have been gate-crashing, low-energy particles," he declares. "The chances that this could have happened five times in our circumstances are about one in a billion.

"I believe we have found the quark and that this is the final particle . . . I am 99 percent sure the tracks are those of quarks of two-thirds primary charge.

"I guess this is the end of the road."

McCusker, whose own reputation among physicists is sufficient for his report to be taken seriously, though critically, is backed cautiously by his boss. Dr. Harry Messell, head of the school of physics at Sydney, will not say yet that the quark has been proved, despite the fact that the possibility is "terribly exciting."

"I will not say we have proved the quark," he says. "We will soon search for the one-third charge subatomic fragment, and when we find that all will be tied up."

"If it can be found, we will find it," says McCusker.

McCusker has built the world's largest array of cosmic particle detectors, covering nearly 100 square kilometers at Pillaga State Forest in New South Wales. He has been seeking the postulated limit of 100 billion GeV for cosmic ray particles.

Two years ago he became convinced that the frequency of high-energy primary cosmic particles, and the violence in the cores of the cones of secondary particles, made cosmic particle collisions with the atmosphere the only possible mechanism for the discovery of a quark on earth.

Working with physicists Dr. L. S. Peak and Dr. L. R. S. Woolcott and graduate student Ian Cairns, McCusker built the array of cloud chambers and ran them around the clock for eight months.

He surrounded his four-chamber system with a special lead barrier to guard against low-energy debris and background radiation.

From the Pillaga array and other detectors scattered around the Sydney campus, he recorded primary particle collisions with the upper atmosphere at energies upwards of 500,000 GeV. He used these as clues to events powerful enough to have produced quarks detectable in his chambers.

Most physicists in recent years have abandoned cloud chambers for the more popular bubble and spark chambers. But McCusker's enthusiasm over his cloud-chamber results, he says, "will mean people all over the world will turn back now to high-pressure cloud chambers" suited to this kind of event.

McCusker himself is already building a high-pressure cloud chamber near Sydney for his own piece of the search.

CHEMISTRY

A manpower oversupply

As the American Chemical Society gathered in New York City this week for what was expected to be the largest assemblage of chemists and chemical engineers of all time, their president was expressing concern about an area of vital interest to all of them—the job market. The outlook—at least for the short range—is far from rosy.

"Let's face it," said Dr. Wallace R. Brode, president of the 115,000-member organization, "we are in a recession. Look at the interest rates. Look at the stock market." (The Dow-Jones industrial average had dropped 7.6 points the day before.) "In addition, cutbacks in Government science funding are affecting us all."

"It is not a very pleasant situation," confirms Mrs. A. M. Bellew, director of the ACS Employment Clearing House. "I would say there is about a two-to-one ratio of applicants to jobs available. This trend started somewhat last year, but it is really bad this year."

One registrant, a Ph.D. chemist with 12 years experience, now working for one of the nation's most respected private research laboratories, says he finds the situation "very, very tight. You have to have almost exactly the type of experience they want."

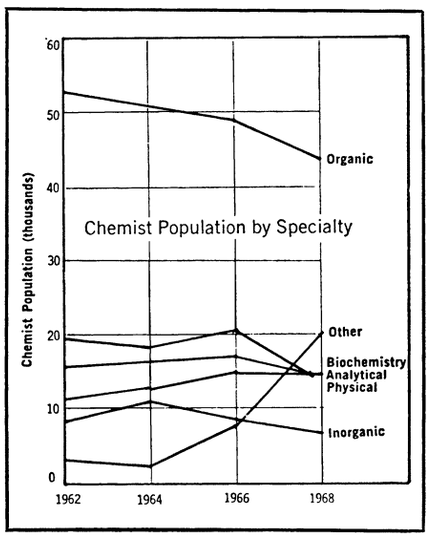
Another, a young Ph.D. inorganic chemist, says things seem to be getting tighter and tighter. "I want to teach, and I find that when an attractive position opens up there are 40 to 50 applicants.

"In fact, the job situation in chemistry is worse than in any other time in the past decade."

The poor economic climate comes after a year that again saw record numbers of persons receiving degrees in chemistry—some 10,800 bachelors degrees and 1,780 Ph.D.'s. In 1965 there were 10,000 BS degrees in chemistry, and 10 years earlier there were fewer than 6,000.

The trend is still up, and the two factors combine for the inevitable—a tight job market. Things would be even worse, points out Dr. Brode, if the college graduates who comprise 30 percent of the men now being drafted into military service were placed on the job market. This is of course no comfort to the chemists.

Statistics compiled for the last six or seven years by the ACS show that each year—for whatever reason—about one percent of the persons who receive a degree in chemistry—bachelors, masters, or Ph.D.—have reported that they were unable to find a job in the three summer months following graduation. The cutoff for receipt of this year's questionnaire to new chemistry graduates has been set for next week, and the staff is eager to see how much the figure will rise above one percent. It appears to be a question of how much, not if.



ACS

Chemical manpower's shifting profile.

Not only is the market tightening up generally, but, as a recent American Chemical Society survey demonstrated, the patterns within the professions that make up chemistry are shifting radically.

Fewer and fewer chemists regard themselves as practicing in the classical fields of organic, inorganic, analytical and physical chemistry. New interspecific fields are emerging and more persons are finding work on the edges of technical practice.

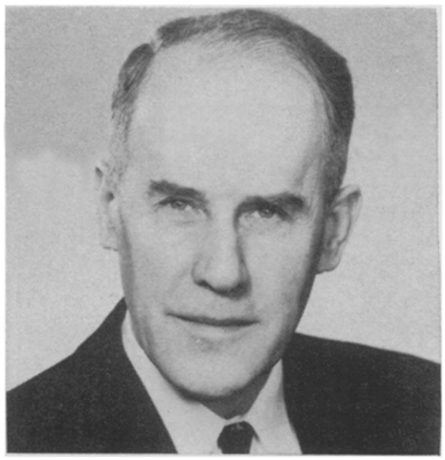
A chart of the ACS findings shows a decline in all of the classic chemical disciplines, and the only rise in a category called "other."

This includes such occupations as abstracting, indexing and information retrieval, education, chemical literature and nomenclature, patents and library work. The largest percentage of other-occupied chemists is in education, with marketing next in line.

"What we need is another Sputnik," says a postdoctoral fellow, who has found academic positions especially scarce. "Let's hope it's in chemistry.

"Analytical chemistry is not too bad, though, and biochemistry is in pretty good shape. Of course, if you are in polymer chemistry you've got it made —that's always big."

A recruiter for the Johnson's Wax Co. typifies the employer's situation. "We can afford to be fussy this year. In the past we've had a lot of competition, but this year the supply of chemists seems to have caught up with and



Dr. Brode: Hard times for chemists.

passed demand. I have already been given 750 resumes and I expect the total will hit 2,000 before the week is out."

However bad the current situation may be, Dr. Brode foresees a time when it will be just the opposite. In the 1990's, severe shortages, not just of chemists but of scientists in all fields are expected.

"By the 1990's," says Dr. Brode, "the size of our college-age graduating group will be the same size as it is today, yet the total larger national population and expanded economy will undoubtedly require additional scientific and technical personnel. We will probably have quite a shortage."

Until then he expects a fairly tight job market in scientific fields, although certainly not anywhere near as bad as it is this year in chemistry.

ENGINEERING MANPOWER

Hard times and a union

A large group of California engineers and scientists ushered in a new era for themselves and possibly for their peers across the nation last week when they voted to affiliate with the AFL-CIO. It was believed to be the first time so large a group has ever chosen to enter the giant union's fold en masse.

The 1,140-member Engineers and Scientists of California (ESC) voted overwhelmingly to link up with the professional, office and industrial union part of the AFL-CIO affiliated Marine Engineers Beneficial Association.

"Engineers haven't kept up with the times on salaries or fringe benefits," says Laurence Rodgers, ESC executive director. "In some cases they make less money designing a tool than those tradesmen who eventually use it. We wanted an organization that had some real strength in negotiations and could give us assistance in organizing."

Most of ESC members are electrical and mechanical engineers employed by the Pacific Gas and Electric Co. The rest comprise a range of scientists and engineers including chemists and physicists from San Francisco Bay area testing laboratories, civil engineers, architectural engineers and surveyors from throughout the northern part of the state.

"Engineers make up the largest group of professional craftsmen in the country," Rodgers points out. "And after its initial taste of success the union has set its sights on organizing this group across the country."

But why did the ESC pick this time to join hands with the AFL-CIO? Why not last year or the year before?

One of the main reasons could be the reverberations from large manpower cutbacks in the aerospace and defense-oriented industries over the past year. While surplus isn't evident in every field, it has hit certain areas and the prospect for the future isn't bright.

"Most companies that traditionally hire a lot of engineers are cutting back and tightening the belt," says Marshall Harris, who runs a large San Francisco engineering employment service. "Companies are no longer interested in the engineer with a couple of years of general experience. The jobs they are filling now are tightly specified and if the man they want isn't around, they just won't hire anyone."

Design engineers have been hardest hit in the slowing market, and the personnel manager from a large West Coast aerospace company tells why:

"Since the end of 1967 we have dropped about 6,500 employees, and about 1,200 were engineers. Most of these were dropped from the hardware and production end of the operation, and only a few from the analytical side. We need the idea men, because in a period like this, it is where your strength lies. It's rather obvious that production is going to lag in the next year, so it's time to really get moving on concepts. With Federal spending cuts, the competition for Government contracts is even keener."

This personnel director said his company's overall manpower forecast for the next year "looks just about like a flat line."

But while there are other instances of large-scale layoffs, they are the exception rather than the rule. Most companies are cutting back through attrition. When an engineer leaves, he simply is not replaced. So instead of engineers dumped into the job market in bucketsfull, it has become a steady trickle.

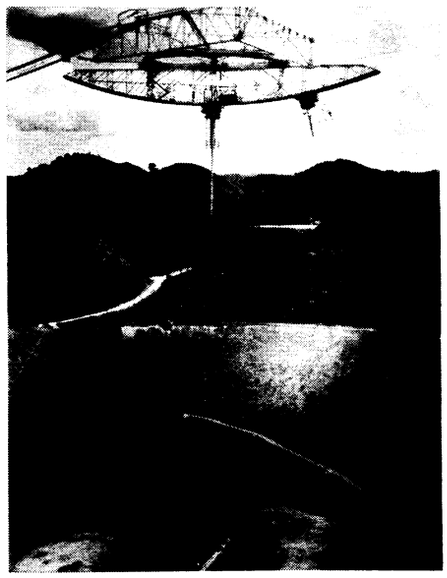
Another bitter pill for engineers to swallow is the dropping salary. "A lot of companies who relied heavily on Government contracts are now trying to find some commercial spinoff from their products," says Harris.

"But since the profit on the commercial market doesn't match that made from a Government contract, the engineer is usually hired for a lower salary."

"I have always thought unions were something for the other guy," said one ESC member, "but then I got tossed around hard and had no comeback. Now we'll have some bargaining power."

RADIO ASTRONOMY

Two years and no action



Cornell

Arecibo: Still in need of a facelift.

The idea that neutron stars might exist had been around theoretical astrophysics for a couple of decades, but it was not until radio astronomers discovered and studied pulsars that there were known objects that could seriously be considered to be neutron stars.

"The presently accepted proof of the neutron star state of matter is a fantastic confirmation of the exhilarating reach of theoretical science," says the Ad Hoc Advisory Panel for Large Radio Astronomy Facilities, known as the Dicke panel after its chairman, Dr. Robert H. Dicke of Princeton University.

The Dicke panel cites pulsars, and other successful work by radio astronomers, in its latest plea to the National Science Foundation for money for the construction of new radio telescopes.

The panel first met in 1967 (SN: 9/2/67, p. 225), when it issued a series of recommendations for new radio astronomy construction. It met again this summer and now says: "Two years have passed without the implementation of any of the 1967 recommendations of this panel for the construction of major new radio astronomical telescopes. . . . The facilities for radio astronomy in the