GLENN RESEARCH CENTER (GRC)

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NACA Lewis's 1957 Transformation

"Hey, did I hear you use the word 'spaceflight'?" "Yes, sir," replied Lewis research engineer Ed Jonash. Jonash was rehearsing his talk on high-energy fuels for a small contingent of Headquarters officials days before the NACA's 7–10 October 1957 inspection. "We'd better take that out of there," warned Executive Secretary John Victory. "Suppose a Congressman heard you say 'spaceflight'?"

Lewis researchers were not focused on spaceflight at the time, but merely saw it as a logical extension of their aeronautical propulsion efforts. Victory, however, did not want to jeopardize the Agency's funding by giving the visiting officials the impression that the NACA was going beyond its aeronautical mandate. He ordered references to space to be excised from the presentations. Late in the afternoon on Friday, 4 October, the TASS news agency announced that the Soviet Union had successfully orbited the first artificial satellite. The Space Age had begun. When the inspection began on Monday morning, the statements regarding space were not only reinserted into the talks, but emphasized.

The year 1957 was one of the Lewis Flight Propulsion Laboratory's most transformative years. The laboratory took steps to accelerate the redirection of its research from aviation to missiles and to transition liquid hydrogen from an experimental fuel to a reliable, usable propellant. By the end of the year, lab leaders would urge the NACA to take the lead in the development of a new U.S. space agency. Liquid hydrogen would play a key role throughout.

In the midafternoon of 13 February 1957, NACA pilots Eb Gough and Joe Algranti took a B-57 Canberra out over Lake Erie and successfully switched the fuel supply from JP-4 to hydrogen. The aircraft performed superbly as the hydrogen-fueled engine etched a long vapor trail across the deep blue sky for the next 20 minutes before Algranti switched back to jet fuel. The mission was the first flight demonstration of liquid hydrogen. It came just two years after Lewis researchers began using small, experimental engines to study hydrogen combustion on test stands. The B-57 flight not only confirmed the performance of hydrogen, but more importantly proved that the cryogenic fluid could be safely stored and pumped in an operational system.

In early March 1957, Associate Director Abe Silverstein created the Fluid Systems Components Division to intensify the lab's efforts regarding the handling of cryogenic fluids. On 11 April, Congress approved an NACA appropriations bill that included

funds for a new cryogenic fluids research complex at Lewis. Shortly thereafter, a new Air Force–sponsored hydrogen production plant began operation nearby to supply the lab with large quantities of hydrogen to conduct its research.

On 26 April, Lewis held a conference to present the initial results of the hydrogen aircraft program to 175 guests. In addition, the lab announced that it would be hosting two larger events in the fall—an NACA inspection for industry and political leaders and a technical conference on advanced flight propulsion. The Lewis staff spent the next six months preparing for these events.

Silverstein also established a group of six senior managers in early March to guide the laboratory's research agenda and define facilities required for that research. This Research Planning Council would play a critical role in the technical and physical expansion of the laboratory in the coming months and years. The council, which disbanded the massive Compressor and Turbine Division in July, decided by the end of the summer to terminate the lab's celebrated turbojet engine program.

In August 1957, Lewis engineers started up their new Rocket Engine Test Facility (RETF) for the first time. The RETF, which could fire 20,000-pound-thrust engines, was at the time the largest U.S. facility for testing high-energy propellants. This was the first in a long succession of new or repurposed facilities dedicated to space activities. The RETF would be prominently featured at the upcoming inspection.

The NACA conducted an inspection at one if its laboratories every three years. Hundreds of public officials and industry leaders were invited to hear presentations on the laboratory's research and facilities. These elaborate events provided the NACA with a great deal of exposure, so they were subject to meticulous planning and close review by Victory and other NACA leaders. For the 1957 inspection, the Lewis staff prepared several stops highlighting some of the lab's more traditional work, such as aircraft noise reduction,

A researcher works a demonstration board in the Rocket Engine Test Facility during the 1957 inspection of the National Advisory Committee for Aeronautics (NACA) Lewis Flight Propulsion Laboratory in Cleveland, Ohio. (Photo credit: NACA)

high-temperature materials, and supersonic turbojets. In addition, there would be presentations on advanced efforts such as nuclear aircraft, hypersonic propulsion, and high-energy fuels.

The event began on Monday, 7 October, just three days after the Soviets launched Sputnik. Over the weekend, there was not only a general elevated national interest in space, but a concern by many citizens, journalists, and politicians that the Soviet Union had technologically surpassed the United States. "[Sputnik] is bad because of their progress," admitted NACA Administrator Jimmy Doolittle during one of the coffee breaks, "but good because it will shake us loose from our complacency." The Lewis staff did their best to ease these concerns for the visitors.

Lewis researchers had been studying high-energy propellants since the mid-1940s in an attempt to identify fuels that yield significantly better performance without substantial increases in risk or expense. Although the studies were geared toward aircraft and missile propulsion, by 1957 it had become apparent that these fuels could be used to launch payloads into

space. To demonstrate these capabilities, the engineers at the RETF created a display above the control panel that featured Earth with both a satellite and spacecraft orbiting above. The speakers compared the performance the solid rocket fuels then being used to propel missiles to the potential superior performance of propellants such as hydrogen, fluorine, and ammonia.

The hypersonic propulsion stop included a discussion of the nascent field of ion engines. Since these thrusters must operate in a vacuum, their only application is space propulsion. The demonstration of a rudimentary thruster within a glass jar seemed to elicit the most response from the press, who wrote articles including "Space-Ship Engine Forerunner Exhibited," "Model of Manned Space Ship Revealed by NACA," and "Ions May Hold Space Travel Key." Throughout the week, both the media and guests praised Lewis for its foresight regarding space. The *Cleveland Press* ran the headline, "Vital research in the US race to send American airmen orbiting through space ahead of the Russians is going on in NACA's Air Lab."

In this atmosphere, Silverstein requested funds to construct a million-pound-thrust rocket test stand. Headquarters, however, could not afford the expense of operating such a facility at the time. The Lewis Research Planning Council then proposed a $6 million budget request for FY 1958 to initiate a series of rocket facilities at Plum Brook Station. On 3 November 1957, the Soviets demonstrated an even higher level of technical competence by launching a dog into space aboard the significantly heavier Sputnik II. Days later, President Dwight Eisenhower gave the first indication that the United States would make space a priority by appointing a Special Assistant for Science and Technology.

Meanwhile, the Lewis staff continued to prepare for the Flight Propulsion Conference. One team of researchers wanted to include data from the firing of a small regeneratively cooled hydrogen-fluorine rocket engine in their presentation. After months of preparation, they attempted a run on 5 November. Just moments before the engine was to be activated, a fluorine leak caused the test cell to burst into flames. Over the next three weeks, the staff rushed to rebuild the cell. The team labored on the installation around the clock during the final days before the conference. At 6 a.m. on 22 November, the hydrogen-fluorine engine came to life. One of the men rushed to process the data while another went home to clean up for his talk. Hours later, he was dramatically handed the data as he spoke from the podium.

In general, Lewis used the conference to make the case that hydrogen-fueled aircraft and ramjet missiles could compete with intercontinental ballistic missiles (ICBMs). Although these vehicles did not come to fruition, the high-energy fuels and cryogenic technology discussed would soon be applied to rocket stages. Perhaps the most advanced portion of the conference was the final session on performance and missions. Here, Lewis researchers used some broad "back of the envelope" calculations to compare the performance of different types of propulsion systems for a variety of missions, including surface-to-surface missiles, Earth satellites, lunar orbits, and piloted missions to the surface of the Moon. This is likely one of the NACA's first detailed considerations of a lunar landing.

Meanwhile, both the NACA and the government deliberated on the best way to address the new space challenge. In late November, Senator Lyndon Johnson opened a series of congressional hearings to critically review the status of U.S. missile and space technology. President Eisenhower had planned to deliver a nationally broadcast speech from Cleveland on 26 November. Afterward, he was to visit the new RETF facility at Lewis. The trip was canceled at the last moment after the President suffered a mild stroke, however.

On 6 December, the first U.S. response to Sputnik ended traumatically when the Vanguard rocket toppled over on the launch pad. At Lewis, Walter Olson revisited a document he had drafted in 1955 that urged the NACA to explore spaceflight. He noted a number of space-related areas that the NACA could readily support, including a space station. His colleague Bruce Lundin, however, envisioned an even

more ambitious effort. Following the loss of Vanguard, he drafted a report that called on the NACA not only to support U.S. space efforts, but to aggressively lead the way. He and the other Research Planning Council members began developing proposal plans for a new space laboratory.

On 18 December, NACA leaders called a meeting in Washington, DC, to discuss the group's future role in space with representatives from the three laboratories. Silverstein cleaned up Lundin's proposal and presented it to the others. Lewis was the only lab that advocated for a strong role in space. When offered an opportunity to voice their opinion later that evening, younger members from the laboratories were much more universal in their desire get into the space effort. By mid-January 1958, the NACA had resolved to seek leadership of the U.S. space efforts. By March, President Eisenhower had decided to use the NACA as the basis for the new National Aeronautics and Space Administration.