

BILL PICKERING is retiring as director of Caltech's Jet Propulsion Laboratory on April 1. It is not true that this means the U.S. space program is coming to an end.

Since 1958, when the U.S. sent up its first satellite, Explorer I, it has been generally accepted that William H. Pickering *was* the U.S. space program. This is an exaggeration, of course. He has only been the *unmanned deep* space program.

Pickering went to work for the Jet Propulsion Laboratory in its earliest days, 1944, and has served as its director since 1954. Small wonder, then, that at the mammoth retirement party given him by the Lab in March, most of the 3,000 guests wore outsized green buttons bearing a caricature of the boss, and the legend, "Mr. JPL." His career, like the Lab's, has spanned the whole history of space flight. His story and the Lab's story are synonymous.

Of course, *his* story started a little earlier. He was born on Christmas Eve, 1910, in the capital city of Wellington, New Zealand, where his father was a pharmacist. His mother died when he was very young, and Bill was sent off to live with his grandparents in the small country town of Havelock. Bill was a good student from the start, and he had an early interest in engineering, which the family considered entirely natural. After all, his great grandfather had built the

first railway tunnel in England. At the age of 12 or 13 Bill read a magazine article about a new method of sending and receiving information called radio, and in no time at all he had built the first crystal set in Havelock. (The set came close to being permanently shut off, however, when Bill turned over the headphones to his grandmother for the first time, and she heard dance music coming from Sydney, on a *Sunday*.)

Bill started a radio club when he went to high school in Wellington a few years later, and the members built and operated their own ham radio station.

In 1928 Bill entered Canterbury College in Christchurch—the engineering school of the University of New Zealand. He only stayed through his freshman year, however, because his uncle, a mining engineer now based in Los Angeles, thought Bill would have a greater opportunity to develop his engineering talents at Caltech. So, after the summer vacation (which comes along in December in New Zealand), Bill came to the U.S. and to Caltech.

At that point in his life Bill wanted to be an electrical engineer, but at Caltech A. A. Noyes kept urging him to go into science. Bill did both. He got his BS in 1932 in science, and his MS (1933) and PhD (1936) in physics, with a minor in electrical engineering.

As an undergraduate at Caltech Bill won one of the coveted Junior Travel Prizes, along with Charles Jones,

now a consulting engineer in Pasadena. With two other students, they took the train to Detroit, bought a new Ford, drove it East, and shipped it to Europe, where, in six months, they drove 16,000 miles. (Total cost to Pickering—\$900, the full amount of the Travel Prize.)

In his senior year the first student houses were built on the Caltech campus, and Bill was one of the first occupants of Dabney House, where he roomed with Gordon Bowler—which is how he met Gordon's sister Muriel. They were married on December 30, 1932. While Bill went on with his graduate work at Caltech, the young Pickerings lived in Los Angeles, where Muriel worked as a librarian.

Bill got his PhD cum laude in 1936 and stayed on at Caltech as an instructor in electrical engineering (doubling as an instructor in history in those depression days as well). Soon he was involved in the pioneer cosmic ray studies being conducted by R. A. Millikan, along with a couple of other bright young men—H. Victor Neher, and Carl Anderson. Each of them brought a special expertise to this research—Neher dealt with electrosopes, Anderson with cloud chambers, Pickering with Geiger counters.

Pickering's first job on the project was to build the Geiger counters to be used in investigating cosmic rays. (His research for his PhD degree had been on these rare new instruments.) The team flew these counters in balloons, as high as they would go. Cosmic ray information came back by radio and was recorded on the ground.

Because they wanted a worldwide record of cosmic ray intensity at various altitudes, Millikan and his helpers traveled in the late thirties and early forties as far afield as India and Mexico. The war kept threatening to shut the project down, but the young researchers soon learned what a lot of other people already knew—that it took more than a war to daunt R. A. Millikan. In 1939, for instance, Neher and Pickering were on their way to meet Millikan in India when war broke out in Europe. They might not be able to get through, they wired Millikan; should they go back home? Come ahead, said Millikan. On December 7, 1941, the group was making cosmic ray observations in Mexico when the Japanese attacked Pearl Harbor. Should they quit and get back home? We're here, said Millikan, so let's get on with the work.

For Bill Pickering, this cosmic ray research "led me into my interests in great heights above the earth, and sending back messages"—not to mention his interest in instrumentation and control problems for balloons and other vehicles in space.

By 1944, as an assistant professor of electrical en-

gineering at Caltech, Pickering was deeply involved in wartime activities—teaching in the Navy V-12 program, training people in electronics for work in war industries in the national Engineering, Science and Management War Training Programs, working on radar development at the MIT Radiation Laboratory, and—later—serving on the Scientific Advisory Board of the U.S. Air Force, and directing the Army's investigation of Japanese incendiary balloon attacks on the West Coast.

Those Japanese incendiary balloons were a constant, nagging menace. Bill Pickering and Bill Nash (now Caltech's director of placements), in trying to find out how the balloons worked, and how to cope with them, had a standing order for anyone who found one to ship it to Caltech. The balloons were made of rice paper, and, aside from the bombs they carried, they contained a block of high explosives, to blow the whole thing up after the bombs were dropped. Consequently, the remnants that were delivered to the Pickering-Nash office at Caltech were usually beyond study.

One day, though, Pickering and Nash got a well-preserved balloon in their morning mail, and set about opening it with great excitement, which was only heightened when they uncovered the block of high explosives—still intact, and ready to blow. With the greatest of care, they carried their precious package to the roof of Bridge—and yelled for the Army to come and get it.

In one of their more ingenious experiments, they patched up one of the balloons, completely equipped except for explosives, and tethered it 1000 feet in the air at Oxnard, intending to make radar observations. But the rope broke and the balloon sailed away. Disappointed, but not too concerned, because the balloon carried a prominent sign that carefully explained its research nature, Pickering and Nash went back to Pasadena.

It was some time later that the Harbor Defense at Oxnard got a call from the Sheriff's Office in Flagstaff, Arizona. The balloon was down in their area and somebody better come and get it right away. Well, would they please *send* it back? They would not. But did they read the sign, about its being a U.S. experiment. Yes, and it was the most suspicious thing about it, because everyone knew that was a "typical Jap trick." The Army went and got it.

Despite all this wartime activity, Pickering was invited in 1944 by Theodore von Karman, director of Caltech's Guggenheim Aeronautical Laboratory, to join a new government-sponsored wartime project for research on long-range rocket vehicles and missiles.

This was the small-scale project that soon developed into the Jet Propulsion Laboratory, a government-owned research and development facility operated by Caltech for the benefit of the Department of the Army.

Von Karman and Pickering made a trip to Germany and Japan in October 1945 to study rocket development in those countries, and Pickering's first job on the rocket project at JPL was as chief of the Remote Control Section. His knowledge of electronics and instrumentation helped to produce such successful pioneer rocket vehicles as the Private and the Wac-Corporal—research rockets, built with various objectives in mind, and with varying instrumentation.

By 1949 Pickering, who was now a full professor of electrical engineering at Caltech, was spending most of his time at JPL on the development of the Corporal, which would become the nation's first ground-to-ground guided missile. In that year, the Army asked JPL if they could convert the Corporal from a research rocket into a weapon—which meant it would have to be operated by battlefield troops, not research engineers. Bill Pickering was put in charge of the project.

With this project, JPL moved from straight research to research *and* hardware development. The Lab had to develop the engineering capabilities to look at this rocket vehicle as part of a total weapon system. In fact, it now had to encompass everything from electronics to physics, chemistry, metallurgy, applied mechanics, and aerodynamics, and do everything right down to writing training manuals.

The Lab began to grow—fast. It had already come a long way from a graduate study project for Caltech aeronautics students—and it had a long way to go. In 1954 Pickering succeeded Louis G. Dunn (PhD '40) as director of the Lab.

JPL had been speculating about space ever since the war. As early as 1946, for example, it produced some reports on satellite orbits and associated rocket problems. By 1948 Pickering was serving on a high-altitude research committee, which had been set up to try and find ways to use rockets for upper atmosphere research. The satellite program did not get started until the International Geophysical Year was set up, however. In 1955 President Eisenhower announced that the U.S. would put up a satellite during the IGY in 1957-58, and Project Vanguard was established to do the job.

The Navy Vanguard project moved slowly. JPL was working with the Army at the time, on the development of the Jupiter reentry nose cone, and the Lab became more and more convinced that the Army might really be able to launch a successful satellite during the IGY.

The point was moot, though. On September 4, 1957,

the Russians launched Sputnik.

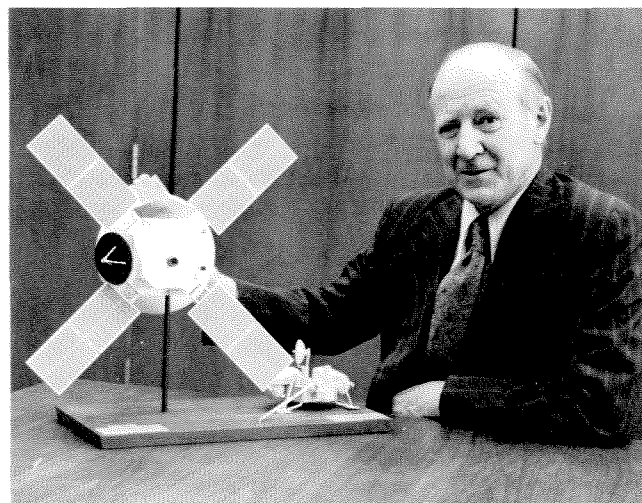
“An emotional trauma shook the land,” Pickering wrote at the time. (Typically, he was not visibly affected by the shake.) “For the first time,” he said, “we realized that American science and technology were not supreme in the world, and that what we regarded as a land of lumbering peasants could beat us into earth orbit.

“... There seems to be an unwillingness to face up to the obvious fact that the Russians are ahead of us. Let's admit this. They *are* ahead of us, so what do we do about it? What we need is strong leadership, good engineering, good management. We are not asking for a lot of scientific breakthroughs. We are asking for good management and good engineering on programs which already exist and are slowly coming to fruition.”

In November 1957, JPL and the Army Ballistic Missile Agency were directed to prepare, and orbit, a satellite before March 1, 1958—and Pickering became a miracle man after he and the JPL staff managed to accomplish that spectacular feat in just 83 days.

Explorer 1, the first U.S. satellite, was launched on January 31, 1958. It was the beginning of the space age in American science. “The event was also symbolic of the mixing process between engineering and science,” says Pickering, “between the world and the research laboratory. It had mixed rocket technology with the universe and reduced astronautics to practice.”

It was the first of a long series of historic flights for JPL, which was transferred in 1958 to the National Aeronautics and Space Administration, the civilian space agency, and was assigned the basic responsibility for the unmanned exploration of the moon and the planets.



W. H. Pickering with a model of the Viking spacecraft scheduled to land on Mars on Bicentennial Day—July 4, 1976.

These are some of the highlights of that exploration to date:

Pioneer 4 (1959) was the first U.S. spacecraft to escape the earth's gravitational field.

Ranger 7 (1964) flew 240,000 miles to land on the moon—right on the spot selected for the landing—and transmitted back to earth the first close-up pictures (3416 of them) of the moon.

Rangers 8 and 9 (1965) brought to almost 17,000 the total number of close-up pictures of the terrain on which the U.S. astronauts would someday land.

Five Surveyor spacecraft (1966-1968), following Ranger in the orderly exploration of the moon, landed on the lunar surface and not only transmitted even more detailed pictures, but served as remote-controlled laboratories to examine the lunar soil and test its ability to support the manned Apollo 11 spacecraft that followed in 1969.

Mariner 2 (1962), the first successful U.S. planetary mission, gave us our first close measurements of Venus.

Mariner 4 (1965) took the first close-up pictures of Mars.

Mariner 5 (1967) flew within 2500 miles of the surface of Venus, observing physical properties of the atmosphere and collecting material for the mapping of its surface features.

Mariner 6 and 7 (1969) flew by Mars, taking pictures from an altitude of 2100 miles.

Mariner 9 (1972) flew to Mars and became the first space vehicle to be put into orbit around another planetary body—and yield more data than all other planetary missions combined.

Mariner 10 (1974), sent past Venus and on to Mercury, was the first spacecraft to use the gravity of one planet to speed it toward a second, and give us a close view of the planet nearest the sun.

Viking 1 and 2 are now on their way to Mars. Launched last August 20 and September 9, respectively, they are scheduled to land there on July 4, and sometime in September 1976, starting the search for evidence of life on Mars.

The Viking missions (with responsibility shared between Langley Research Center and JPL) are the most ambitious unmanned space ventures ever attempted. But then, in their time this has been true of every one of the unmanned space ventures directed by Bill Pickering since 1957. Some have been more memorable than others—most notably the 83-day wonder, Explorer 1, the first U.S. satellite.

The Lab knew it was on the firing line with Explorer. The whole world was waiting for our answer to Sputnik. Vanguard had already flubbed its launching. Everything was riding on Explorer.

For the launch, Pickering was at the Pentagon in Washington, with a small group of men including Wernher von Braun, director of the Army Ballistic Missile Agency, and James Van Allen of the State University of Iowa, who had designed the instrumentation for the satellite. The group was assembled in the tele-conference room on the third floor of the Pentagon when Explorer blasted off successfully at 10:48 p.m. on January 31, 1958. Minutes later the report came in that the second stage of the 70-foot Jupiter C rocket had been ignited. There were still two stages to go... How *did* they go? they finally asked General John Medaris, in the blockhouse at Cape Canaveral. "We don't know yet," he answered. "Have a cup of coffee, smoke a cigarette, and sweat it out with us."

An hour went by, and a half-hour more. At X-firing time plus 100 minutes they could expect word that Explorer had been tracked coming in over the Pacific Coast on its first orbit around the earth.

X plus 100 minutes—Nothing

X plus 104 minutes—Pickering is on the phone to his tracking men in California: "Have you got anything yet?"

X plus 107 minutes—A faint signal

X plus 108 minutes—Von Braun says someone must have heard an electric razor.

X plus 109 minutes—Pickering is shouting into the phone: "Frank, why the hell don't you have anything?"

X plus 110 minutes—Pickering is listening. "Yes? Got one! Give me another." A few seconds pass. "OK—two. Give me another one."

It had been agreed that when three stations reported in, they could be sure of an orbit. Then the phones began to ring all over the room. Reports were coming from everywhere. Explorer was in orbit.

"I suppose scientists have been just like other people all the time," Abe Mellinkoff wrote in his column in the San Francisco *Chronicle*. "But I certainly didn't know it. That's why I was shocked to learn what Dr. W. H. Pickering said over the long-distance phone to his spotter in California when the American Sputnik was a few



February 1, 1958—W. H. Pickering, James Van Allen, and Wernher von Braun happily display a model of Explorer 1 at a press conference held only minutes after this first U.S. satellite had gone into orbit.

minutes late on its first trip.

“Dr. Pickering didn’t say: ‘Perhaps we should recalculate our apogee.’ He said: ‘Frank, why the hell haven’t you got something?’

“It seems to me this appeal should go down in American history with ‘Don’t fire until you see the whites of their eyes,’ ‘I’ve just begun to fight,’ ‘Remember the Alamo,’ and ‘Nuts.’”

Pickering’s appeal to Frank should probably go down in JPL history too—as just about the most emotion the boss ever displayed in all the years he directed the Lab. Somehow he usually managed to meet the most horrendous crises with a quiet voice and a reserved manner. To the great good fortune of the Lab, and the space program, he was—and is—unflappable.

In a sense this was true of most of the other men

gathered in the Pentagon tele-conference room. After they were assured of the success of Explorer 1, there wasn’t any shouting and cheering; in fact, there was more of a feeling of relief than of triumph.

Despite the fact that it was about 1:30 a.m., the National Academy of Sciences had set up a press conference on Explorer. Van Allen, Von Braun, and Pickering piled into a car, were driven through the Washington night, and gamely went in the back door of what they confidently expected would be an empty hall—only to be greeted by a tremendous cheer from an overflow audience that convinced them for the first time that there were other people, after all, who thought they had accomplished something of importance. The press conference ran for almost two hours.

There were some low points in the Pickering career

too. Lots of them. The first five Ranger shots at the moon were failures. Khrushchev was scoffing at the U.S.—“They proclaimed for all the world to hear that they were shooting a rocket at the moon, but they missed every time....The Soviet pennant on the moon has for a long time been awaiting the American, but in vain, and it is lonely.”

The Ranger troubles were not all of the Lab’s making, but morale at the Lab was not the best in the world. After Ranger 5, NASA called a halt in the program and the Lab asked for a year to work on Ranger 6. Finally they were ready. The flight of Ranger 6 was perfect. Fifteen minutes before impact, the television cameras were scheduled to begin operating. Then we would begin to get our first close-up pictures of the moon. But the cameras never came on. After a year’s work, and just fifteen minutes before payoff—there was nothing.

“I was proud of the Lab,” Pickering says, “—because they didn’t fall apart.”

And the Lab must have been proud of him for the same reason. Shortly after the failure of Ranger 6, they had their big annual party, where they chose a Queen of Outer Space. Bill Pickering always got a round of applause when he came out to present the lady with her crown—but *that* year, they didn’t just applaud; they tore the place apart.

The hard-luck spell was broken three months later when the Lab put up the successful Ranger 7.

On April 1, Bill Pickering turns over the directorship of the Lab to Bruce Murray, professor of planetary science at Caltech, and a geologist by training, who has served as a principal scientist in many JPL spacecraft explorations of the solar system. The Lab is now Pasadena’s biggest industry, with 4000 employees and a \$65 million annual payroll.

Pickering, who has actually only been “on leave” from Caltech for the past 22 years, will return to the campus as professor of electrical engineering, at the same time as he keeps a number of other activities going. The most notable of these are probably his chairmanship of a National Academy of Sciences committee that serves as an advisory group on research for the Navy, the development of a new research institute in Saudi Arabia, and the establishment of an International Solar System Decade, somewhat along the lines of the 1957 International Geophysical Year, which would draw together the people working on studies of the planets and the solar system.

With their son and daughter now grown, the Pickering live in a spacious house high in the Flintridge hills. It is not at all a pretentious house, except for its view, which is commanding—and then some—overlooking

a good portion of southern California, including the Lab. With a good telescope, in fact, Pickering could look right into the windows of his ninth-floor office at JPL—or vice versa.

Bill does his own gardening (which is practically unheard of anymore in southern California) and keeps a small but catholic vegetable garden going. Both Pickering are stamp collectors, and they have comprehensive collections of space stamps and issues from New Zealand.

The honors and awards that have come to Bill over the years line the halls of the Pickering house—and they range all the way from his election to the National Academy of Sciences *and* the National Academy of Engineering to his selection as Grand Marshal of the Pasadena Rose Parade and membership in the

Concatenated Fraternity of Master Missileers
Pentagon Chapter

Kept vigil for 4 hours—2130, January 31 to 0130,
February 1, 1958

Jupiter C—Satellite Explorer

Accordingly, let it be proclaimed that he now has attained the exalted rank of Master Missileer and shall henceforth enjoy an AA-1 seating priority at all future Pentagon launchings, with the privilege of double oxygen rations on the first United States Army ship to penetrate the celestial frontier en route to the moon. Also, he is entitled to repeat ad infinitum to all and sundry persons every detail of all of the events leading up to, during, and following the launching of said Jupiter C—satellite Explorer (and to make any desirable elaboration thereon to suit his fancy, provided he adheres somewhat closely to the agreed facts).

Suffice it to say that Bill Pickering is too forthright to elaborate on his space achievements, which have been impressive enough to need no elaboration anyway. In fact, his direct, unassuming, and understandable explanations of these achievements have made him a favorite of reporters. One of the rare critical comments he has drawn from a reporter came in an account of a press conference, held on one of his many visits to his birthplace, and printed in the Wellington, New Zealand, *Evening Post* on February 10, 1965: “Dr. Pickering, dressed in a quiet dark suit, showed that he has acquired few of the customary American mannerisms since he went to California in 1929....the Americanisation was only apparent when he launched into a rapid-fire delivery of space achievements and aspirations.”

It’s an Americanisation we can all be proud of—all over the world. □