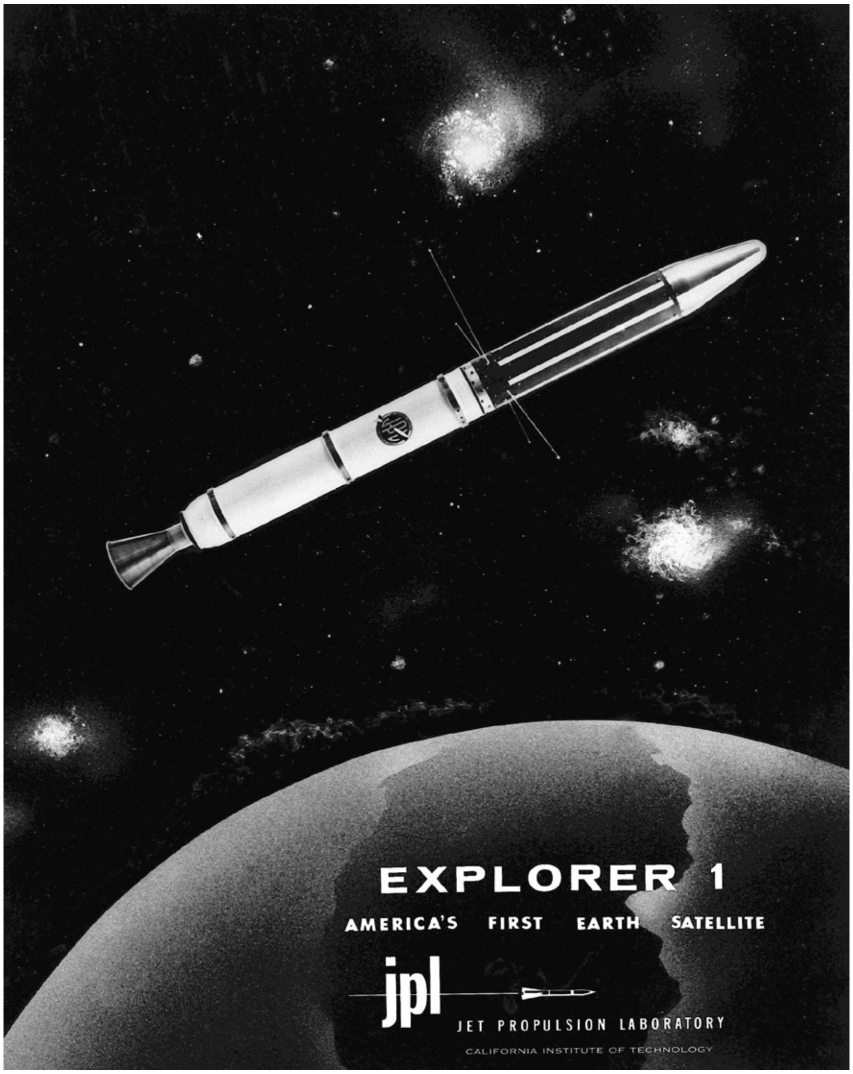
From Rockets to Spacecraft:
Making JPL a Place for Planetary Science

by Erik M. Conway



The cover of a brochure JPL created in 1958 to explain the Explorer mission to the American public.

Since the dawn of the space age, JPL spacecraft have visited the sun, the moon, and all eight planets, and some are even headed out of the solar system entirely. The agency that sent the Voyagers, Galileo, and Cassini to the outer planets, landed rovers on Mars, mapped Venus's cloud-shrouded surface, and paved the way for Neil Armstrong's "one small step" on the moon began as a military rocket research facility run by a pacifist who just wanted to explore the upper atmosphere. Caltech's Jet Propulsion Laboratory unofficially started life when Frank Malina [MS ME '35, MS AE '36, PhD '40], a graduate student of Professor of Aeronautics Theodore von Kármán, and some friends test fired a rocket engine in a dry wash in 1936. JPL has been out of the rocket business since 1958, a victim of its own success at developing the United States' first satellite—Explorer 1, launched in response to Sputnik, which in October 1957 staked the Soviet Union's claim to low Earth orbit. Following in the heels of the launch of the world's first intercontinental ballistic missile—a Russian one—in August 1957 and, passing overhead every 96 minutes, Sputnik reminded a jittery America that nuclear warheads could be put up there just as easily. This is the story of JPL's journey from weapons lab to planetary explorer.

Malina, von Kármán, and American Rocketry

Malina, the son of Czech immigrants, graduated from Texas A&M in 1934 and came west to the Guggenheim Aeronautical Laboratory at Caltech (GALCIT), in hopes of developing rockets capable of much higher speeds than piston-engined aircraft could achieve. He was encouraged by von Kármán, GALCIT's director, who gave him work at the drafting table in support of some of von Kármán's own research, and eventually got him a position in the GALCIT wind tunnel. In 1936 Malina paid a visit to rocket pioneer Robert Goddard's test

Below, left to right: Rudolph Schott, Apollo Milton Olin Smith, Frank Malina, Ed Forman, and Jack Parsons (right, foreground) take a break between rocket-engine tests on November 15, 1936.

Right: Another test firing on the 28th.

facility in Roswell, New Mexico, to seek a collaboration, but found Goddard uncooperative.

Rocketry was in the air, as it were, and a public lecture on recent German rocket-plane work by grad student William Bollay [MS ’34, PhD ’36] drew Pasadena residents John W. Parsons and Edward Forman, who were doing rocketry experiments of their own. Parsons was a self-taught explosives expert, while Forman was mechanically skilled. Bollay referred them to Malina, and the threesome formed the core of what would become known around Caltech as the Suicide Squad.

Theirs was not an easy relationship. Parsons and Forman just wanted to fire rockets into the sky, while von Kármán insisted, and Malina agreed, that collecting performance data and developing a theoretical understanding of how rocket engines worked was paramount. Eventually the group agreed to build an instrumented, alcohol-burning test motor. Most of their rig was scrounged from junkyards, as Caltech was not funding this “spare time” project. They soon attracted Bollay and two other grad students, Apollo M. O. (“Amo”) Smith [BS ’36, MS ME ’37, MS AE ’38] and Hsue-Shen Tsien [PhD ’39], who helped Malina with the theoretical work and sometimes with the test rig; and meteorology graduate student Milton W. “Weld” Arnold [MS ’37], who unexpectedly provided the huge sum of $1,000—in small bills. Arnold never told the team where the money came from, and they didn’t press him on the subject.

The first day of testing was Halloween 1936. Caltech had not welcomed potential fires and explosions on its campus, so Forman suggested a spot in the Arroyo Seco on the outskirts of Pasadena above Devil’s Gate Dam, part of the regional flood-control system—a suitably remote area that was still easily accessible from campus. Even so, it took hours to ferry equipment up the Arroyo. On the first three tests, the powder fuse the group was using to light the motor blew out. No ignition. The fourth time, they taped the fuse into place, and the motor ignited . . . as did the oxygen line. “The oxygen hose for some reason ignited and swung around on the ground, 40 feet from us. We all tore out across the country wondering if our check valves would work,” Malina would later write home. The valves did their jobs—there was no explosion, nobody injured, and little equipment was damaged, thanks to a sandbag wall. No data was collected from the thrust gauge, but they did learn that the powder-fuse idea was a bad one. Forman modified the motor to accommodate a spark-plug igniter instead, and the team lugged their gear back to the Arroyo on November 15 for four more attempts. The new electric starter worked reliably, and Malina got his first thrust data. More tests on November 28 and January 16 provided enough data to satisfy Malina, and the January tests were the last ones in the Arroyo for a while.

The tests pleased von Kármán enough to give them space on the third floor of Guggenheim, the building that also housed GALCIT’s pride and joy—a 10-foot-diameter wind tunnel, the largest in the world. But a rocket-fuel leak that instantly rusted all the metal surfaces in the building, including the wind tunnel’s delicate torsion gauges, evicted them. A few months later, the thrust balance they had installed on Guggenheim’s outside wall exploded, damaging the building. This did not enhance their standing. They kept working on campus, however, until May 1938. By that time, the demands of “real life” had drawn them away from the rocket work, as several of the experimenters had taken on outside jobs in order to feed themselves.

The future JPL could have fizzled there, but the rocketeers were rescued in January 1939 by a $1,000 grant from the National Academy of Sciences. Henry “Hap” Arnold, chief of the Army Air

Right: The GALCIT rocket group makes final plans for the first jet-assisted takeoff test flight. From left: Clark Millikan, Martin Summerfield (MS '37, PhD '41), Theodore von Kármán, Frank Malina, and pilot Homer Boushey.
Far right: Shortly thereafter, the Ercoupe was flung skyward by 28 pounds of solid-fuel-fired thrust.

Photo courtesy of the Caltech Archives.

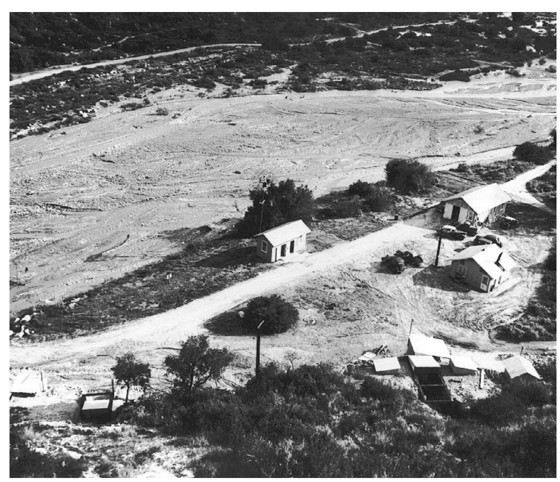
Corps, had visited GALCIT in spring 1938 and was intrigued enough to ask the academy's Committee on Air Corps Research to fund a project to develop rockets to help aircraft take off on short runways. The committee—whose members included both von Kármán and Caltech's de facto president, Robert A. Millikan—agreed. Malina reassembled his little group and they started working, in the Arroyo, on what would become known as Jet-Assisted Takeoff (JATO) rockets. In July, they were given another $10,000. After this, they were officially known as GALCIT Project Number One.

Arnold had financed the JATO work in the belief that the United States would soon be at war. Malina and von Kármán, a Hungarian immigrant, thought so too. They had both supported the Soviet Union's lonely effort to oppose Germany's proxy forces in the Spanish Civil War. In fact, Malina joined a Communist discussion group in 1937, although the magnitude of his involvement has never been clear. He denied ever having been a Communist party member, and the group dissolved after the shocking announcement of the Soviet Union's nonaggression pact with Germany in 1939. Malina was otherwise a pacifist, willing to work on rockets for the Army only because of their value in opposing Fascism.

The JATO tests eventually moved to March Field, near Riverside, California. After a series of firings with the airplane chained down, on August 12, 1941, Army lieutenant Homer Boushey made the first JATO flight in an Ercoupe—a fighter-sized civilian aircraft. The rockets cut the plane's takeoff distance in half. Impressed, the Army gave GALCIT more money to make larger JATOs, and in April 1942, those rockets muscled a 20,000-pound Douglas A-20 bomber into the sky. In those days, Caltech had no prohibition on faculty members running outside businesses, so von Kármán and Malina set up a company named Aerojet—now a major space and defense contractor—to manufacture them. This allowed Malina and Tsien to continue research, while Aerojet dealt with the challenges of large-scale production. Parsons and Forman went to Aerojet, while the rest of the original team left the rocket business entirely.

GALCIT Project Number One officially became the Jet Propulsion Laboratory in June 1944. It remained a Caltech organization, although not yet a full division of the Institute, with von Kármán as the chair of its executive board. With numerous Army research projects to work on, JPL grew rapidly. At the same time, the city of Pasadena was expanding northward, producing the odd sight of a large industrial facility adjoining a tony residential zone.

Malina drew on Caltech faculty as well as hiring from the outside. Aeronautics and meteorology



In February 1942, there were only a few small buildings and some rocket-motor test pits at JPL's present site in the Arroyo Seco.

professor Homer J. Stewart [PhD '40] headed the Lab's research and analysis branch, and electrical engineering professor William Pickering [BS '32, MS '33, PhD '36] set up the guidance and controls section. Aeronautics also contributed professor Louis Dunn, who became Malina's assistant director. Most of the work concentrated on improving the performance of solid- and liquid-fueled rocket engines—studies of combustion thermodynamics, means for cooling rocket engines, and ways to control solid-rocket burn rates. The Lab also developed three series of complete rockets, as opposed to rocket *engines*—a critical turn on JPL's path to the planets.

Fittingly for an Army contract, the Lab's first complete rocket was called the Private. It stood eight feet tall, had a range of about 10 miles, and was unguided except for its tail fins. In one of the Lab's earliest failures, Malina and Tsien thought they could double its range by enlarging some of the fins into wings. There they rediscovered what the Wright brothers had realized in 1902: winged flight is fundamentally a control problem, not a lift problem. The winged Privates all corkscrewed out of control after launch, crashing far short of the finned Privates' mark. But calling this a failure may be too strong, as it showed that the Lab would need to emphasize guidance and control technologies—another prerequisite for spaceflight—if the range of its rockets was to improve.

The next three all failed, with the third being the most spectacular. Dubbed the "rabbit killer," it lifted far enough to clear the launch tower, tipped over, and scooted along the ground for a few hundred yards before exploding.

Next came the Corporal, JPL's first guided missile. The Lab started by developing a shorter-range rocket to test the Corporal's liquid-fueled engine, which ran on aniline and red fuming nitric acid. This unguided version was named the WAC Corporal, for "Without Attitude Control." The WAC Corporal debuted on October 11, 1945, at the Army's new test range in White Sands, New Mexico. It set an altitude record of 230,000 feet—more than twice what stratospheric balloons could reach. The first guided Corporal, the Corporal E, flew successfully in May 1947—a fluke, as it turned out. The next three all failed, with the third being the most spectacular. Dubbed the "rabbit killer," it lifted far enough to clear the launch tower, tipped over, and scooted along the ground for a few hundred yards before exploding. It took JPL a year and a half to fix Corporal's problems.

By then, Malina was gone. His late-'30s flirtation with Communism had started to haunt him by early 1946, when the FBI raided his house while he was away at a conference. The FBI had no evidence that he had remained active after 1939, but that meant little during the "Red Scare." Malina was also increasingly unhappy with weapons work. He knew that his rockets would shortly be married to atomic bombs, and he hated the idea. He had proposed offering the WAC Corporal to the larger scientific community, but in 1945 and again in 1946 Caltech's board of trustees turned him down. (In a vindication for Malina, Aerojet eventually adapted the WAC Corporal into the Aerobee sounding rocket—ironically, with Navy money. Aerobees were widely used for upper-atmosphere and cosmic-ray research until the mid-'60s.) So in July 1947, after receiving a job offer from biologist Julian Huxley, director of UNESCO, Malina moved to Paris and left rocketry forever.

Louis Dunn, a transplanted Afrikaner, succeeded Malina. After a series of successful Corporal flights in late 1949 and early 1950, the Army asked that the Corporal be turned into a deployable nuclear-weapon system. In May 1952, the Army ordered 200 missiles and requested a production rate of 20 missiles per month; this didn't come close to happening. There were reliability problems with the electronics, but the Corporal posed other problems as a field weapon. Because the nitric-acid fuel was so corrosive, it had to be carried in tanker trucks until launch. And then there was the radar and command gear. Each missile was supported by eight trucks, so each of the nine Corporal battalions deployed to Europe stretched for miles on the road, and required many hours to set up and fire.

This drawback triggered a return to solid-fuel rockets, which had been plagued by safety issues. A solid propellant core burns from its central axis outward, with the burning surface expanding as it does. More burning propellant equals more pressure, and explosions were commonplace. But in 1948, three JPL engineers found that a star-shaped central cutout allowed even a very large core to burn at a constant pressure. This technology became the basis for JPL's last Army missile, the Sergeant, authorized in 1954, and for all the

A Corporal missile on its launch truck.

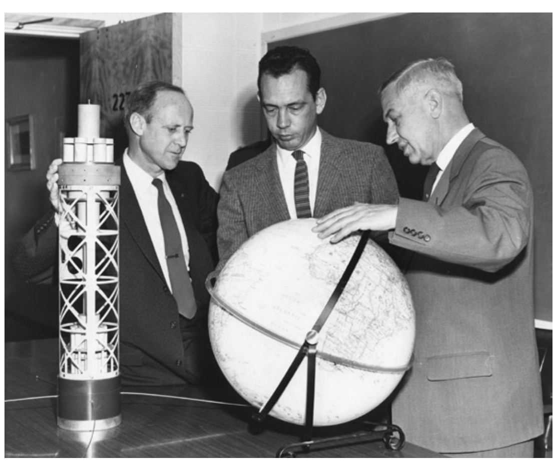
large solid-fuel rockets developed in the 1960s and 1970s: the submarine-launched Polaris and Poseidon ballistic missiles, and the solid-rocket boosters that have been strapped onto liquid-fueled rockets ever since.

Baby Steps Toward Space

The Sergeant contract came to JPL a few months before the ascent of its third director—William Pickering, previously head of the guidance and controls section. As a grad student under physicist Robert A. Millikan, Pickering had studied cosmic rays, flying sensitive instruments on high-altitude balloons. The data were sent back by telemetry, so Pickering worked at the cutting edge of instrument technology as well as science. He had a long-standing interest in adding the latter to JPL's activities, having joined Malina in the effort to get the WAC Corporal opened up for scientific research in 1946. (Dunn, by contrast, was perfectly happy making weapons—in fact, he resigned JPL's directorship to head the Ramo-Wooldridge Corporation's Atlas missile program.)

The time was ripe for a fundamental shift in JPL's mission. Neither Caltech president Lee DuBridge nor Pickering was content with JPL's Army role. Classified weapons development did not sit well with the Caltech faculty, because secrecy prevented any significant interaction between campus and JPL, and development was not *research*. JPL was not making fundamental discoveries, but was merely solving utilitarian problems. Pickering and DuBridge wanted JPL out of the weapons business.

Pickering was a member of an informal group known as the Upper Atmosphere Rocket Research Panel. Chaired by James Van Allen, a cosmic-ray specialist and head of the University of Iowa's physics department, and originally called the V-2 Upper Atmosphere Panel, this group selected and developed scientific instruments that flew on German V-2 rockets captured at the end of World War II.



From left: JPL director William Pickering, Explorer project manager Jack Froehlich (BS '47, MS '48, PhD '50), and Caltech president Lee DuBridge in February 1958. Pickering holds a mock-up of Explorer's instrument package.

When the V-2s ran out in early 1948, they changed their name and switched to several newly developed rockets, including Aerojet's Aerobee. The Army, meanwhile, had settled Wernher von Braun and his ex-Nazi rocketeers on the grounds of the Redstone Arsenal in Huntsville, Alabama, to create the Army Ballistic Missile Agency (ABMA).

The world's first successful two-stage rocket, the Bumper WAC, perched a WAC Corporal on a V-2. (The V-2 gave the Corporal a "bump" to higher altitudes.) This one was Cape Canaveral's inaugural launch on July 24, 1950.

In 1954, the rocket research panel got a scientific Earth-orbiting satellite project added to the program of the upcoming International Geophysical Year (IGY) of 1957–58. A worldwide program of coordinated experiments by scientists on both sides of the Iron Curtain, the IGY was intended to vastly increase our knowledge of our planet while showcasing the virtues of cooperation over confrontation. A committee chaired by Homer Stewart was given the responsibility of choosing IGY's satellite. ABMA and JPL proposed a five-pound uninstrumented sphere, to be tracked by radar, called Project Orbiter. The Naval Research Laboratory and the Glenn L. Martin Corporation proposed using the former's sounding rocket, the Viking, to launch a 25-pound package capable of carrying several small instruments and a transmitter. This was called Project Vanguard. In August 1955, the committee recommended that Project Vanguard be approved, because it offered a greater scientific return.

Stewart and one other member disagreed vehemently. "I remember staying up 'til three o'clock in the morning at home writing the most purple prose that I have probably ever written, trying to write the minority report as to why I thought that was the wrong way to go," Stewart remembered much later. He thought the Navy's proposal, which required a substantial scaling-up of Viking's first and second stages and the development of a new third stage, would need more work than there was time for, while the Army's Redstone launcher was much further along.

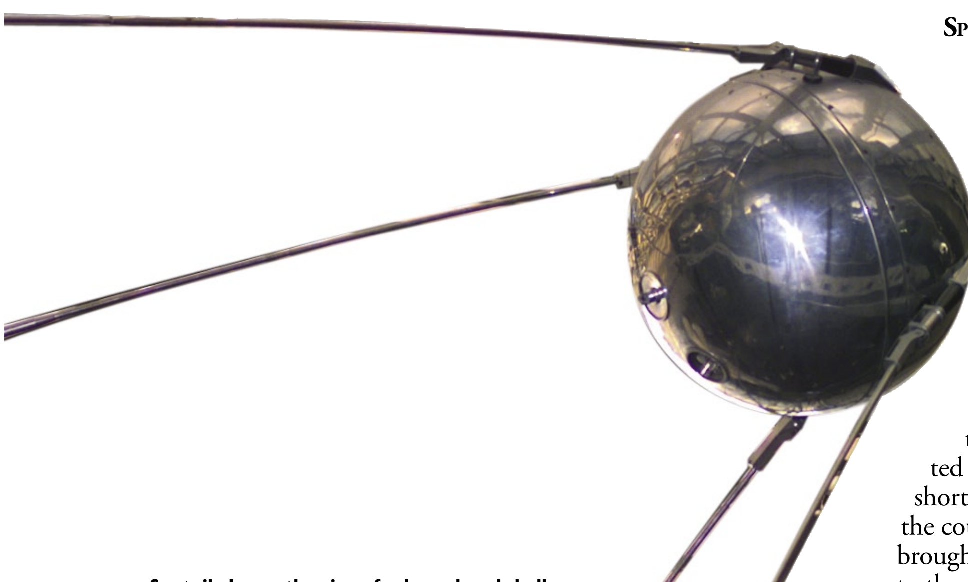
Having lost their bid for orbit, JPL and ABMA teamed up on a highly classified effort known as the Reentry Test Vehicle (RTV) program, part of the development of an intermediate-range ballistic missile named Jupiter. The Jupiter warhead would reach space and reenter Earth's atmosphere, which meant it would experience enormous temperatures. The Germans were aware of this hazard—during the war, some V-2s had vanished midflight en route to London, and von Braun's team eventually discovered that they were exploding from reentry heat. ABMA needed to demonstrate that it could prevent the Jupiter from experiencing this little problem, and the RTV program was designed to prove that an ablative heat shield—a fiberglass-based material in this case—would provide sufficient protection by simply burning away, carrying much of the heat with it.

ABMA provided the liquid-fueled booster, while JPL provided the solid-fueled upper stages and the guidance and control system. JPL also developed a tracking system, called Microlock, which enabled reception of milliwatt-strength signals from thousands of miles away. ABMA had decided to use transistors—brand new technology—for the RTV's transmitter, and they operated at extremely low power levels. Even so, Microlock allowed the missile to be tracked through its entire flight—vital because ABMA intended to retrieve the warhead from the ocean and inspect the heat shield. Not getting the warhead back amounted to a failed test. (This technology, of course, would also prove vital for communicating with far-flung spacecraft.)

RTV flew three times. The first flight used Project Orbiter's configuration, complete with a dummy payload that ABMA's commander, General John Medaris, had filled with sand—on orders from his superiors—to give it enough extra weight to ensure that it didn't "accidentally" go into orbit. Flown as Missile 27 on September 20, 1956, this shot demonstrated the launch vehicle, tracking, and communications systems. Surviving correspondence suggests, but does not prove, that JPL and ABMA hoped this would overturn the decision to let the Navy's Vanguard go first. If so, it didn't work. Missile 27's backup, Missile 29, was put into storage.

Corporal missiles being assembled at JPL. This building was later used to build the Mariner and Ranger series of spacecraft.

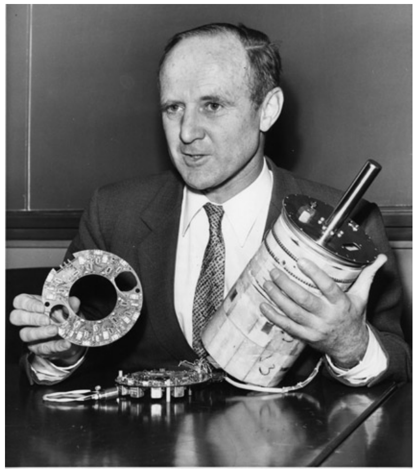
Missile 34, which had a dummy Jupiter warhead with a heat shield, was launched in May 1957. Its guidance system failed, but the warhead was tracked to splashdown. The warhead was never found, however, probably because the floats failed. But the next flight, Missile 40, was a complete success that September. The rescue ship *USS Escape* retrieved the warhead, which showed little damage—although one of the float bags had shark bites in it, leading to jokes that the previous attempt had been eaten. Medaris ended the program, and the remaining sets of RTV hardware joined Missile 29 in storage.



Sputnik 1 was the size of a large beach ball.

Sputnik Changes Everything

Pickering was at a reception at the Soviet embassy in Washington on the evening of October 4, when the news broke that the Russians had beaten Project Vanguard into orbit. Using a modified ICBM, the USSR had orbited an 84-kilogram sphere named Sputnik. Pickering made his way to the IGY offices nearby, and with some other JPL folks tried to calculate when it would fly overhead. He remembered later that "the Soviets were clever because they put a transmitter on there that transmitted on 20 megahertz. That was a frequency any shortwave receiver could pick up. People all over the country could listen to this thing. . . . It was brought home to everybody in the country." More to the point, Sputnik demonstrated that the Soviets



Pickering poses with a copy of Explorer's cosmic-ray detector and some of its circuit boards in December 1957.

were now capable of dropping nuclear warheads on the United States almost without warning. Fears of a "nuclear Pearl Harbor" were rampant among the American public, and the Dow plunged 10 percent in the next three weeks.

The night of Sputnik's launch, von Braun and Medaris happened to be in a meeting with Secretary of Defense Neil McElroy down in Huntsville. "Vanguard will never make it!" von Braun said. "For God's sake, turn us loose and let us do something! We can put up a satellite in sixty days, Mr. McElroy." But McElroy, mindful that the White House wanted the science-oriented Vanguard to fly first, returned to Washington unmoved. But a few weeks later, President Eisenhower did approve Medaris' recommendation to pull Missile 29, the Project Orbiter–configured backup RTV, out of storage . . . just in case. After the November 8 launch of Sputnik 2—which carried a dog, Laika, on a one-way trip into space, raising the stakes enormously in the game of international prestige—the White House also approved construction of a payload for Missile 29. But who would build it?

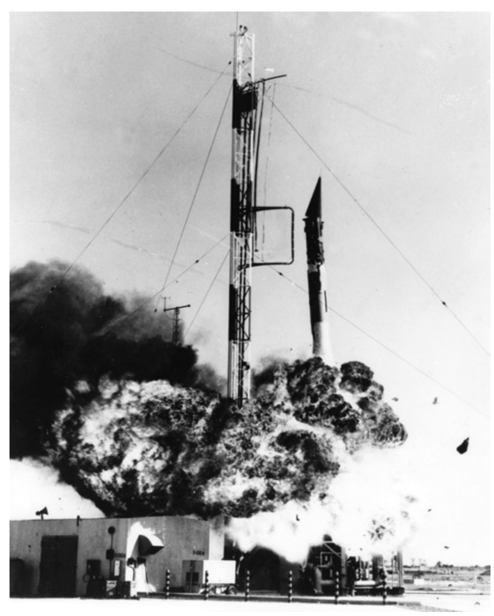
Wernher von Braun, space enthusiast that he was, wanted the job. But in a private meeting with Medaris, Pickering argued that JPL should "be responsible for the upper stages, the satellite itself, and the tracking of the satellite." When Medaris agreed, "the project was set up that way, so that the ABMA was responsible for . . . the Redstone rocket. And we built the rest of the system. At first, I think the group at ABMA were rather unhappy that they didn't have the entire responsibility but in point of fact, it worked out very well."

Initially, the effort was called Project Deal, a name derived from the all-night poker games that JPLers often played on the train down to the White Sands testing grounds. Project manager Jack Froehlich [BS '47, MS '48, PhD '50] reflected "when a big pot is won, the winner sits around and cracks bad jokes and the loser cries, 'Deal!'" Pickering asked his old friend Van Allen for a cosmic-ray detector to use as a science payload. Van Allen was down in Antarctica for the IGY, so he dispatched a grad student, George Ludwig, to JPL to build what was basically a Geiger counter. The payload would be a whopping 20 pounds.

Despite von Braun's boast, JPL and von Braun's group gave themselves 90 days to pull the launch vehicle out of storage, recondition and assemble it, and build the final stage, the satellite, the other instruments, and the radios. They also had to build a ground station at Pasadena and a more elaborate antenna array, capable of triangulating the spacecraft's exact position by interferometry, at Earthquake Valley, in the desert inland of San Diego. (The British IGY team agreed to build copies of JPL's Microlock tracking station and put them in Nigeria and Singapore, so that data could be captured from other parts of the prospective orbit.) In reality, the schedule meant that construction had to take less than 90 days, to allow for extensive testing. Nobody wanted to put up the first American satellite and then never hear from it again! As things turned out, the job was finished in only 84 days of frenzied, round-the-clock effort.

Meanwhile, the Navy's Vanguard launched on December 6. The rocket got about four feet off the pad, lost thrust, fell backwards, and exploded—all on live TV. The satellite fell free of the burning wreckage, transmitter still beeping. It now hangs in the National Air and Space Museum in Washington, D.C. Flopnik, as it was instantly dubbed in the press, was the Army and JPL's golden opportunity.

Eisenhower approved an end-of-January launch for Project Deal, now renamed Explorer. The upper stages and satellite were moved from Pasa-



Vanguard erupted in flames on the launch pad on December 6, 1957.

dena to Cape Canaveral in mid-January under very tight secrecy restrictions. Assembly was completed on January 29, and then bad weather intervened. In the late evening of January 31, problematic high winds abated and Medaris gave the go-ahead.

This is how the Associated Press reported it: "The Army's Jupiter-C missile blasted off Friday night, carrying a satellite into space. Army officials said it would not be known for about two hours whether the missile had succeeded in propelling the first American 'moon' into orbit around the Earth."

Explorer caused some nervous moments when it did not show up at JPL's California tracking station on time. JPLer Al Hibbs [BS '45, PhD '55], at the Cape and using data from the tracking station on the Caribbean island of Antigua, was certain that it had gone into orbit and had already told Medaris so (see *E&S* Number 2, 2003); Pickering, in Washington, wanted to hear from California before announcing it to the public. Explorer finally showed up eight minutes late—it had gotten extra velocity from winds in the upper atmosphere, and was in a higher orbit. JPL radio engineer Henry Richter, in charge of Explorer's electronics, recalls that the first detection was actually made by the San Gabriel Valley Amateur Radio Club. (The station at JPL itself turned out to be blinded by high-voltage power lines running through the mountains right behind the lab.) The Earthquake Valley station picked up the signal moments later.

At 2:00 a.m. on February 1, Pickering, von Braun, and Van Allen hoisted a model of Explorer's third stage and payload above their heads at a press conference at the National Academy of Sciences in Washington for a photo that ran under the next day's headlines in newspapers around the world. The Sputnik challenge had been answered.

Explorer 1's Geiger counter would fall silent for a few minutes each orbit. Since the instrument was sending data back to Earth in real time, some losses were to be expected, but Van Allen eventually realized that the detector was overloading, not failing. Explorer 3, launched March 26, carried a tape recorder to capture a full orbit of data, and

Explorer 1 being mated to the Jupiter-C rocket.

Van Allen determined that Earth was surrounded by belts of very high energy radiation. (Explorer 2, launched March 5, did not reach orbit when the fourth stage of its Jupiter-C rocket failed to ignite.) The Van Allen belts, as they are now known, are formed by charged particles trapped in Earth's magnetic field, and were the first scientific discovery of the new space age.

Pickering, Van Allen, and von Braun triumphantly display a model of Explorer at the press conference in Washington, D.C.

Making NASA

Eisenhower now had to decide who would control the nation's space capabilities. The Army had won, but it made little sense for them to own this technology. Eisenhower, a five-star general, could see that the Air Force, the CIA, and even the Navy had better claims to military uses of space. He also had to consider the public impact—a military program would be classified, unlikely to produce the public spectacles that the Cold War competition for "hearts and minds" seemed to require.

There were strong advocates for a civilian space agency. Scientists wanted an open, unclassified program. And then there was the old National Advisory Committee for Aeronautics (NACA), whose four research centers—Langley, Ames, Lewis (now the Glenn Research Center), and the High-Speed Flight Station (now the Dryden Flight Research Center)—had been the foundation of American aeronautical superiority. NACA's leadership, however, was deeply divided. Many of Langley's personnel thought very little of space, for example, seeing little work for an aerodynamicist to do up there. At a December 18, 1957, meeting now known as the "Young Turks" dinner, an open

In a ceremony on October 1, 1958, President Eisenhower commissions T. Keith Glennan (right) as NASA's first administrator and Hugh L. Dryden as deputy administrator.

The official seal of NASA's predecessor, the National Advisory Committee for Aeronautics (NACA), established in March 1915, depicts the Wright brothers' first flight.

fight broke out over the agency's direction. The space advocates were eventually shouted down, but the agency brass got the message and decided to promote NACA's conversion into a new, civilian space agency. And so NACA became NASA, the National Aeronautics and Space Administration. But the National Aeronautics and Space Act of 1958, signed into law on July 29, did not change the status of JPL or the ABMA. They remained Army facilities. Pickering wanted JPL moved into NASA, as did NASA administrator T. Keith Glennan, who also coveted ABMA. But even though Pickering promised to finish up the Sergeant contract, the Army was not keen, for obvious reasons: losing ABMA and JPL meant losing the next military, and technological, frontier to the Air Force. Glennan prevailed, and JPL was formally transferred to NASA on December 3. ABMA would stay in the Army until July 1, 1960, when it became the Marshall Space Flight Center.

Claiming the Planets

It was not clear what the Lab's role would be in this brand-new agency. Should JPL try to take the lead in manned space flight, stick to satellites, or pursue the planets? At a brainstorming session, Pickering and his senior staff concluded that JPL should not stick to Earth-orbiting satellites, despite having just launched America's first one. Al Hibbs would later recall, "Finally, it was decided we will go after the moon and planets. . . . We'll get out of the satellite business, because we could see there were going to be communications satellites, there were going to be observations satellites, there were going to be military satellites . . . and the aerospace companies were going to be in this. It wasn't just going to be us any more." But JPL could go to the planets uncontested. NASA had no planetary plans at all, as reaching Venus and Mars was thought by headquarters to be far too audacious for the new technology's capabilities.

That's precisely what attracted JPL—the planets would be hard technologically, but hugely rewarding scientifically. Pickering recalled, "I think the principal thing as far as Caltech was concerned was the opportunity to move out of the field of classified military research into a field of space science which would have a much broader attraction to the faculty as a whole." And the rest, as they say, is history. □

Erik M. Conway is the Jet Propulsion Laboratory's historian. He has written numerous articles on aviation and atmospheric science and three books: High-Speed Dreams: NASA and the Technopolitics of Supersonic Transportation, 1945–1999*; * Blind Landings: Low Visibility Operations in American Aviation, 1918–1958*; and* A History of Atmospheric Science in NASA, 1958–2004*; all published by Johns Hopkins University Press.*

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