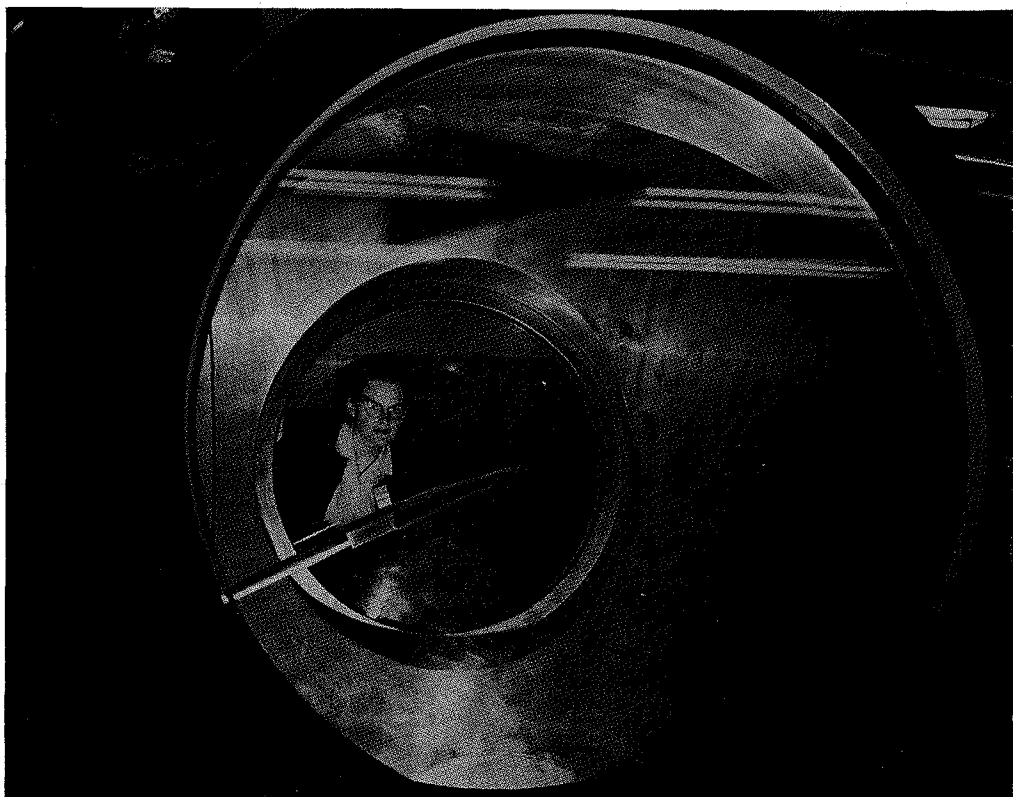
Many industries are looking especially for women engineers, par-

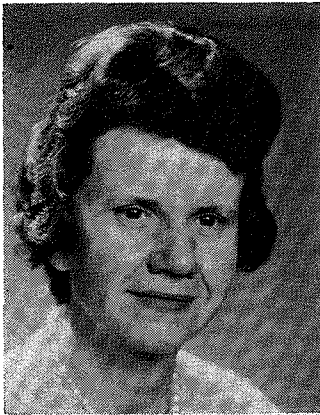
ticularly the airplane factories in California and other Western states, the area with the greatest concentration of engineers, male and female. The Bell Telephone Company is constantly seeking women engineers. These companies are aware that women are particularly gifted to perform the high precision work requested in the engineering of their products. Firms which manufacture radio, television, and other communications equipment employ numbers of women engineers for the same

reason. The Government does not discriminate against women, and therefore a fair number join the Civil Service. Some women teach in engineering schools.

Reports of the Department of Labor indicate that women in the scientific fields generally command higher starting salaries than women trained in other professions. They also show that 15 years after graduation a decidedly larger proportion of the graduates who have majored in a technical or scientific skill still work in their field, while

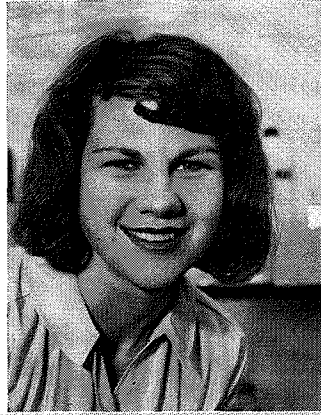
Miss Shirley Holmgreen, an aeronautical engineer with the Boeing Company in Seattle, Washington, inspects a hot shot gun, part of her research project at Boeing.





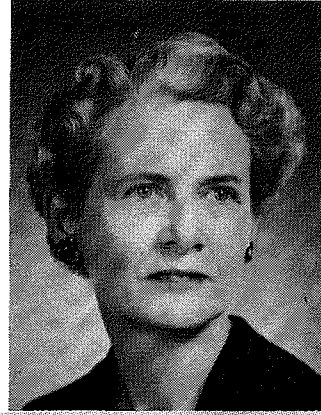
Betty Jost

Betty J. Jost, P.E., is a group leader in the actuator design group of Ledex Incorporated, Dayton, Ohio. During her 14 years with that firm she has held supervisory positions in production control, materials control and inspection. Her work includes application design in the actuator product line for both commercial and military uses. Miss Jost is president of the Dayton Society of Professional Engineers, a chapter of the OSPE.



Barbara Lunde

Mrs. Barbara Lunde works in the Stabilization and Control Branch of the Space Craft Systems and Project Division, Goddard Space Flight Center, Greenbelt, Maryland. She recently invented a new valve with no moving parts for controlling the jet spray of liquid propellants from satellite reaction jets. Together with Mr. William D. Hibbard of the same branch. She has made a patent disclosure for her new invention.



Lottie E. Miner

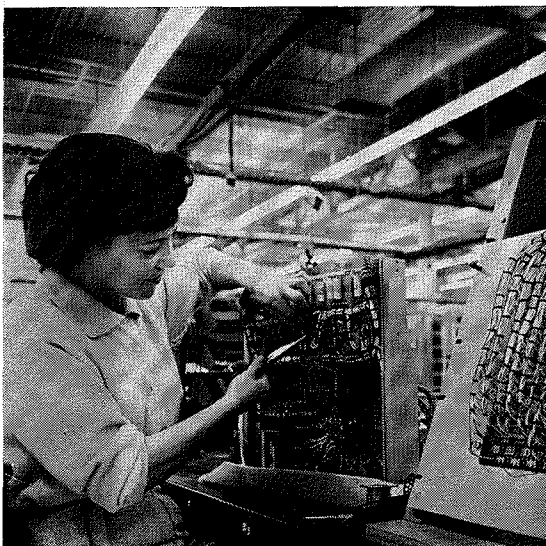
Lottie E. Miner, P.E., is president of Miner & Miner Consulting Engineers, Inc., of Greeley, Colorado, and chairman of the board of Miner & Miner International with branch offices in Brazil and West Pakistan. She and Mr. Miner founded the parent firm in 1946. She assisted in the technical work and general planning and management of all aspects of the operation, and upon his death she took over the firm.



Elsie Eaves

Elsie Eaves, P.E., has been for 31 years manager of the ENGINEERING NEWS-RECORD's business news department, where she developed exclusive construction cost and volume statistics. She also managed CONSTRUCTION DAILY, which she helped to develop. Miss Eaves pioneered as the first woman to earn many professional engineering recognitions and honors. She is a life member of the Queens County Chapter, NYSSPE.

Women are known to be outstanding computer programmers, but they are also good at untangling the wiring in a control chassis for a magnetic-type computer controller.



among those with liberal arts backgrounds there are a high number of clerical and nonprofessional workers.

A recent National Engineering Aptitude Search Testing Program, sponsored by the Junior Engineering Technical Society, showed that 7 per cent of the approximately 900 junior high and high school students whose scores indicated high engineering attainment were girls. Engineering colleges across the country are open to them, some actually would welcome more women in their graduate courses.

Women who have become engineers have found their work most rewarding. "It has been a fascinating profession, and I firmly believe that the field of engineering offers some excellent opportunities for women." "I have al-

ways had cooperation at all levels of operation in our firm." "As mother of two, wife of an engineer and an engineer myself, I would encourage my daughters to pursue careers in the world of science and engineering, if their aptitude and temperament indicate success." "I work with a company of 300 employees, and I recommend this size of operation particularly to women engineers. The opportunities for varied experience are excellent." So comment women engineers from across the country.

The President's Commission on the Status of Women is drawing up plans for new and expanded services for women, particularly for wives and mothers, that will include education, counselling, training, and arrangement of care for children during the working



Helen Peters

Helen Joyce Peters, P.E., staff specialist in groundwater for the Department of Water Resources of the California Department of Water Resources in Sacramento, was recently promoted to senior engineer, making her the highest ranking woman in the Department. She is one of the eight women who are registered with the State of California as professional engineers. Mrs. Peters joined the Division of Water Resources in 1962.



Betty Chapman

Mrs. Betty Chapman, mother of two, believes that scientific and baby formulas mix very well. She is a computer programmer for Sylvania Electric Products, Inc. "If a girl's fascination for mathematics and engineering persists after she survives high school, where she is likely to be pointed out as 'that girl mathematician,' the chances are good that her interest in the subject is deep and genuine," Mrs. Chapman feels.



Dr. Lillian Gilbreth

Dr. Lillian M. Gilbreth is president of Gilbreth, Inc., industrial engineering and management consultants, and an international consultant and lecturer. She has pioneered in applying motion study and scientific work analysis to aid the handicapped and disabled and has developed means of eliminating physical strain. Her career is marked by many awards, honorary degrees, medals, and honorary memberships.



Dr. Beatrice Hicks

Dr. Beatrice A. Hicks, P.E., president and chief engineer of the Newark Controls Company of Bloomfield, New Jersey, has pioneered in the design, development, and manufacture of pressure and gas density controls for aircraft and missiles. In 1959, she and her husband, Rodney C. Chipp, P.E., were chosen by NSPE to represent the Society on an 11,000 mile fact finding and good will tour of South America.

day. About 34 per cent of the women in the U.S. are working at present and a very large number of these do not interrupt their careers, even if they have small children. At present there are about 25 million women employed in this country and about 35 per cent of them are married. Woman labor force participation is still rising steeply. There is, however, no indication that more women will go into engineering.

Why are American women so reluctant to join the profession?

The first reason seems to be the conservative attitude that engineering is an "all male" profession and that there is no place for women in this field. Girls are told to pursue a more feminine profession and they feel that engineering

Dr. Cynthia Hsiao-Ping Kozin was the second woman to receive a Ph.D. in engineering at Purdue. About four women a year become doctors of engineering in the U.S.



"is not the thing to do," and "nobody else does it." A guidance counsellor at a local high school said that no girl has ever asked her about engineering, and if someone had asked, she frankly would not have known how to answer. It is not uncommon that girls are shielded away from engineering careers during their high school years, and only few are actually screened for scientific or engineering abilities.

Steps to correct this situation are being made slowly, particularly at higher guidance levels in large metropolitan areas, with considerable thanks to the wide-reaching activities of the Society of Women Engineers. The effort to interest an increasingly large number of women to enter engineering has the wholehearted support of the

Federal government and many of the engineering colleges.

Women are also aware that not all employers will hire them, even if they are outstanding in their profession. Many firms are reluctant to invest time and money in an employee who, in all probability, will leave after a few years to marry and make a home. But this is certainly true for women in other professions, and it would seem more or less an excuse for an employer who is in doubt about hiring a woman engineer. Large firms with subsidiaries around the country feel that they cannot relocate women once they are married, and are therefore reluctant to employ them.

In many industries women are still confronted with social obstacles. The engineer's environment is predominantly a world for men, and the few women who enter it must be acceptable to and willing to work with men, very often almost exclusively, even if self-employed as engineering consultants. If a job requires a woman to work with crews of men in isolated areas, social customs prohibit her participation.

An employer can diminish difficulties of this kind only by hiring several women engineers at a time.

Despite the various barriers encountered by women engineers, there remains a relatively wide choice of employment for the college trained engineer. There are individual firms in nearly every branch of industry that seem willing to hire engineers, regardless of sex. Women are said to do well in fields related to such consumer goods as household appliances and equipment, textiles, clothing and food—that is, in the fields where they have a natural interest. But the large number of women employed in other fields show that a woman is just as good at building bridges as she is in aircraft design, urban development planning, or highway construction.

All technical and professional societies in the United States invite women engineers into their membership, but the only organization that devotes itself completely to the interest of women engineers is the Society of Women Engineers (SWE), headquartered in New York City. This Society counts at present about 700 mem-

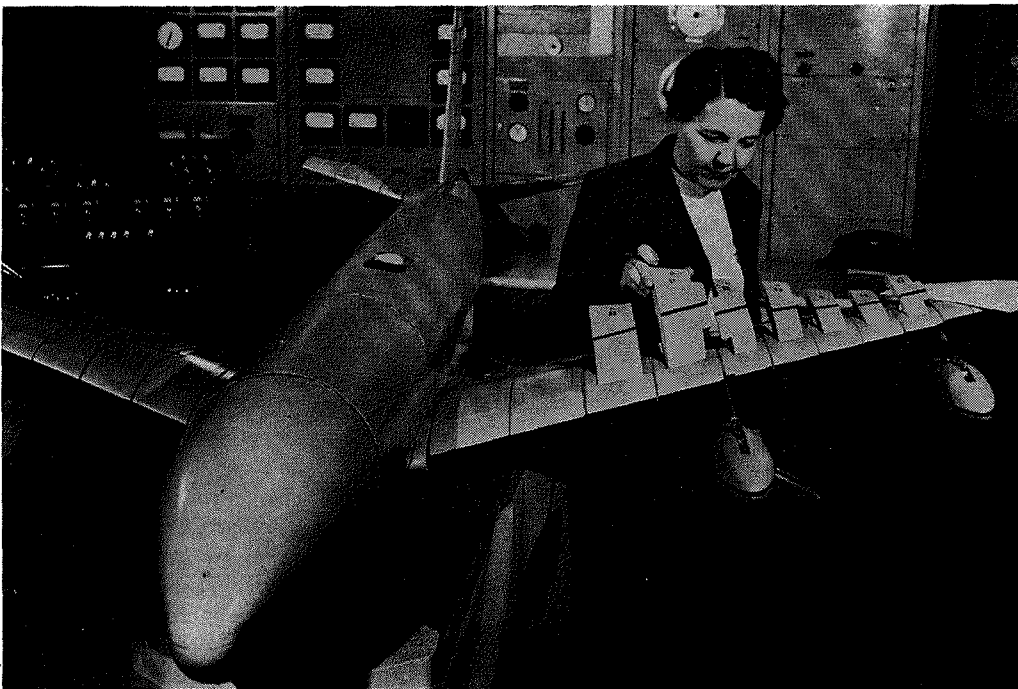
bers from the various fields of engineering and related sciences.

Engineering opportunities for women around the world vary considerably. The Soviet Union at latest count had a manpower pool of approximately 1,200,000 engineers. More than one third of them are women, despite the very vigorous education program the Soviet student is motivated to pursue. In addition to his special engineering field the student is well trained in Soviet philosophy, Russian history, his own and foreign languages, and economics. The engineer is a person with prestige and status in the Soviet Union—far more than his counterpart in the United States, and therefore the profession is a desirable one, even for women. The Government encourages them and supports married professionals with liberal investment in childcare and maternity benefits. Also the heavy losses of men during World War II and the expanding labor requirements of a growing industrial economy have made it necessary for women engineers and scientists to support their male counterparts in their profession.

The Scandinavian countries follow the Soviet Union with women making up 11.2 per cent of the engineering manpower force in Finland, 9.8 per cent in Norway, and 9.4 per cent in Sweden.

In Central and Southern Europe as well as in Great Britain the number of women in engineering is still below 1 per cent. Women are accepted, not without skepticism, but are not at all asked or encouraged to enter the engineering field. However, those who choose engineering as a career are admitted to technical schools, universities, and polytechnic institutes, in all European countries, on equal terms with men. Access to industry, though, does not seem to be equal for men and women. There are no women engineers on boards of large companies, and a woman has to be much better than her male colleague to obtain equal recognition.

In the Middle Eastern countries, where education of girls is still in an early stage, enrollment of women in engineering colleges is as



Miss Elizabeth Plunkett, a research engineer with the Boeing Company, is one of the 700 women successfully employed in aircraft research, aeronautical control, and aircraft manufacturing.

THE LATEST COUNT OF THE U.S. CENSUS BUREAU SHOWS THESE NUMBERS OF WOMEN ENGINEERS EMPLOYED IN THE UNITED STATES



| | |
|----------------------------------|-------------|
| AERONAUTICAL | 778 |
| CHEMICAL | 542 |
| CIVIL | 700 |
| ELECTRICAL AND ELECTRONICS | 1561 |
| INDUSTRIAL | 2266 |
| MECHANICAL | 557 |
| METALLURGICAL | 279 |
| MINING | 21 |
| SALES | 101 |
| UNCLASSIFIED | 726 |
| TOTAL | 7531 |

TOTAL MALE ENGINEERS AT THE SAME CENSUS COUNT 852,016

high as 9.5 per cent, and the number is rising steadily. Women engineers work in governmental agencies, in mining, oil, atomic research, and teach at universities. They are very well received by their fellow engineers, and work on equal terms with them in their respective fields.

Women engineers can be found in all countries of South America, with 150 of them registered in Buenos Aires alone. Out of 1400 engineering students in that city, 57 are girls. But the standards of the South American society do not permit a married woman to work, and therefore the turnover is very high and her chance to attain a high position is quite small.

There are eight women engineers in Australia, and two women are enrolled in engineering colleges in New Zealand. Africa so far has no women engineers, although women do go to engineering colleges. As of yet they study domestic sciences and learn to assist men in the practical work. But as the social and educational pattern of these countries evolves, women will not be new in engineering colleges, and they will be

used to sharing the working places with men.

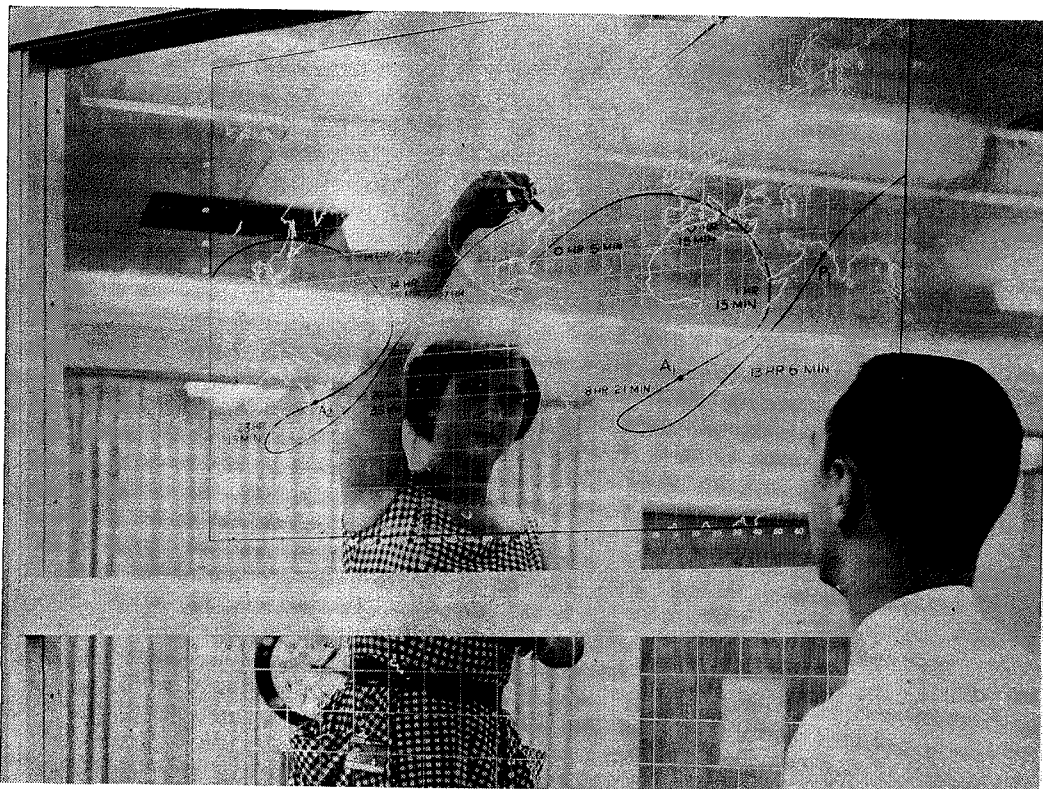
This survey of the various countries shows that in the territories where engineers are most needed, women are welcome to work with the men, and they do the same jobs their male counterparts do.

In their own words they make working conditions more pleasant for the men, and they are proud to help in the development of their country.

In this country or in any other place on earth, should young girls be encouraged to go into engineering? Yes! If the girl has the necessary aptitudes, the necessary interest and enough courage to join the very few of her kind, then she should go ahead and study engineering. But she should well consider the field of engineering she wants to study, and make sure that opportunities for employment in her field are available without relocation. She should choose a field in which a woman is physically at ease. She has to have enough courage to get along with those who single her out as an "oddball" and as a "loner" in her work. In the words of Miss Aileen Cavanagh, past president of SWE, we should not attempt a mass conversion, just because the Soviet Union is so far ahead of us in the employment of women engineers.

"I don't think that this could be done given present social mores," she said. "We have our own cultural values and family oriented ways to which we should be true. We still want all our career pro-

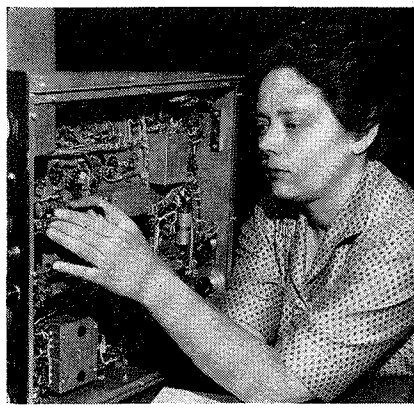
Mrs. Sylvia Marcus, of Space Technology Laboratories, Inc., is tracking a missile over North America in the Laboratory's Scanning Center.



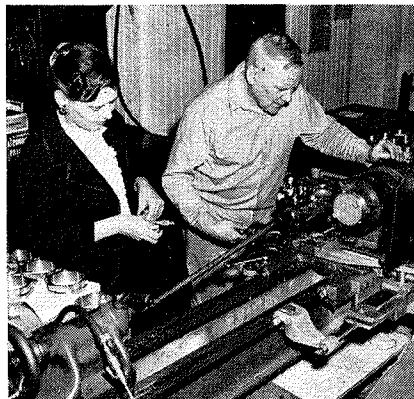


professionals, both men and women, to enter engineering, because it is what they themselves want to do with their life energies. Our concern is that engineering aptitudes and interests be cultivated and allowed to develop in any girl possessing them. And if she goes on voluntarily to prove her capabilities through scholastic achievements, she should have as fair an opportunity as do her male colleagues and fellow students to find career fulfillment in her chosen profession. In any case a girl must have the necessary aptitude and interests for success, and I would warn away all those who do not."

Despite the difficulty a newly graduated woman engineer encounters when seeking an opportunity for professional success and personal satisfaction in a specialization where men have always predominated, she will continue to encourage young girls to join her small group. She will get little support and no encouragement. Engineers will have to join the small number of women in other professions considered relatively unusual for them, such as architecture, geology, the ministry and the law, to help broaden occupational opportunities for themselves in the professions. These women themselves will have to continue, for some time to come, to bear the major responsibility for development of equal opportunity in their fields. They will have to spend much effort and time to go out and reach the young girls in high schools and colleges to tell them about the merits and enjoyment of their re-



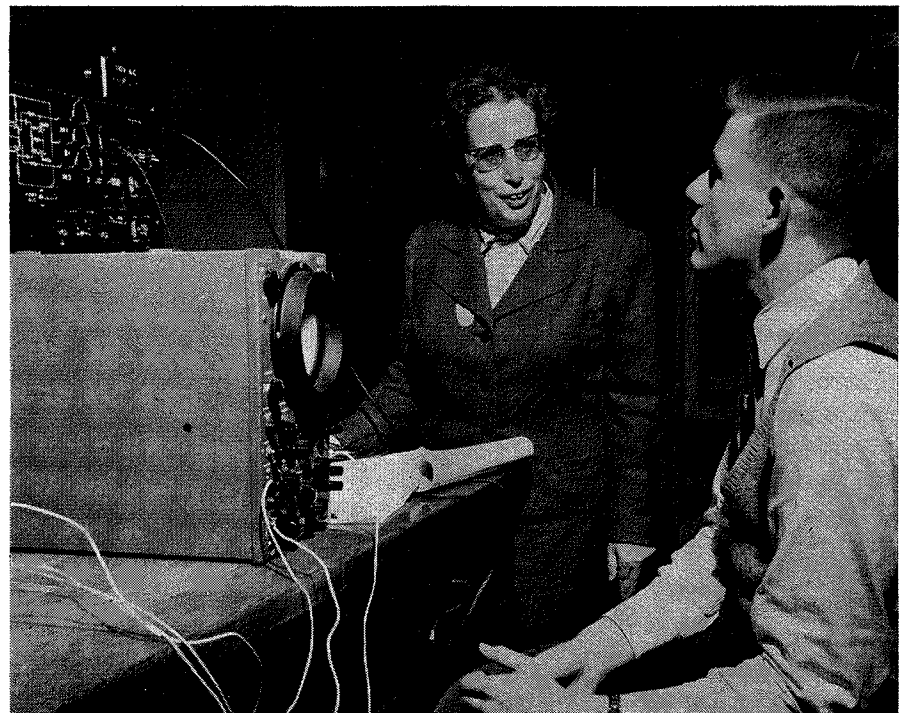
Marian Arven, research engineer at Pacific Telephone-Northwest, working on transmission measuring set.



An engineer as dedicated to the progress of her own firm as to the advancement of women in the engineering fields: Dr. Beatrice Hicks.

spective professions. Women engineers in this country are outstanding enough to carry out this difficult task.

To study the world-wide need for women to enter engineering and to investigate the problems common to women in scientific and engineering work, the Society of Women Engineers recently invited professional women from around the world to the First International Conference of Women Engineers and Scientists, in New York City. Representatives from Western and Eastern Europe, South America, the Middle and Far East, Japan, Australia, and the U.S. read and heard papers on the need for highly trained engineers and scientists and on their role in providing the basic human needs for a better society. During technical sessions papers were presented on supply and delivery of food and water, shelter and clothing, on raising living standards through heat, light, power, communication, transportation, environment protection, and space exploration. The visitors toured the World's Fair and visited industrial firms and research centers in New York.—End



Professor Cecily Froehlich instructs students in the electrical engineering department of the City College of New York.

A MERICAN WOMEN, in small but increasing numbers, have been distinguishing themselves as engineers.

Although women had entered all branches of engineering by the early 1900's and had won both academic and professional honors, it has not been until recent years that their numbers have become significant. The number of employed women engineers jumped from less than 750 in 1940 to approximately 6,500 in 1950, probably as a result of women's tremendous response to the needs of the economy during World War II. Women during that period showed not only their interest in, but their capacity for, employment in this traditionally men's field, and established themselves as a permanent part of the nation's human resources in engineering.

Although approximately one-half of the women engineers in 1950 were employed in civil and electrical engineering, two of the largest engineering occupations, they were represented also in the other branches. Civil engineering employed about 30 per cent of all women engineers, electrical engineering about 20 per cent, and chemical engineering about 10 per cent. Mechanical and industrial engineering attracted the next largest number of women with the remaining number divided about equally between metallurgical and mining engineering, and aeronautical engineering.

The persistent idea that engineering was a hard and rough occupational field and, therefore unsuitable for women has been successfully refuted by the variety of work



August 1959

Greater Use of a Great Potential

Women in Engineering

By

ALICE K. LEOPOLD

Assistant to the Secretary of Labor and Director of the Women's Bureau, U.S. Department of Labor.



Mrs. Leopold

women have undertaken in this field. While they have been attracted mainly to the design, development and research functions, they have found rewarding employment in many others. Of some 400 women engineers responding to a survey conducted cooperatively by the Society of Women Engineers and the Women's Bureau a few years ago, almost sixty per cent were employed in activities related to designing (33 per cent), development (15 per cent), and research (11 per cent). In addition to the roughly eight per cent employed in each of such functions as technical writing and/or editing, and management, four per cent were teaching or employed in job training; three per cent in production and/or quality control, and the rest in miscellaneous other functions.

Many of the contributions made by outstanding women engineers are already widely known, but some of their accomplishments deserve emphasis at the risk of repetition at a time when an awareness of the great potential they repre-

sent is so essential. The impact made by internationally known Dr. Lillian Gilbreth is common knowledge, but the total impressive story of women engineers must be pieced together from many sources, including newspaper and magazine stories, the biographical sketches of some seventy-five women engineers in the first edition of *Who's Who of American Women* and personal contacts with some of the women themselves.

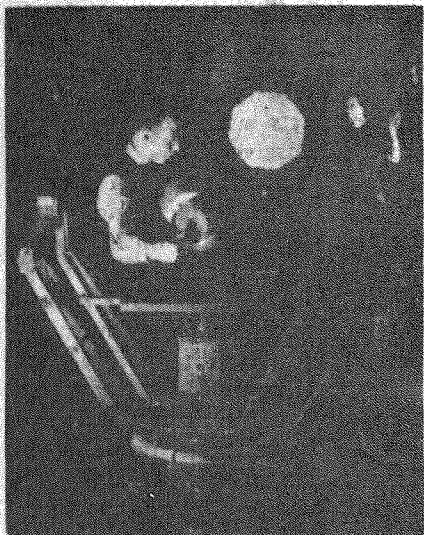
It is apparent from even a cursory review that women engineers have made their mark on highway construction, on communications equipment, on electronics development, on aeronautical improvements, and on satellite, rocket and missile progress—to list a few areas which amply illustrate the diversity of their interests and efforts. Women engineers, though only 1.2 per cent of the profession, have been chosen as delegates and conferees to international congresses and conferences because of their recognized leadership.

A few brief sketches of individual accomplishments may be



This woman engineer, Miss Emma Barth, is checking the construction of a generator which she designed. She attended evening classes for seven years to earn her engineering degree.

more meaningful in highlighting achievements of women engineers than a long recital of honors, awards, and contributions. There is the story of one able and highly motivated woman who was originally refused admission to the engineering school of her home state, who did not take "no" for an answer, but enrolled elsewhere, completed two years of work in



A former science teacher and co-author of several articles in the field of residence lighting, this woman engineer heads a commercial engineering laboratory.

one, and returned—this time to be admitted. Obtaining a position in the Federal Government, her work performance has been such that she has for some time headed the specifications staff in the Aircraft Engineering Division of the Civil Aeronautics Administration.

ANOTHER interesting story is that of a young electrical engineer who embarked on an engineering career with her bachelor's degree at age twenty-one, skillfully combined her profession with marriage and motherhood, and has helped develop improved sonar displays and techniques applicable to anti-submarine warfare.

Still another story is that of an engineer who as a girl reportedly took apart all the clocks in the house and put them back together again to run better than they did before. Having demonstrated her capacity in mathematics, economics, and physics as an undergraduate she went on to earn her master's degree and her doctorate, and then achieved the rank of associate professor. She was lecturer in mathematics in several universities, and conducted university research in electromechanics on contract with the Government. She was later sought out by a nationally known firm to develop and direct its programming for electronic computers in which work she has become an expert.

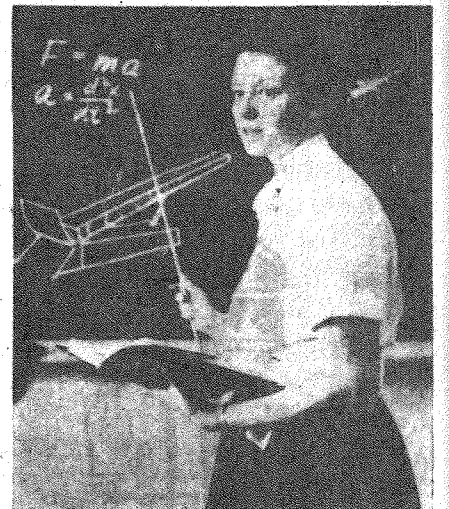
Another example of success in a different field is that of a renowned scientist-engineer who has become a project director in a recognized college of engineering and a world authority on solar energy research. In 1952 she received an award by the Society of Women Engineers as "Outstanding Woman Engineer of the Year." Her successes include such developments as solar stills for life rafts and solar heating equipment for houses.

Equally interesting stories could be told of many more such notable women including that of a chemical engineer, holder of a Master of Science degree from an institute of engineering and employed as an engineer by a large automotive corporation, whose professional growth and activity in many scien-

tific, engineering and honorary organizations have brought her recognition as one of her city's "Women of Achievement;" or a supervisory mathematician in a naval computer division, or still others who helped develop rockets and launching mechanisms for guided missiles.

The influence of women engineers can be found in basic metals, steel, concrete, architecture, shipbuilding, railroads, bridges, automotive equipment, industrial machinery, heating and refrigerating equipment, electronics equipment, household appliances and equipment and many more products essential to our security and our standard of living. The foregoing examples, however, are sufficient to suggest the versatility and diversity of available talent and competence.

Interest in women engineers and in their contribution to economic progress and higher standards of living has become world-wide. During the past year the United Nations Commission on the Status of Women reviewed the participation of women in engineering, architecture, and law throughout the world. Replies to their questionnaire were received from approximately forty countries. Although unqualified comparisons of the data were difficult, a few telling facts were quite clear. We know, of course, of the emphasis placed

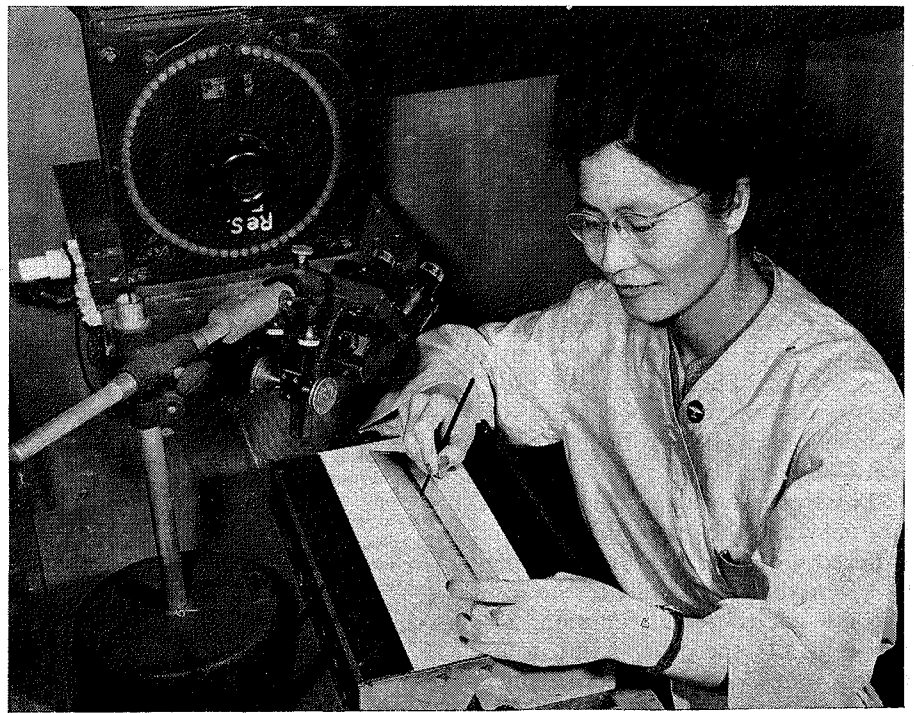


This rocket engineer is in charge of twenty-three draftsmen and engineers who are working on a launching system for short-range interceptor missiles.

upon engineering and the sciences in Soviet Russia and on the active participation there of women in large numbers in these professions.

It is, therefore, not surprising that the one fact which stood out above all others was the far higher percentages of women among the engineers in not only the Soviet Union, but also Poland and Czechoslovakia, than in the other European countries or in the United States and Canada. Another impressive fact was that there are women engineers the world over—in Asia; in the Orient; in South America; in small countries, like Thailand and Korea, as well as in large countries, and in basically agricultural countries, like Australia and Argentina, as well as in the highly industrialized countries of the world. An interesting item in point is that two women from Madagascar were studying aeronautical engineering at the time of the report. The third unmistakable fact was that many countries have higher percentages of women among their engineers than the United States.

THE replies indicate that women generally have equality under the law in access to professional training in the reporting countries. Reports from most of the countries stated that equality exists also in actual practice, although two countries reported that preference is given to male candidates when educational facilities are inadequate to accommodate all candidates. Fewer replies, however, indicated that in actual practice women have equal access with men to employment in engineering positions. Some reports indicated that only a few women, or no women had qualified as engineers or demonstrated such ability. Reports from approximately one-fourth of the countries stated that women engineers encountered opposition and prejudice when seeking employment and that men were frequently given preference for traditional reasons. The International Federation of University Women reported in their reply that "in most countries, girls are not attracted or are not encouraged to take up engineering, and the British Association's opinion that



Mrs. Chung Kwai Lui Wei was the first engineer to make an electroluminescent lamp at a large industrial laboratory—Westinghouse Lamp Research Labs in Bloomfield, N.J.

'only those who are really keen will make the effort against discouragement from parents and teachers' could probably apply to a great number of countries."

In the United States, we have been alerted as a nation to the need for many more highly trained skilled scientists and engineers than we have ever before thought necessary. We recognize also the need for more thoroughly and competently trained supporting personnel to utilize more effectively highly trained creative specialists.

Many leaders keenly aware of our needs are calling attention to the potential engineering talent of our womanpower resources. At a conference of employers and educators held at Bryn Mawr College in 1954, the numbers concluded that "Women, judged on the basis of ability and performance, have shown themselves to be capable of holding important positions in research, development, and the application of science."

The President's Committee on Scientists and Engineers stated in October, 1957, that "Obviously, steps must be taken to break down

employment barriers to women in science, engineering, and the technician fields. . . . Long established prejudices against women in engineering and science need to be broken down, not only among employers, supervisors, and co-workers, but among the women themselves."

Successful efforts to increase women's participation in engineering must include the motivation of more women to train for the field and the assurance of opportunities to utilize such training.

A review of statistics on engineering enrollments and degrees suggests that women in the United States have hardly begun to take advantage of the training opportunities open to them. We know that most publicly supported institutions admit both men and women to all courses of study. Also, of the 153 institutions accredited by the Engineers' Council for Professional Development in 1958, most are coeducational. Moreover, cooperative engineering programs are open to women as well as to men, and men's schools admit women to graduate courses.

The total number of women enrolled in engineering degree-granting institutions, however, is relatively small. The United States Department of Health, Education, and Welfare, Office of Education, reports that of the 289,680 total men and women students enrolled for resident or extension course study toward an engineering degree in the fall of 1958, only 1,718 (slightly over half of one per cent) were women. These 1,718 were only one-tenth of one per cent of women's total 1958 college enrollment of 1,148,130.

Total engineering enrollments in 1958 for both men and women suffered a decline for the first time in seven years; for women, the loss was 3.6 per cent and for men, 2.5 per cent. On the other hand, total college enrollments for both men and women reached all-time highs in 1958—for women a gain of 7.8 per cent over the previous year and for men, a gain of 5.3 per cent. Whereas women's total college enrollment in 1958 rose relatively higher than that of men, their total engineering enrollment fell relatively lower.

The number of engineering degrees conferred on both men and women rose at all levels in 1957-58. However, of the 41,767 conferred, only 133 were earned by women. The major branches of engineering in which degrees were conferred upon women included chemical

Engineering Enrollment of Women, Fall, 1958

| Engineering Curriculum | First Degree | Master's Degree | Doctor's Degree |
|-------------------------------|--------------|-----------------|-----------------|
| Total | 1,583 | 111 | 24 |
| Aeronautical | 48 | 6 | 1 |
| Agricultural | 4 | 0 | 0 |
| Architectural | 48 | 0 | 0 |
| Ceramic | 25 | 4 | 1 |
| Chemical | 270 | 20 | 1 |
| Civil | 138 | 8 | 4 |
| Electrical | 243 | 23 | 4 |
| Engineering mechanics | 2 | 1 | 0 |
| Engineering physics | 28 | 2 | 1 |
| General engineering | 49 | 6 | 0 |
| Geological | 6 | 0 | 0 |
| Geophysical | 2 | 0 | 0 |
| Industrial | 36 | 5 | 1 |
| Mechanical | 160 | 7 | 3 |
| Metallurgical | 16 | 5 | 1 |
| Mining | 2 | 0 | 0 |
| Naval architecture and marine | 3 | 0 | 0 |
| Petroleum | 10 | 1 | 0 |
| Sanitary | 0 | 4 | 2 |
| Textile | 6 | 1 | 0 |
| Unclassified | 427 | 13 | 0 |
| Other | 56 | 5 | 5 |

engineering, with a total of 27 degrees; electrical with 25; mechanical with 19, and civil engineering with 14.

The reasons behind these figures are manifold, but assurance of suitable employment opportunities and knowledge of their existence can be strong factors in influencing more women students with the required abilities to study for engineering professions.

Despite the recent slight decline in enrollment the long term trend in numbers of women engineers has been definitely upward, characterized by sharper increases at cer-

tain times than others. American women can be counted on to respond to today's demands as they have done in the past in times of national emergency. Increasing participation on their part is inevitable as our labor force expands to produce the goods and services needed for our growing population as well as our national security. The Women's Bureau of the United States Department of Labor urges no special privileges for women but opportunities for them to use their talents and abilities fully to serve our national goals.

—End.




The transmission loss on various types of telephone calls is being demonstrated by Mary Murphy, supervising engineer with the Illinois Bell Telephone Company.




The national president of the Society of Women Engineers, Miss Catherine Eiden, is working on cost studies for a telephone company. She also teaches engineering economics to her fellow workers.



Engineers are getting prettier. Barbara Beckmann was the first woman to receive a chemical engineering degree from the University of Mississippi in 1961. Today Mrs. Beckmann is in the operations research group at Humble's refinery in Baton Rouge, La. Her job: to assist colleague engineers in the use of all computer programs relating to process engineering and mechanical engineering calculations. Women in technical fields are becoming less of a rarity, thanks in part to the efforts of such organizations as the Society of Women Engineers. For that story, see pp 10-11.



Society of Women Engineers



"Adults ask little boys what they want to do when they grow up. They ask little girls where they got that pretty dress."

So speaks the president of a women's college in emphasizing the hard road that young women must walk if they seek professional careers.

"When I was a little girl, I opened my dolls to see what made the crying."

So speaks a woman engineer from Brazil who walked the road successfully.

Because it is the biological nature of the female sex to bear children, many brainy women forsake such intellectual arenas as the law, medicine, engineering and the physical sciences. They trade in the career aspirations of their youth for the satisfactions of motherhood or else they settle for less taxing jobs in offices and factories. And talents they sharpened in the classroom grow rusty.

The Society of Women Engineers, an organization whose members prove that slide rules and baby carriages can and do mix, is trying to do something about the natural siphoning off of all this brainpower.

There are 25 million working women in the U. S., a third of them married, but the ranks of women engineers are disappointingly thin, the society feels. As of the last census, men engineers outnumbered women engineers 852,016 to 7,531.

In Russia, by contrast, more than 30 per cent of all engineers are women.

The society's information programs are designed to encourage qualified young women to enter the field of engineering and to equip themselves to return to it in

their later married years when they're no longer needed as full-time mothers.

It was World War II that gave American women a vigorous push into technology. Girls with a knack for mathematics were drafted as engineering aides when the men went off to fight. The ladies found they liked the work, and after the war many of them went back to school to qualify themselves as full-fledged engineers.

By the end of the '40s, there were enough women in engineering to support organizations in Philadelphia and New York. These two groups led to the formation in 1950 of the Society of Women Engineers. Now headquartered in Manhattan's United Engineering Center, the society has more than 700 members in 16 regional sections around the country. There are also a handful of foreign members plus student sections in 17 universities.

The society carries out a number of projects to inform young women, their parents, counselors and the general public of the qualifications of women engineers and the opportunities open to them. At the same time, it encourages women already in the field to attain high levels of educational and professional achievement.

Under way at the moment are a survey of students, with data on enrollment and drop-out trends over the past eight years, and the compilation of a directory of women engineering graduates in the U. S. and Canada, pinpointing how they have fared since graduation.

An earlier study of women in the field produced this profile of the typical woman engineer: She's 36 years old and equally likely to be married or single. If married, she has three children. She works in industry and



Beatrice Hicks is president and engineering director of Newark Controls Company in Bloomfield, N.J. Inventor of the gas density switch, a key component in systems using artificial atmospheres, Mrs. Hicks has pioneered in the design, development and manufacture of gas density and pressure controls for aircraft and missiles.



Laurel Roennau, who once worked as an airplane mechanic, earned the society's award for studies in space biology carried out as a member of the guided missile research division of Space Technology Laboratories, Inc. Mother of two young sons, Mrs. Roennau now serves on the board of commissioners responsible for Los Angeles' airports.



Laurence Pellier was cited by the society for her work in the field of metallurgical engineering. Mrs. Pellier works as a research metallurgist in Norwalk, Conn., for the Burndy Corporation, a manufacturer of electrical connectors with plants here and abroad. The research laboratory is currently active in the study of surface phenomena.



Grace Hopper, a mathematician, is known for her original work in computer programming. During World War II she developed operating programs for the first automatically-sequenced digital computer, forerunner of the electronic computer. Dr. Hopper is a staff scientist with the Univac division of Sperry Rand Corporation in Philadelphia.

earns a median salary of \$9,500 a year. A college graduate, she has done some graduate work.

Three coveted awards are given by the society each year. One is an "Achievement" plaque that goes to a woman who has made a significant contribution to engineering. Another is a \$500 scholarship for an outstanding engineering student in her sophomore or junior year at college. Third is a \$100 "E" Bond for the best engineering-oriented exhibit entered by a girl in international Science Fair competition.

Last June, the society made its biggest public splash to date by sponsoring the First International Conference of Women Engineers and Scientists. More than 530 delegates traveled to Manhattan from 50 states and 37 countries abroad to discuss the world-wide need for technically-trained "womanpower" and to explore the problems that women in technical work face.

Lillian M. Gilbreth, the famous mother in "Cheaper by the Dozen," was the keynote speaker. Now 86, with 28 grandchildren and 10 great-grandchildren, Dr. Gilbreth is still president of her own industrial engineering and management consultant firm.

The conference was so successful the second one has already been planned. It will take place at England's Cambridge University in 1967.

Isabelle French, a technical editor with Bell Telephone Labs at Allentown, Pa., is 1964-65 president of the society. She succeeded another Bell engineer, Aileen Cavanagh of Whippany, N. J.

Miss French was the first woman to receive a B.S. in radio engineering from Indiana's Tri-State College. That was in 1944. She later did graduate work in physics and electrical engineering at Boston and Northeastern universities.

Vice-president is Alice Morgan, a design engineer with Douglas Aircraft's missiles and space division in Huntington Beach, Cal. Secretary is Lydia I. Pickup, an engineering designer with The Boeing Company in New Orleans. Treasurer is Beatrice M. Williams, a design draftsman with Lockheed-California in Burbank.

Members of the governing executive committee are Elaine Brower, a staff engineer with Chrysler's space division in New Orleans; Barbara Fox, a sanitary engineer with the City of Chicago's water safety control department; Olive Salembier, president of Specifications Packaging Engineering Company in Phoenix, Ariz.; Mary L. Wolf, a senior engineer with Westinghouse's air arm division in Baltimore, and Betty J. Yost, an engineering section leader with Ledex, Inc. in Dayton, Ohio.

Pittsburgh paper
April, 1962

Challenges Cited

Engineers Figure On Adding Women

Future Bright For Them In Profession, Research Head Tells Group At Pitt

By RALPH BREM

Women will have to engineer their impact on the future by themselves, Harold B. Maynard, president of the Maynard Research Council, told a women's engineering group here.

He spoke last night at the Women in Professional Engineering conference dinner at the University of Pittsburgh.

Contrary to popular belief, he said, prejudices toward women engineers are not numerous or deep seated, but women have to be shown how vital and challenging the work can be.

"They, themselves, must formulate the role they will play in the future," Mr. Maynard said, "for in the last analysis no one can do it for them."

He said that was up to the women already in engineering to show the way. Not just the working engineers, but the wives of engineers and women in education.

He said many young women today have mistaken notions about engineering, that they will have to study unusually long and hard, that they will be "odd balls" if they try to enter a male field and that men will discriminate against them on hiring.

"There is a certain amount

of truth in these and other negative considerations, but when did a few difficulties ever stop a woman once she had made up her mind about what she wanted," he said.

He said that's why women in engineering must make the "exciting image of engineering" so challenging that students "will not be deterred by any real or imagined obstacles from reaching their goal."

Mr. Maynard said such recruiting was necessary in this country because the Russians are telling their young people what jobs to take and this means a lot of Red women are being sent into engineering.

Thus, in the future, as they make use of this talent the scales of technological advances will tip in the Russians' favor because of engineering woman power.

"Our own statistics are most disheartening," he said. "Actually enrollment in en-

gineering schools has been declining during the past several years."

Mr. Maynard said the more glamorous fields of science space technology, computers and the like have mushroomed, luring potential engineering students away.

"The boundless engineering-

science resources of the present and the future offer mankind new opportunities, new choices and new responsibilities," he declared.

The fact relatively few women engineers are employed in most western countries appears to be more a matter of their nonavailability than anything else," he said.

The conference closes today.

Chicago Sunday Tribune 6-24-62

Space Careers Stir Interest of Girls, Too

Teen-age boys don't have a monopoly on the desire to work in the United States' space program as planners or astronauts.

Thirty of their feminine counterparts, who were guests yesterday of the National Society of Women Engineers, agreed that recent space achievements have stirred the imagination and interest of girls as well as boys.

Eyes Space Planning

"I think I would choose the planning end of space technology, but the idea of being an astronaut is an exciting one," said Natalie Cordes, 16, of 407 Martin dr., Crown Point, a senior at Andean High school, Gary.

The girls, all superior students, were invited to the society's session at the Illinois Institute of Technology to learn about careers for women in engineering.

Natalie said she felt discussion of space engineering was particularly interesting to the young women.

"It means the opening of an entirely new field when so many others are filling up today," she said.

One of the major projects of the women engineers is to spread career information. They won a disciple in one of yesterday's guests, who was there almost by accident.

Linda Bothwell, 17, of Brecksville, O., went to the session because her cousin, Carol Bothwell, 15, of 1024 E. 50th st., whom she is visiting, was planning to be there and asked her to go along.

Plans to Tell Counselor

"I didn't realize there are so many new careers open to women. I'm going to tell my high school counselor about the job opportunities I've heard about today," said Linda.

Carol, who attends the University of Chicago High school, was most interested in learning about the new space age uses of engineering.

Mathematics is her special interest and she finds the idea of working in the space program—as a planner or traveler—intriguing, she said.

Jane Ryan, 16, of 630 McKinley av., Gary, a student at Andean High school, whose father is a physician, said she found discussion of uses of engineering in medicine particularly interesting.

None of the girls said they would hesitate to seek an engineering career because of the predominance of men in the field.

"That just makes it more of a challenge," said one.



MARCIA NEUGEBAUER

AP Wirephoto

... space scientist

Blonde Illini In Vital Space Role

PASADENA, Calif. (P)—Guess who's worried about solar winds? A blonde named Marcia, that's who.

Ranger I — An unmanned space explorer—is poised to

blast off from Cape Canaveral.

One of the instrument assemblies aboard is called an electrostatic analyzer. One of its jobs is to probe solar winds.

That's where Marcia Neugebauer comes in.

"I'm a co-experimenter with the electrostatic analyzer," says Marcia, 28. She looks like a well-scrubbed, freckle-faced college freshman. But she's a senior scientist who is among the key personnel responsible for Ranger's complex machinery.

Marcia works at the California University of Technology's Jet Propulsion Laboratory here. She is in charge of coordinating the various experiments being performed by instruments on Ranger.

"I'm the only one that worries about the scientific aspects all together," she said.

She said it's up to her division—the division of the space sciences at JPL — to determine where the scientific instruments are placed in the spacecraft and how often a reading is taken from each.

Marcia received a bachelor of arts degree in physics from Cornell University in 1954 and master of science degree, also in physics, from the University of Illinois two years later.

She is married to Dr. Gerry Neugebauer, 28, JPL project scientist for Mariner B, a proposed 1964 unmanned expedition to Mars. The couple, who met at Cornell and have been married for five years, live in Altadena.

The News-Gazette
Women

WEDNESDAY, FEBRUARY 3, 1965.

PAGE NINE

Blasts Prejudice Against Women In Science Field

SAN FRANCISCO (UPI) — Evelyn Harrison, one of 2,000 women who have earned engineering degrees in U. S. colleges and universities, believes there is prejudice against women in scientific fields in this country.

Miss Harrison, one of the highest ranking women in Federal Civil Service, is deputy director of the Civil Service Commission programs and standards bureau.

The blue-eyed brunette, also alternate member of the Interdepartmental Committee on the Status of Women, said that "some of us are concerned about the posture of women in the scientific community."

"It is not up to European standards. We must do something in this country to change the idea that science careers aren't feminine."

She deplores the situation of a girl topping her high school class in mathematics and, after counselling, ends up majoring in home economics or liberal arts.

"We must look at this from the point of the nation's needs for human resources as well as from the right of the individual.

"We don't suggest that all women work, but if a woman chooses to, she should have the same rights and obligations on that job as a man."

At an international conference of women, she found that only 2,000 American women had been graduated as engineers.

"There are 390,000 women engineers in the Soviet Union and 180,000 women scientists. In Great Britain, a woman heads the top nuclear physics group. In India, a woman directs the rural electrification project."

DEMAND FOR ENGINEERING GRADS HIGH

*Champaign News-Gazette
June, 1962*

By Commencement Day only

seven of 278 June graduates from University of Illinois College of Engineering remained available for jobs, according to report by Mrs. Pauline V. Chapman, college placement officer.

For 157 going directly to work, salaries average \$576.60 a month, \$27.47 more than a year ago.

Seventy-four graduates will continue studies for advanced degrees, 63 in engineering, eight in business administration, and three in law. Twenty-nine are headed for the armed services.

Top average salaries are \$616.64 for 14 graduates in aeronautical and astronautical engineering and \$591.26 for 61 in electrical engineering.

Good grades were worth \$56 a month in starting pay. The report shows six students in top tenth of the class who took jobs will average \$606.33 compared to \$550.33 for 15 from the bottom tenth.

Fifty-four students gave location as first reason for taking a job, type of work second, opportunity third, and starting pay as sixth consideration.

Aircraft and missile industries hired 41 graduates, electronic and electrical equipment 40, automobile and heavy equipment 20.

Fifty-eight took jobs in Illi-

nois. Of these, 34 will be in Chicago. California businesses hired 40. Others went to 20 other states.

Of the 40 going to California, three aircraft firms hired 32. Douglas employed 7 aeronautical, 2 electrical, and 3 mechanical engineering graduates from

Illinois; Lockheed 4 aero, 3 electrical, and 3 mechanical graduates; North American Av-

iation 1 aero 3 electrical, 1 mechanical, and 1 metallurgical engineering graduate.

Lady Engineers

*Professional Role of Distaffers
In Highway Work Increasing*

By LOUISE GOHDES, Assistant Information Officer

California's Division of Highways employs women engineers ranging from the associate level down to junior civil engineer—and may soon have women stepping up into the ranks of senior highway engineer. A capable woman "mans" the position of personnel officer for this agency of 16,000 employees. And still other women hold responsible positions in various categories.

Far from being an innovation, this situation has existed since 1948, when Marilyn Jorgenson, with a brand new

degree in civil engineering from the University of Minnesota, received her appointment as junior civil engineer in Los Angeles. And although now the division has quite a number of women in the profession (District VII—Los Angeles, Ventura and Orange Counties—alone has eight associate and assistant engineers of the fairer sex), Marilyn has chalked up a few firsts. She was the division's first woman to become associate highway engineer, and she was the first woman squad boss in charge of a design crew.

In 1957 Marilyn became Mrs. Alvin Reece, and is now the mother of four-year-old Kirsten—blonde, like her mother. How does Mr. Reece react to his wife's being an engineer? He's proud! And he himself is an engineer—with the Los Angeles County Flood Control District.

Designs Interchanges

Back to Marilyn, and what she does. She's recently gained distinction through supervising the design of the three-level San Diego-Santa Monica Freeway Interchange, with new high-speed ramps. Both the San Diego and the Santa Monica are interstate system freeways.

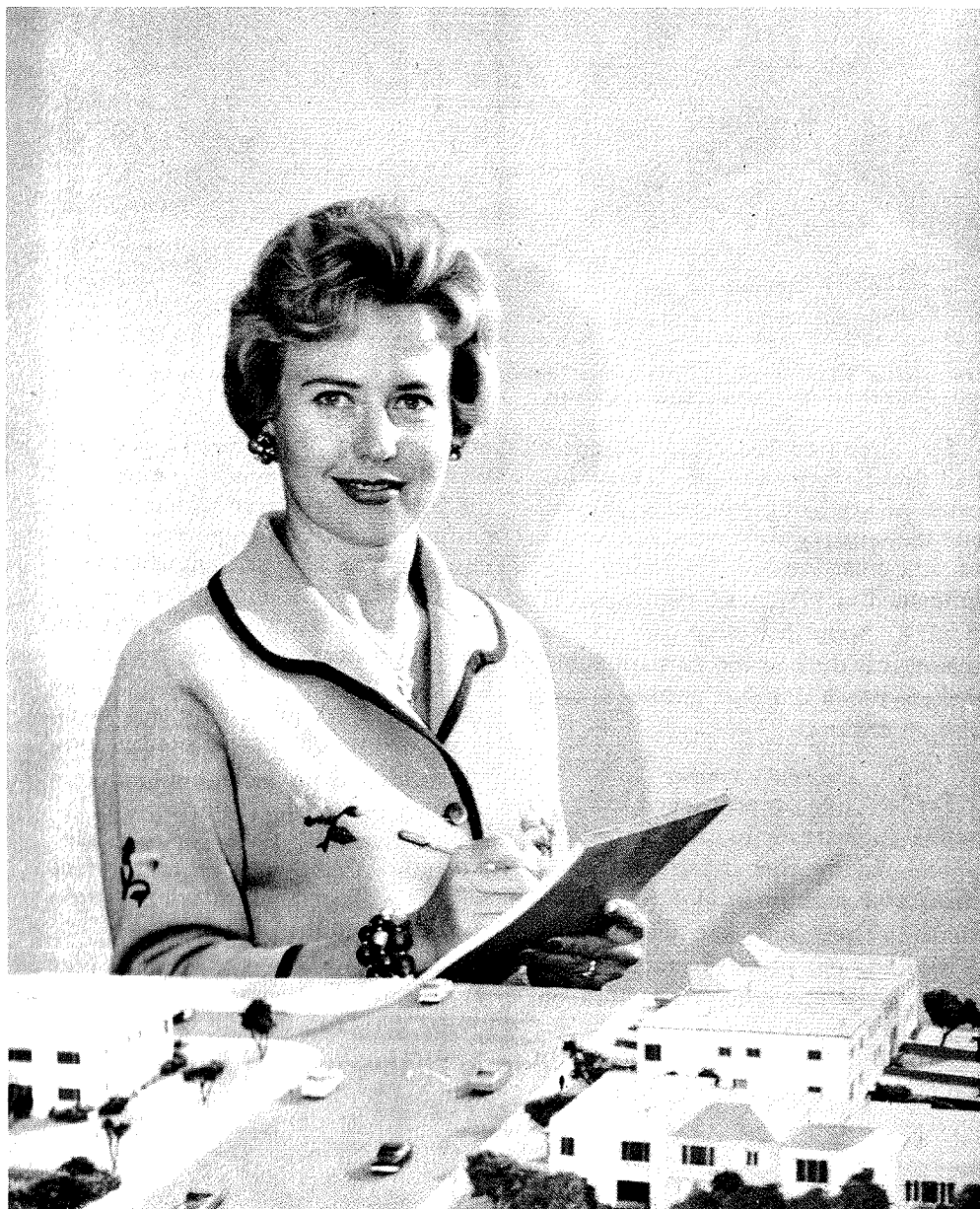
Because speed standards for on- and off-ramp traffic flow were recently upgraded, Marilyn reworked angles of curve radii to accommodate speeds of 50-55 miles per hour. This was only one of many changes with which she had to deal as new specifications were developed. She says that the present design was finally approved 2 years—and 30 preliminary plans—after the project was originally assigned to her.

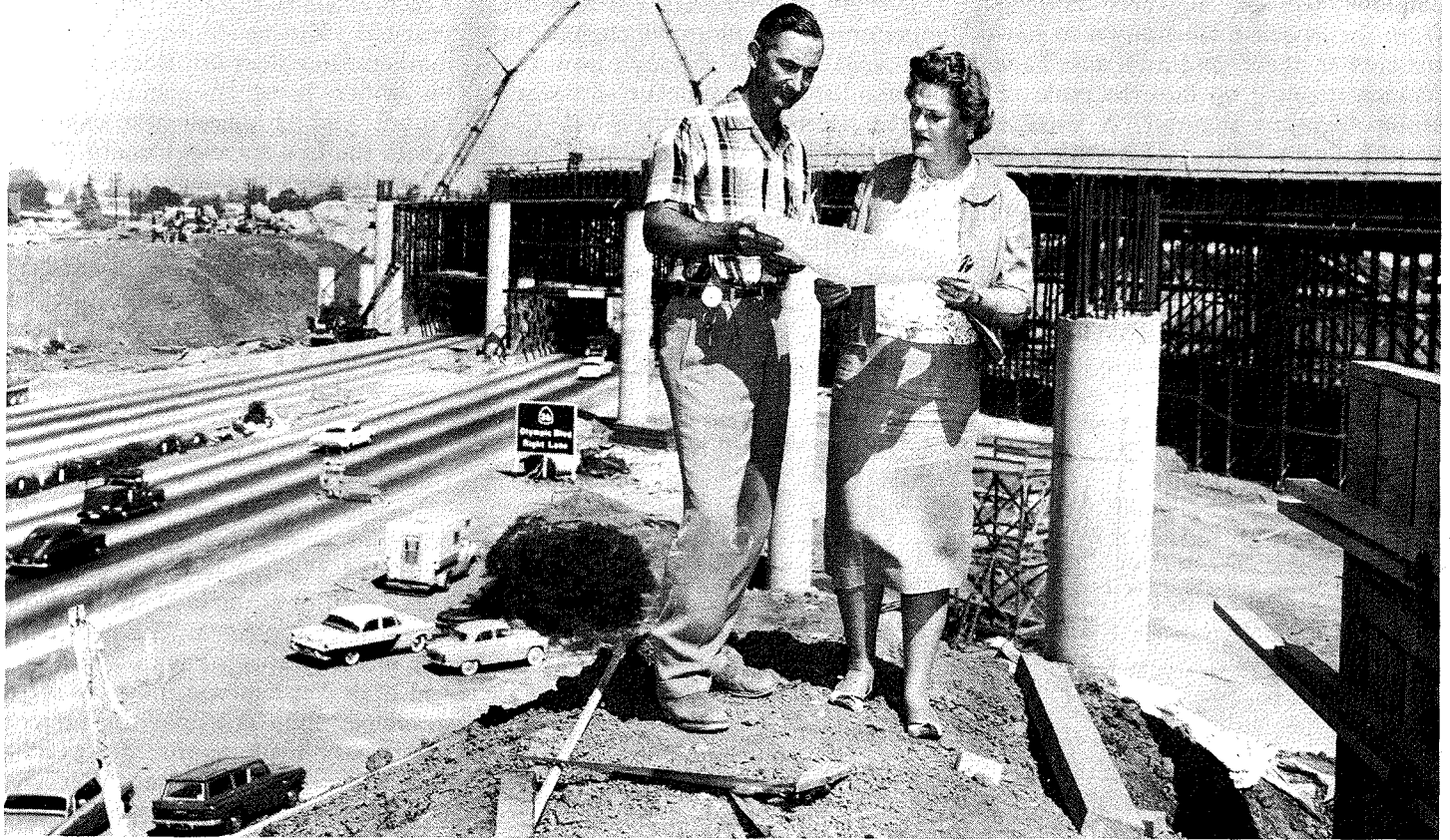
Because plans had to be drawn around a school, a church, a sanitarium, and several large apartment buildings, the design presented additional challenges. Eight people worked with her on the project. As now designed, the southbound San Diego to westbound Santa Monica link of the freeway marks it as the largest single span branch connection in the state's highway system. Since acceptance, her plan has been used as a prototype of bigger and better interchanges to come.

Lifetime Work

Marilyn finds the work so interesting that she expects to stay at it "for the rest of her working days." She finds it extremely satisfying to see the fruits of her labors take form in steel and concrete. And her efforts are now bent toward advancing to senior highway engineer. She feels that women

Associate Highway Engineer Ann Hansen looks up from notes as she reviews a scale model of future District IV freeway project. Technical reports and research are a major part of her work in Traffic Engineering.





Associate Highway Engineer Marilyn Reece, who supervised design of 3-level San Diego-Santa Monica Freeway Interchange in Los Angeles, has on-site discussion with Assistant Resident Engineer Thomas McKinley.

have a definite advantage in the field of engineering, and, says she, "if there's any prejudice toward women, I've not encountered it. Men have always been very helpful; and being a woman has never hampered me in my career."

Then there's Carol Schumaker, slender, brunette, and 32 years old. She, too, is an associate highway engineer; has been with the division for eight years, and is eligible for appointment to the position of senior highway engineer by virtue of having passed the required civil service examination. Via night classes, she's working on her master of science degree which she expects to receive by June of 1964.

Her desire to become an engineer had already formed in high school, because of her liking for math, physics, and the sciences. Following her course of study at Purdue University, she graduated in 1952, with the degree of B.S.C.E. About half way through her senior year she married Bernard Schumaker—also a Purdue graduate, and also an engineer.

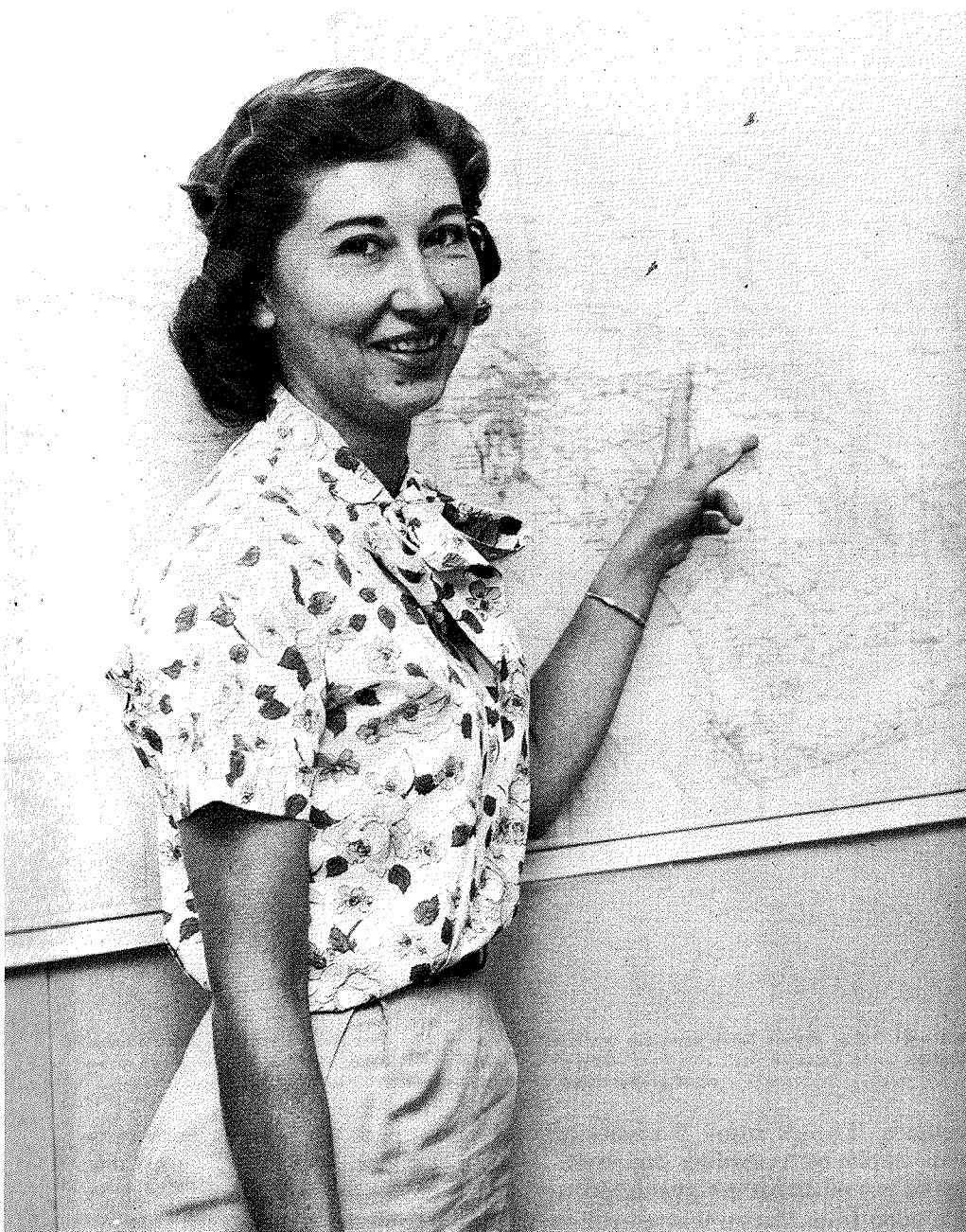
Husband a Teacher

Bernard has recently taken leave of active engineering to become a high school math teacher at Garden Grove. But Carol remains in highway work. At the present time her main project is working out plans for another segment (she's just completed work on

one segment) of the San Diego Freeway. This is a 4.8-mile section near the San Gabriel River which will incorporate several important interchanges. The biggest thing she's been involved in is the interchange of the San Gabriel, Garden Grove, and San Diego Freeways—a really big interchange near the Los Angeles-Orange county line. Although only two levels, it has many complicated connections.

Outsiders who make appointments with an engineer by the name of Schumaker invariably do a "double take" when they find themselves face to face with a 5-foot-2 miss who weighs scarcely more than 100 pounds.

The Schumakers take son Paul (age 9) on carefully planned vacation trips



Noting District VII's freeway progress, Associate Highway Engineer Carol Schumaker indicates one of the project locations in Los Angeles County. Design is Carol's present assignment, following several years each in Advance Planning and Drainage Departments.

each year. Last year, of course, it was the Seattle World's Fair.

12 Female Assistant Engineers

There are still other lady engineers in District VII. Six hold the rating of assistant highway engineer, only one civil service class below Marilyn and Carol. Other districts, too, have women in this classification—making a total of 12 women assistants throughout the State.

In San Francisco, Ann Hansen has recently returned from a leave of absence for a European tour, to reoccupy her post as associate highway engineer in District IV. She believes Italy to be

doing most in multilane highways—all toll—and mainly around Milano, which has become quite an industrial center. While in London, Ann visited the Road Research Laboratory, which is part of Britain's Department of Scientific and Industrial Research. With their staff she discussed their studies covering many phases of accidents, traffic, and safety.

Being in District IV's traffic department, Ann writes technical reports, conducts research, and analyzes data. She, too, has passed the exam for senior highway engineer, having started as junior civil engineer in 1951, just after graduation from University of

Utah. Following experience in planning and design, Ann spent 3½ years on two important construction projects: the Waldo approach to the Golden Gate Bridge, and the Marin approach to the San Rafael-Richmond Bridge. In addition to inspecting all fencing and curb work, electrical items and all utility relocation and installation, she co-ordinated work among the various utility companies, subcontractors, and prime contractor.

Skiing, Cooking, Dogs

Ann's outside interests reach in many directions, among them skiing, swimming, cooking, interior decorating . . . and dog training! She regularly gives much time to work at San Rafael General Hospital. Ann has also done a good bit of modeling—now shelved, as she prefers to concentrate her energies on her job. In connection with her interests she served as president of the Marin chapter of the National Society of Professional Engineers; and she's just applied for membership in the Society of Women Engineers—also a national organization. Also, she's applying for a higher grade in the Institute of Traffic Engineers.

Further demonstrating the effectiveness of women "in high places" is Marian Smith, personnel officer for California's Division of Highways. Having begun in highways personnel on a two-week emergency basis after her graduation from Stanford in 1941, she stayed for about a year and a half, at which time she felt her country's call to duty. For four years she served in the WAVES, attaining the rank of lieutenant. Returning to civilian status, she again found her niche in the personnel department, as personnel analyst. In 1955 she became personnel officer, and as such she supervises the personnel program for the division's 16,000 employees in 348 different classifications in 27 locations.

Busy Job

The duties of a personnel officer sound overwhelming, and almost are to the layman. Just a half-hour in Marian's office, punctuated with phone calls, gives one an idea of what comes across her desk. People call in from everywhere: throughout the

State, other state agencies, and throughout the building. There are questions involving union labor. There's the problem of a state-employed mother who would like to relocate for reasons of her children's health. There are deliberations on sick-leave interpretation. On occasion, she is a "convenient shoulder to cry on," for both supervisors and employees.

A great deal of Marian's time goes into analyzing positions, classifications, and salaries, and keeping tab on the "changing scene" to meet current personnel needs. For example, she's currently involved with the reorganization of the division's accounting department on a statewide basis, and thus dealing with both administrators and employees as to duties, workflow, and similar matters. Last year a new series of classifications for maintenance men was established, clarifying job status, and also recognizing the changing skill requirements in this field. A similar revision is in the offing for landscape workers. In 1961 a series of engineering technician classes was established.

Must Predetermine Needs

Marian must predetermine employment needs of all sections within the division, seeing that adequate eligibility lists exist, and requesting civil service exams to be scheduled as required. To keep personnel activities running smoothly throughout the State, Marian visits each of the 11 districts and the toll bridge headquarters approximately twice each year. She was 1961 chairman of the State Personnel Officers Council, which comprises personnel officers of all state agencies and meets once each month to discuss various phases of the state personnel picture.

Among Marian's many continuing responsibilities are performance appraisal programs, along with development of improved work standards and



Personnel Officer Marian Smith examines the latest Division of Highways staffing pattern, with Personnel Analysts Laura Cameron (left) and Joan Meckfessel. Charted statistics help Marian and her aides recommend proportionate staffing in various districts.

methods. There's many a discussion with employees regarding opportunities to advance. All get genuine consideration from Marian whatever their problem: funny, trying, or challenging.

Slim, Alert, Friendly

Handling all of this, and still more, the slim, alert, and friendly Miss Smith still finds time for outside activity. She's active as a Sunday School superintendent, and active also in the American Association of University Women. During vacation she travels; and has already been to the Orient, to Europe, and Central America. In 1951

Marian spent six months at Mexico City College, studying international relations and Spanish.

Of the staff of personnel analysts who aid Marian in reviewing classifications and salaries, and in similar duties, several are women. Women also hold jobs in such responsible classifications as accounting officers, professional accountants, research statisticians, delineators, and in other specialized division functions, as well as in clerical posts. All told, California's Division of Highways employs well over 2,000 women, and offers great professional opportunity.

THE ILLINOIS TECHNOGRAPH

Volume 76, Number 7

April, 1962

From The Editor's Desk . . .

Even though women have been in all branches of engineering since the early 1900's, the United States still upholds an image which makes mathematics, science, and other technical interests seem very "unladylike." High school girls shy away from technical courses and concentrate on home economics and secretarial courses, thus obtaining inadequate preparation for the study of science. As a result, a vast supply of versatile, diverse, and competent engineering talent is being wasted.

Social customs require little girls to play with dolls instead of trains, yet the fact remains that engineering for women is intellectually satisfying, physically possible, and potentially rewarding from the point of professional recognition. The criticism that women are not physically suited for engineering may have been justified several centuries ago when the terms engineer and skilled mechanic were synonymous; however, the most strenuous engineering gymnastics required today are the wielding of a compass and slide rule.

Perhaps a more valid criticism is that voiced by industry concerning the rapid turnover of women engineers. For instance, General Electric has found the average woman engineer stays with the company only three years. Many firms feel it is a waste of time hiring and training a woman engineer who often finds her job only an interesting intermedium between school and raising a family. These firms should recognize, in light of the present day deficiency of engineers and the cold war situation, that any organization needs a host of young engineers, men and women. Women engineers can be vital in the early years before home duties call, and in later years they can return and perform a service once more. Industry and government alike should realize that even a small number of trained women engineers could form a valuable reserve nucleus in case of an emergency. During WWII women responded nobly to fill the gaps created by men called to the service, and "Rosie the Riveter" has become a legend. No doubt "Elaine the Engineer" will fulfill an even more vital role should any future war occur.

Much of the hostile attitude toward women engineers on engineering campuses is undoubtedly due to the competition they present. With women occupying 448 of the 451 job categories listed by the U. S. census—the three missing are locomotive engineer, locomotive fireman, and firefighter—it is easy to see why many male students may shudder at the thought of engineering suffering a mass female invasion, yet after one century of medical training for women, in 1950 only six per cent of the United States' practicing physicians were women. "Healing the sick" is unquestionably "more womanly" than designing a city sewage system or public highway.

While the Soviet Union has over 29 per cent women engineers, the United States has less than two per cent. The reasons for this are many ranging from the present tendency in this country toward early marriages to the lengthening span of training and advanced study required in a scientific field. The basic reasons, however, are the failure to remove the outdated social customs and the laxity of informing every female child of high school age or younger of the unlimited opportunities the engineering profession offers.

It is up to the colleges and universities to encourage qualified female registrants; a duty of professional societies to exert their influence and prestige; and an obligation for every male engineering student and engineer to accept the opposite sex as a vital element in our quest as engineers for economic progress, a higher standard of living, and a peaceful but strong nation.

—G. M. D.

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Lady Engineer

Ah Shucks,

No Dirty Jokes This Quarter

By Kay Nestleroad

I look back with mixed feelings on my first two years as a woman engineering student. Some happy, some sad, and some funny experiences come to my mind: happy because my courses were passed, sad because harder work would have brought better results, and funny because of my position as a woman in engineering.

My years were full of experiences . . . "Be sure to remember to sign up for ROTC, except of course for the lady present," was the first official recognition I encountered. I think it would be fun to try to sign up for one of these classes. The shock when I walked into class would be worth observing.

The knack of walking into class is one talent a woman engineering student has to learn. Shyness is usually lost by the first week of school, though it recurs in the sophomore year when she happens to be the only female in the class. (The Engineering College thoughtfully has two women together in a freshman class.)

The first day of classes of any quarter is an experience in itself. The instructor begins with the attendance which goes something like this: Mr. Moore, Mr. Nestleroad, Mr. Nolon—As he goes on I try to get his attention and by the time he realizes his mistake and repeats MISS Nestleroad I'm red with embarrassment and have received several snickers and laughs from my classmates. Oh well, such is the life of a woman engineer.

Another common experience is to have a lecturer say "Gentlemen," (pause) "And er, lady,

too." Wonder whether it's better to be ignored? I have received no special consideration from my instructors other than the usual comment, "Well, guess I can't tell my dirty jokes this quarter."

The reason I think many women are discouraged from entering engineering is lack of experience. I have found this to be the worst problem I have encountered. It is a struggle to accumulate the knowledge which the males have acquired over two years of shop and a lifetime of tinkering with cars, clocks, lamps, etc., which girls have been discouraged from even considering.

One thing, though, I have found that I am encouraged from every side. My professors, the deans of the college, and many of the people I have talked to have done their best to encourage me.

My advice to freshman women engineering students? Stick to your guns, it gets easier after the first year, though it may not seem so now.

The favorite comment, "Did you go into engineering to catch a man?" does not apply to me. I think it goes unsaid that there are surely plenty of easier ways to catch a husband than to go into engineering.

Why am I in engineering? Because I believe in making the most of one's talents. I like and enjoy math and science so I want to make use of these talents so as to develop myself. I also want to be creative and do something to help society to be more efficient.

Ohio State
ENGINEER
Nov. 1962

LIPSTICK IN THE LAB

Ford women
in research

In an age of rapid scientific exploration and inquiry, it is not surprising to find a growing number of women joining the ranks of industrial scientists, engineers, technicians and others probing for new materials and sources of energy.

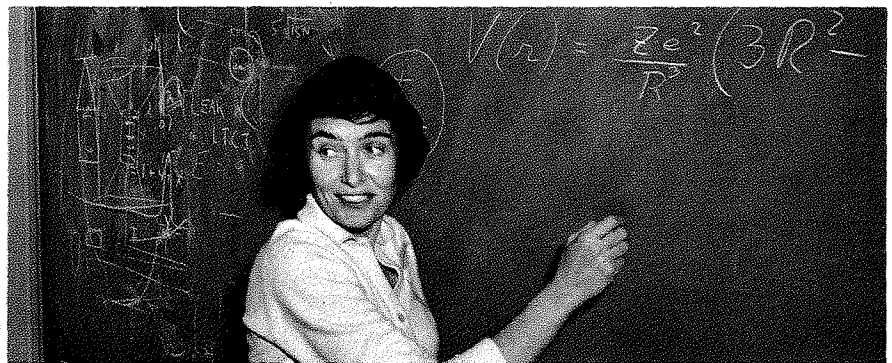
At Ford Motor Company's Research and Engineering Center, more than a dozen women are engaged in a wide variety of research jobs, almost all of which are usually held by men. Women metallurgists, chemists, physicists, mathematicians and biologists are stepping successfully into complex and demanding positions and, judging by their performance to date, should increase in number in the years ahead.

These scientists seem to possess no single identifiable characteristic except a strong academic background and an unusual amount of poise and confidence.

Dr. Mary Beth Stearns—one of Ford's best-known women researchers—is a case in point. She brings to her job a wide knowledge of theoretical physics, a mastery of sophisticated research techniques and a charm that somehow one doesn't expect to find in a laboratory.

According to Dr. J. E. Goldman, a University of

1. *Dr. Mary Beth Stearns, a senior scientist in the physics and electronics department of the Scientific Laboratory, writes formula for her work in solid state physics. Dr. Stearns obtained her bachelor of science degree in physics from the University of Minnesota and her doctorate in physics from Cornell University.*



Pennsylvania-trained physicist and associate director of Ford's Scientific Laboratory, Dr. Stearns is one of the most valuable researchers in the Company.

"She's one of our senior scientists," he said recently, "and a darn good one, too."

Although the majority of Ford's women in science have academic science training, not all of them work in laboratories. Some are employed in libraries as technical literature researchers. Others are employed in sections using computers and dynamometers rather than test tubes.

Whatever their positions, however, Ford feels they are making an important contribution, doing—as one scientist puts it—a man-sized job.



Working with brakes, suspension systems and exhaust systems, Mildred Page details engineering designs in the truck chassis design department.



Literally in the middle of things, Ann Fletcher sketches a steering mechanism with the help of Robert Malin of Ford's product engineering department. Mrs. Fletcher, a former engineering student at Wayne State University, is a patent draftsman-industrial illustrator.

Illinae Engineer

Barbara Johnson Is Helping to Plot Moon Shot

Barbara Crawford Johnson '46 counts herself lucky to be in the army of research personnel which some day will see the results of its labors blasted into the sky.

She heads a unit at North American Aviation at Downey, Calif., concerned with the exacting task of guiding the proposed Apollo moon rocket safely back into the earth's atmosphere.

Describing the project, Barbara explains, "When the Apollo comes home from its 240,000-mile mission to the moon, when it points back home at the tiny revolving ball that is our earth, it will be like threading a needle in the sky."

To complete its mission Apollo must land at a preselected site within the first atmospheric "pass." As it enters the atmosphere it must proceed through a narrow "corridor" approximately 40 miles wide.

If it overshoots the corridor it will not have enough atmosphere to slow it down. If it undershoots it will decelerate too fast for human survival.

Her group, one of many working under North American Aviation and other contractees of the National Aeronautics and Space Administration on the Apollo program, provides spacecraft systems design requirements for other researchers, deriving them from analysis of the problems of entry and of the general mission.

Barbara's husband, Bob, also an engineer with North American, is a supervisor in thermoanalysis.

The Johnsons have a 4-year-old son, Eric, with whom they enjoy family outings nearly every weekend in the mountains or at the seaside. Eric is a regular boy, and "It's funny to hear him use words like heat transfer and temperature

control—words he's heard all his life," Barbara recently told a Christian Science Monitor reporter.

To a girl considering a career in engineering Barbara would lend encouragement, believing "It matters little whether you are a woman or a man if you have something to contribute."

If a girl does choose this predominantly male field, however, she cautions, "The biggest mistake a woman can make is not to act like a woman."

Barbara enjoyed mathematics and physics in high school at Sandoval where her father, C. E. Crawford, A.M. '29, was superintendent, so she decided to try engineering.

While earning her B.S. in the general engineering curriculum, Barbara, an Evans Hall resident, served on Student Senate and worked on the Technograph, in the Women's Athletic Association,

Women's Group System and the Society of Women Engineers and Architects.

She has been with North American since soon after graduation when she was accepted as a junior engineer in aerodynamics.



Barbara Crawford Johnson '46 walks past an Apollo spacecraft simulator en route to her office at the space and information systems division center of North American Aviation.

Feminine Success in Man's Field

This Lady Knows Her Rockets

Mrs. Sidney L. Simon (Dorothy Elaine Martin, Ph.D. '45) is termed "the most important woman in space science and possibly the most important lady scientist in the country" in the November 14 issue of the Saturday Evening Post.

The 39-year-old chemist is "up to her lipstick in rockets, missiles and other space vehicles," Roul Tunley writes in an article entitled "The Lady Knows Her Rockets."

"Doctor Dorothy," as she is called to distinguish her from her husband, also a doctor-scientist, is technical assistant to the president of the Avco Corporation at Andover, Mass.

She checks out ideas and projects for the non-scientist head of the corporation and advises him on their feasibility and does independent thinking in the realm of pure science. Much of it is concerned with missiles and anti-missiles and her particular field is propulsion.

The Post quotes an associate: "When a man lands on the moon in, say, ten years' time, Doctor Dorothy, if she isn't there already, will probably have done some of the fundamental thinking behind the work in getting him there."

More remarkable, she has risen to the top in her field while still remaining feminine and following



'Doctor Dorothy'

her husband in switching jobs over the years. Her boss, James R. Kerr, says:

"It may well be that when the history of the twentieth century is written, the crux of Dorothy Simon's contribution will not be so much in helping people get into space and hop from planet to planet, important as that will be, as in proving that women can be as effective as men in a man's field and still remain women."



SUPERVISES FILTERS: Mrs. Elaine Schapiro has joined Control Electronics Co., Huntington Station, N. Y., as supervisor of the filter engineering department. For the past three years Mrs. Schapiro was a project leader at Avien, Inc., New York.

The Dads Illini

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Charter for University of Illinois student section, Society of Women Engineers, was officially presented by Mrs. Dee M. Holladay (left), chairman, Chicago section, to Patricia A. Martin (seated center), Villa Park, at meeting on Urbana-Champaign campus. Kathryn A. Miller (seated right), Fairfield, is vice president; Sandra G. Collins (standing center), Collinsville, secretary-treasurer; and Miss Grace Wilson, associate professor of general engineering, adviser. Though this chapter started in 1960, official charter presentation was delayed. The national society has 16 local and 11 student sections over the nation. University of Illinois has 32 coeds enrolled in engineering at Urbana-Champaign.

Girl Graduates

Coeds' Opportunities Widen, But Many Jobs Remain Closed to Them

Raytheon, Litton to Step Up Recruiting, GE Concerned That Women Often Leave

Crowding in 'Glamour' Fields

A WALL STREET JOURNAL News Roundup

Young women winding up their college studies this spring will find more jobs to choose from than last year's graduates did. But lingering sex barriers and fierce competition in some popular fields will force many of the graduating coeds to settle for less attractive positions than they had hoped for.

This is the picture shown by a Wall Street Journal survey of 30 college placement officials and 50 corporation personnel executives. The survey indicates that the current business upturn will mean some new jobs for women in industry, particularly for girls trained in mathematics and the sciences, but that women won't benefit nearly as much from the quickened pace of industrial activity as will men graduates. Women are winning growing acceptance in jobs above the clerical level in the world of finance, including insurance and banking. And demand from the teaching field, which takes more than half of the women graduates seeking jobs, continues strong, as does demand from such traditional fields for women as retailing, nursing and secretarial and library work.

On the other hand, most business firms remain reluctant to open management training programs to women, partly because of sheer prejudice but also because of well-grounded fears that the girls won't stay around long enough to justify investing a lot of money in training them. General Electric Co. notes the average college woman stays with the company only three years. "She regards her job as an interesting interim between school and raising a family," comments a spokesman. "If we knew a man was going to be with us only three years, we wouldn't hire him."

The "Glamour" Fields

There's considerable evidence that the liberal arts graduate who boasts no particular specialty faces rough going, especially if she sets her sights on a job in one of the "glamour" fields—such as publishing, advertising, television or foundation work. "Outside of teaching, there's no market for English, history and psychology majors," says Andre Beaumont, New York University's assistant director of placement in charge of the business and industrial fields. A girl who sets out to dazzle Madison Avenue as an advertising copy writer frequently ends up by considering herself lucky if she's offered a job as a secretary to an account executive—and she won't have a chance at even that job unless she's proficient in typing and shorthand, which often isn't the case with liberal arts graduates.

According to Government estimates, some 145,000 girls will receive bachelor's degrees this spring, up from 134,000 a year earlier and 116,000 five years earlier. Of these, if Labor Department studies of past graduating classes are indicative, around 80% will seek full-time work. Well over a third of the women graduates will probably be married within six months after graduation, but a majority of this group will nevertheless continue to work.

Girl graduates tend to be much more casual than men about lining up jobs, college placement officers say. The girls generally are less conscientious about signing up for interviews with corporate recruiters who visit the campus—perhaps partly because they assume many recruiters aren't interested in them. Many girls like to travel during the summer following graduation and as a result don't get around to serious job hunting till several months after leaving the campus.

Assessing the Job Market

Since girls often do take their time about finding a job and frequently bypass the usual placement and recruiting procedures, definitive answers to questions about how this year's graduates will fare aren't possible now. But many personnel and placement people have gathered enough information to make preliminary assessments of the job market women graduates will enter.

"There will be more jobs on the market, more competition for graduates and more employers considering women for jobs who wouldn't have done so otherwise," says Mr. Beaumont of NYU. William C. Gutman, Jr., director of placement at Temple University in Philadelphia, comments: "I wouldn't say there's going to be a tremendous jump in the number of women being sought this year as opposed to last, but the trend has been upward for several years and is just as strong in this direction this year as last."

If data gathered by Northwestern University is any indication, the increase in job opportunities for college women this year will definitely be modest. Dr. Frank Endicott, placement director, reports that of 215 companies surveyed, only 42, the same number as last year, plan to recruit women at the university. These 42 companies say they will need about 870 women, up from 843 in 1961. In contrast to this 3% increase for women, the companies plan to boost their total hiring of college graduates by almost 23% this year.

Women in the Laboratory

It may be, however, that Northwestern's figures do not fully reflect one of the most clear-cut job trends—the mounting demand for female scientists, technicians and mathematicians. Many companies are after all the women they can sign up in these categories, but the supply is frequently so limited that recruiting efforts accomplish little. At NYU, for example, less than 10% of next June's women graduates will receive degrees in the physical sciences and mathematics.

"The biggest demand for women is in engineering, mathematics and the physical sciences," says Donald La Boskey, of the placement center at the University of California at Los Angeles. "There used to be prejudice against hiring women in these fields, but it's being overcome now." Adds Mildred

Girl Graduates: Job Opportunities Widen, But Barriers Remain

Continued From First Page

Webber, a placement official at the University of Michigan: "Women have just as good a chance as men in any science field and can earn comparable salaries."

Raytheon Co., a big Lexington, Mass., electronics firm, hopes to hire about 10 scientifically oriented girls this year, compared with only three last year. But, complains a spokesman, the colleges "just don't have many girls who specialize in the fields we are interested in."

A major West Coast electronics firm, Litton Industries, Inc., comments: "We've hired very few women college graduates in the past, but we're stepping up our recruiting of women, especially those with electronic engineering and physics degrees. Whenever we find a woman in one of these fields, we snap her up." As do many firms, Litton makes wide use of its technically trained women in programming computers. Parke, Davis & Co. is looking for girls trained in fields such as pharmacology and zoology; the Detroit pharmaceutical firm finds women better-suited than men for some finicky lab jobs. "Women are more patient and painstaking," says Dr. Allen C. Moore, a research personnel official at Parke, Davis.

Women Bankers

A number of sources attest to the widening opportunities for college women in the financial field, though here, as in the scientific and technical areas, the supply of interested and qualified girls is limited. "More women are going into market research and investments," says Anna Hanson, placement director at Simmons College, a girls' school in Boston. Several Wall Street investment firms now have training programs for women college graduates. In San Francisco a banker comments: "Women are becoming more important in the banking industry than ever before. We don't have enough of them. Years ago a man would not think of talking to a woman about a loan, but now we have several under consideration as officers."

In the insurance field, Metropolitan Life Insurance Co. admits women to its middle management training program and also hires girls with backgrounds in mathematics to train as actuaries, figuring out insurance rates on the basis of life expectancies and other factors. In Chicago, Combined Insurance Co. of America reports it hopes to hire 25 to 35 women college graduates this year, compared with five a year ago. Some of the women will work at electronic data processing jobs, but a number will be employed in selling, a field college placement officers say women shun but a field in which the company finds they compete "embarrassingly well."

Retailing, a field long open to women with college diplomas, is likely to continue to provide jobs for a large number of graduates. "Retailing is one of the best bets for a girl looking for a job," says Abraham & Straus, a New York department store. In Pittsburgh, James Holcomb, placement director at Duquesne University, comments: "This is an area that more girls are going into every year. Because of the growth of shopping centers and branch stores, the stores have a definite need for women graduates." Mr. Holcomb reports the demand for women graduates to become merchandising trainees has doubled in the past three years.

The War Between the Sexes

Even in retailing and other fields employing large numbers of women, however, considerable sentiment against hiring them persists in some quarters. "We'll lose \$4,000 by putting a girl through a training program only to find that she insists on getting married and having a baby," says one retailing executive who recently decided to cut the proportion of women employes in his store. In technical fields, some of the companies hiring women indicate they do so only because men aren't always available. The personnel manager of an electronics company, for instance, says his company has no bar against women but adds: "From a man and woman of equal caliber for professional jobs, we'd select the man."

There's a widespread feeling that women simply don't fit into some industries, except to perform clerical chores in offices. Declares Verne Peak, director of personnel for Kaiser Industries Corp., a producer of steel, aluminum and cement: "We don't make any effort to recruit women, because the opportunities are mainly for men. Can you imagine a female chemical engineer in a cement plant?" In Pittsburgh, a center of heavy industry, "there are about 25 or 30 companies who won't hire girls," according to Mr. Holcomb of Duquesne.

In the advertising business, women who manage to rise above the secretarial level still face major obstacles in achieving top jobs. "Women traditionally aren't permitted to deal with industrial clients," says Ethel Paley, head of placement services at Barnard College, the women's college of Columbia University. "Something like cosmetics is all right, but industry in general is out." Forced to work behind the scenes rather than deal with clients, women find it difficult to rise to the position of account executive.

Though women with scientific and technical college backgrounds frequently can command the salaries on a par with those of their male counterparts, pay for college women generally continues to trail men's pay. "There is always wage discrimination against girl graduates, particularly in the retailing field," says a University of Tennessee official. At the University of Wisconsin, Miss Emily Chervenik, a placement official, observes: "The double wage standard still holds, except in mathematics and sciences." Starting salaries for women will edge upward this year but will still lag by \$50 to \$100 a month behind offers to men for equivalent positions, Miss Chervenik estimates.

Technocutie . . .

Miss Lois Backer

. . . What? An Engineer?



Increased rumors of several unidentified creatures — creatures resembling “girls” — have been circulating on the Engineering campus for some time. With the help of the Society of Women Engineers it didn't take TECH long (there were more than anticipated) to locate one, and here she is . . . lovely Miss Lois Backer—one of 23 charming women engineering students who are adding a touch of grace to our previously homogeneous engineering campus.

Lois was valedictorian of her Roanoke High School class, and she is now a 4.5 plus General Engineering freshman whose domestic talents acquired during five years of 4-H, should appeal to every engineer. Her beauty is self-radiating, but just for the records, she has been a Dolphin Queen semi-finalist as well as a Miss Woodford County contestant in the Miss America preliminaries.

Only one problem remains—where can TECH find another photographer? . . . Ours has found a new hobby—“Creature Watching”! As a matter of fact, where is the rest of the staff? . . . Hey fellows . . . wait for me!

Women in Engineering

by Pat Martin

In small but increasing numbers, American women are distinguishing themselves as engineers. The persisting idea that engineering is a hard and rough occupation unsuitable for women has been refuted by the women who have pioneered and succeeded in this field. Today the tremendous number of women in all Russian technical fields shows us an excellent example of how this untapped resource can be utilized. Surprisingly, this utilization of women has not slackened their pace, but rather helped them in the space race and certain other areas.

In America, as prejudices are slowly decreasing, the number of women in engineering has increased. In 1950 there were some 6,500 women engineers, in contrast to less than 750 in 1940. All evidence indicates this rising trend will continue.

Women who choose—for one reason or another—to enter engineering have before them a varied, interesting, and exciting college career. Even now, with many successful women in engineering, college girls are often advised not to enter engineering. As a result many potential women engineers never experience the challenge, excitement, and pride of an engineering profession.

The first challenge comes when someone asks what you are majoring in. A woman engineering student soon learns to tolerate criticism and those who come up with the universal questions such as, "Did you go into engineering just because that is where all the men are?" The challenge comes in proving to the world that all women engineers are not two-headed, sexless creatures who wear shapeless dresses and horn-rimmed glasses. The challenge comes in wearing skirts and being feminine in a traditionally man's world, and still proving that you can do a good job. And the challenge comes most of all in making a success . . . in getting through college and earning that treasured degree . . . in going into industry and being an

asset to your country and your employer.

The excitement comes in many ways. It comes while standing in lines those first few days and returning wondering stares of the men about you. It comes during the first classroom days when you notice the ratio of men to women, and when your instructors persistently call the roll it is always Smith, Brown, White, and then, Miss Jones. It comes from figuring out a difficult problem or from receiving a good exam grade. It comes from winning the respect of the people around you, men and women. It also comes in a very special way when you attend a dance with your special beau and meet the people from your classes who stare in wonder and obvious admiration to see you at a dance with a boy and really looking quite feminine and pretty. It comes in dating men and being able to talk to them intelligently; in being able to listen and understand. It comes most of all when you discover that you are finally being treated as an equal; the men around you have accepted you and are ready to help you and to be helped, are ready to accept the astonishing fact that you are a woman engineer and most of all a Woman. It has often been said that college life is the most exciting time of a woman's life. It is sometimes hard to realize that this is doubly true of a woman engineering student. She has all of the normal excitement, and so much more if she can only meet the challenge.

And then there is Pride . . . that funny little word that creates an inner glow that can grow into a fire . . . that funny little word that drives people onward to bigger and better goals . . . that makes them try harder when it seems almost impossible . . . that word that makes a person want to be different and special . . . that drives someone to the point of exhaustion and leaves them happy merely because they are proud of their accomplishment, and they can see pride reflecting in the faces of the

people around them. Pride . . . an undefinable word that means the world. It is a sparkle of happiness that you are doing what you are doing, a fascinating aura of joy that you are what you are and nothing else. This is what it takes to become a good woman engineer. This is the spirit, combined with dedication and hard work, which caused our pioneering women to become engineers and to succeed in spite of what society and near-sighted people said and did to make it hard for them.

Today the problem is supplying adequate high school counseling to women whose aptitudes in math and science point to an engineering career. The Society of Women Engineers is trying to help in this respect by counseling high school seniors. In the coming years it is possible to envisage more and more women making a success in engineering. At the present moment there are 23 women enrolled in engineering at the University of Illinois. These women are scattered throughout all branches of engineering.

The rumors of hard work and no fun are partly correct. True, engineering isn't easy; but in actuality few free things are worthwhile. A woman should not be forced into engineering. It must be something she freely elects with her eyes open and her chin firmly set, since there are times when things seem almost impossible to bear; times when the easy thing to do would be to simply give up and try something else. A young woman entering engineering must be fully aware of what she is doing. She must be proud of her work and stand up for it; she must be ready to give up some of the small things she wants now and keep sight of the further more important goals; she must be ready to meet the challenges that will inevitably come. But the thing to remember is that when it is all done, and the hardships and worries are over, you will have something, something special, precious, and worth much more than it cost. ♦♦♦