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NACA Triennial Inspections

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NASA Inspections

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LEWIS RESEARCH CENTER AND THE POST-WAR NACA INSPECTIONS

By Bob Arrighi with assistance from Glenn Bugos

Young space power researcher Bill Brown stood under the lights on a makeshift stage in the Engine Research Building and began to run through his talk on power-conversion research at Lewis Research Center. He was stopped almost immediately by Center Director Abe Silverstein. Silverstein pointed to a full-scale model of a SNAP-8 reactor and barked, "I do not want to see that on the stage. I don't want it. Get it off there." The shaken Brown was participating in a dress

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rehearsal for Lewis's upcoming 1966 inspection. The inspections, which were initiated under the NACA, allowed the Center to brief a handpicked legion of government officials, military leaders, and commercial manufacturers on its research activities and test facilities. The precisely organized and well-rehearsed inspections provided the NACA with an opportunity not only to showcase its capabilities, but also to solicit suggestions for further research and strengthen its case for continued federal funding. These were elaborate affairs. There was no tolerance for mistakes, either in the logistics or in the technical talks. Brown sighed with relief the following week, after his final practice run—sans the model—when Silverstein said, "Great job" and quickly went on to the next stop.[1]

The NACA management conceived these annual meetings, referred to as "industry conferences," in the 1920s as a conduit between their research laboratory at Langley Field and the nation's aviation leaders.[2] The NACA could demonstrate its research efforts and test facilities at the conferences while receiving valuable feedback from guests regarding the issues that needed addressing and what facilities were most effective.

The conference attendees, composed of elites in the field of American aviation, actively participated in the discussions. Therefore, NACA Chairman Joseph Ames demanded perfect coordination and presentations at the conferences to put the NACA in the best possible light. Director of Research George Lewis worked with the Langley Memorial Aeronautical Laboratory (LMAL) staff on the content and staging of the talks and the facility tours, while Secretary John Victory handled the logistics and socialization.[3] Ames personally reviewed the presentations during rehearsals and discussed the content, visuals, and oration directly with the speakers. Victory would assume this role following Ames's resignation in 1936.[4]

Several dozen guests attended the first conference in May 1926. By 1936, attendance had grown to over 600 and required the addition of a second day.[5] The NACA Headquarters invited hundreds of guests from the military, industry, universities, and government. Some invitations were sent to specific individuals, whereas others requested that organizations dispatch a representative.[6]

It became customary for the NACA officials and attendees to meet in Washington, DC, the day before and take an overnight cruise across the Chesapeake Bay to Langley. After a lavish breakfast in Hampton, Virginia, the visitors caravanned to the laboratory for a morning tour of the facilities. This was followed by lunch and the requisite group photograph. The afternoon was spent being briefed on the NACA's research and requesting ideas for future research. The group reboarded the steamship at the end of the day for the return journey. In those final hours, the leading lights of the nation's aviation field held relaxed conversations over drinks and dinner regarding the NACA and current aeronautical concerns.[7]

This annual NACA spring ritual was suspended during World War II (WWII) as the organization turned its attention to improving military aircraft. The final conference in 1939 was referred to as an "inspection"—a military term—for the first time. It was at this point that the NACA created its Moffett Field and Cleveland facilities. In lieu of the overarching

1 Bill Brown, interview by Bob Arrighi, 17 December 2003.

2 James Hansen, *Engineer in Charge: A History of the Langley Aeronautical Laboratory, 1917–1958* (Washington, DC: NASA SP-4305, 1987).

3 Alex Roland, *Model Research* (Washington, DC: NASA SP-4103, 1985).

4 Abe Silverstein, interview by Walter Bonney, 21 October 1972 and 20 September 1973, Glenn History Collection, Oral History Collection, Cleveland, OH.

5 Hansen, *Engineer in Charge*.

6 Mary Lou Gosney, "Invitations for 1954 Inspection," memorandum, 1 April 1954, Glenn History Collection.

7 Roland, *Model Research*.

industry conferences, military and manufacturing representatives made frequent visits to the three NACA laboratories for classified technical conferences on specific topics.[8]

As the war began winding down, the new Cleveland lab began inviting large groups of visitors for "inspections" of its facilities. These included briefings, exhibits, and tours of the facilities, but the visits were on a much smaller scale than the fabled prewar conferences at Langley. The Cleveland visitors included the National Aviation Writers, the Institute of Aeronautical Science, and groups of Army and Navy officers. Grandstands were erected beside the Altitude Wind Tunnel to facilitate group photographs of the visitors. During this period, the lab also used the "inspection" term for smaller visits by VIPs such as General Dwight Eisenhower.

Meanwhile, members of the aeronautical industry began voicing concerns during the war that the NACA was not responsive enough to their needs. They urged the NACA to share its research findings in a more timely and broad fashion. In response, George Lewis began appointing additional industry members to both the Executive Committee and the technical committees; and the power of the technical committees was elevated.[9] The NACA also instituted an Industry Consulting Committee in September 1945, which led to the addition of technical experts on airframes, engines, and aircraft operation to the Executive Committee. The dissemination of NACA reports was expedited, and the number of topical meetings increased. Perhaps the most palpable measure was the reinstitution of the NACA inspection conferences.[10]

The NACA and the field of aeronautics had changed dramatically in the mid-1940s. The former tripled in size, incorporated a broader spectrum of research, and replaced the ailing George Lewis with Hugh Dryden. The aviation industry also expanded and was transitioning into new technologies such as jet aircraft and missiles. So there were concerns in March 1946 when new NACA Chairman Jerome Hunsaker suggested that each of the three research laboratories begin holding annual inspections.[11]

The growth of the aviation industry required close attention to the number of invitees and the addition of more inspection days.[12] The traditional exchange of information with the guests would be supplanted by even more polished presentations that would demonstrate the NACA's capabilities, facilities, and effectiveness. Summaries of the talks with selected photographs were printed in 8- by 4-inch pamphlets and distributed to the guests. Langley Engineer-in-Charge Henry Reid suggested that photographs be taken of all the charts and exhibits for dissemination afterward and to serve as base material for budget requests.[13]

On 9 May 1946, the NACA opened its first inspection in seven years at Langley. Over the course of three days, guests heard about new technologies such as the helicopter, as well as traditional Langley research topics.[14] Two months later, on 16 July 1946, the Ames Aeronautical Laboratory held its very first inspection. The single-day event focused on the new research work necessitated by supersonic flight. In addition, aeronautical legend William Durand formally activated Ames's new 12-Foot Low Turbulence Pressure Wind Tunnel.[15]

8 Ibid.

9 Ibid.

10 T. L. K. Smull, "Report to the Industry Consulting Committee," 23 May 1947, Glenn History Collection.

11 NACA Executive Committee Meeting Minutes, 21 March 1946, Glenn History Collection.

12 Ibid.

13 Henry Reid to Edward Sharp, 15 October 1947, Glenn History Collection.

14 "Fifteenth Annual LMAL Inspection Huge Success," *Wing Tips* (7 June 1946).

15 "Officials from AERL at Ames Inspection," *Wing Tips* (2 August 1946). AERL stands for "Aircraft Engine Research Laboratory."

From 1947 to 1953, Langley and Ames held inspections biennially.

The Cleveland facility held its first inspection 8–10 October 1947. The laboratory supplemented the Headquarters invitation list by requesting the presence of local manufacturers and officials. As a result, the inspection was expanded from two to three days. The VIPs and industry representatives attended on the first day, military officials on the second, and representatives from Cleveland-area industry and universities on the third.[16] The rosters of those who were invited and those who attended were carefully tracked. Chief of Public Affairs Walter Bonney invited specific members of the press corps to attend one of the days.[17]

The nearly 800 guests were briefed on full-scale engine testing, ramjets, axial-flow compressors, turbojets, fuels, icing research, and materials at eight different tour stops. The lab's altitude propulsion facilities—the Altitude Wind Tunnel, the Four Burner Area, and an altitude tank in the Engine Research Building—were highlighted.[18] Unlike its sister laboratories, Cleveland held inspections annually through 1951, with the exception of 1950. The 1948 inspection is notable for the rededication of the facility as the Lewis Flight Propulsion Laboratory in honor of the recently deceased George Lewis. The event also featured the nearly complete 8- by 6-Foot Supersonic Wind Tunnel.

The presentations, physical logistics, and scheduling for the inspections required a tremendous amount of planning and coordination, but the technical talks were the most important. Early on in the preparations, Silverstein, who then served as Chief of Research, decided which topics and facilities to highlight. The division chiefs then selected individuals (and alternates) to develop and deliver the presentations. Even though many of the visitors possessed technical backgrounds, great efforts were made to convey complex subject matter in simple, easy-to-understand language. Speakers were encouraged to incorporate models, charts, photographs, and films into their presentations. There were several rounds of practice runs in the weeks leading up to the event, including the "semifinal" and "final" full dress rehearsals. The former was critiqued by Silverstein and the latter by John Victory.[19]

The physical preparations began weeks in advance. There was a general round of basic cleanup and repairs. The grounds were landscaped and buildings painted. Carpenters built stages and platforms; audio engineers installed public address systems and projectors; and mechanics fabricated exhibits and models. The publication branch created signs, slides, and pamphlets. Hundreds of comfortable chairs were borrowed and properly disseminated among the stops. The cafeteria scrambled to cater to hundreds of guests. An urgent call went out prior to the 1957 inspection requesting that staff return all of the plates, cups, and utensils that had wandered off to their offices.[20] The secretarial staff served as hostesses and servers at the luncheon and parties.

Unlike the early Langley inspections, it was impossible to sequester these large crowds on a single vessel. Instead, the NACA made arrangements with several major railway lines to transport guests to Cleveland from East Coast and Midwest cities, and the Cleveland Hopkins International Airport waived its landing fees for the dozens of transport aircraft bringing attendees in for the day.[21] Lewis set up an information desk

16 "NACA First Annual Inspection, Flight Propulsion Research Laboratory, Cleveland, Ohio," 10 October 1947, Glenn History Collection.

17 "LMAL To Hold Inspection," *Wing Tips* (16 May 1947).

18 "NACA First Annual Inspection, Flight Propulsion Research Laboratory, Cleveland, Ohio."

19 Wilson Hunter, "Tentative Rehearsal Schedule for the 1954 Triennial Inspection," memorandum, 20 May 1954, Glenn History Collection.

20 "Will You Please Send Them Home?" *Wing Tips* (14 August 1957).

21 Wilson Hunter, "1954 NACA Inspection," memorandum, 25 May 1954, Glenn History Collection.

and lounge area at the airport for these guests.[22] Most of the visitors, however, were put up at the elegant Cleveland Hotel downtown on Public Square and bused out to the lab in the morning.

Perhaps the most difficult task was scheduling the activities. Every minute of the day was scripted. The visitors arrived at the laboratory around 8:30 a.m. They registered in the lobby of the Administration Building, then proceeded down the hall to the auditorium. At 9:30 a.m., Jerome Hunsaker or Victory greeted the guests and provided an overview of the NACA's history. This was followed by Hugh Dryden's description of the NACA's research methodology. The Lewis contingent, led by Director Ray Sharp and Silverstein, briefed the group regarding the tour stops and Lewis's overall research efforts. Executive Engineer Carlton Kemper then highlighted the lab's primary test facilities.[23] The introduction concluded with a group photograph of the guests.[24]

At 10 a.m., the hundreds of visitors were then separated into color-coded groups of about 40 to begin the tour. At Lewis, there were customarily eight tour stops—each with 30-minute sessions featuring several speakers. The guides and support staff were pressured to maintain a tight schedule that included short breaks for coffee and cigarettes and lunch. The breaks were as stringently planned as the talks. For example, hostesses were instructed to provide 10 percent more coffee than was needed at each stop.[25] The day concluded around 4 p.m. with a reception at the picnic grounds or hangar. The guests were then bused back downtown for dinner at the hotel.

Traditionally, Lewis held a private inspection for the staff on the Friday afternoon following the event. Afterward, a party was thrown at the picnic grounds to celebrate the event's success.[26] Employees were then invited to bring their families in on Sunday for an open house. The technical presentations were or were not held for them, depending on the security levels at the time. Either way, almost all of the laboratory buildings were open to the families. These open houses regularly drew 3,000 or 4,000 people on a single afternoon.[27]

The enthusiastic letters of appreciation from the guests and NACA management began rolling in almost immediately afterward. Meanwhile, the Lewis planners began assessing the event—including the evaluation of the speakers and a lighthearted review of how they utilized their pointers.[28] The staff contributed suggestions regarding displays, talks, and planning.[29] The inspection planning materials—including invitation lists, schedules, correspondence, transcripts of the talks, and photographs of the exhibits and charts—were then collected and bound in a single volume that was permanently stored in the Lewis library.

In June 1949, Langley veteran Ira Abbott drafted guidelines for the new NACA inspections. His primary concern was that the content of the inspections was overly technical. "The visitors can be expected to carry away only a general impression. The inspections should be conducted so that this impression is not one of bewilderment, but rather one of confidence that the Committee knows its business and is making

22 William Gough to Wilson Hunter, "1954 Triennial Inspection at the Lewis Laboratory," 28 June 1954, Glenn History Collection.

23 "NACA First Annual Inspection, Flight Propulsion Research Laboratory, Cleveland, Ohio," 10 October 1947, Glenn History Collection.

24 Ibid.

25 Wilson Hunter to William Dey, "Refreshments To Be Served During the 1954 Inspection," 5 April 1954, Glenn History Collection.

26 "Lab To Observe Open House Sunday Sept. 25," *Wing Tips* (16 September 1949).

27 "Pre-Inspection Hustle-Bustle," *Wing Tips* (25 June 1954).

28 Carlton Kemper, "1954 Inspection—NACA—Lewis Flight Propulsion Laboratory," memorandum, 8 June 1954, Glenn History Collection.

29 John Hopkins to Wilson Hunter, 17 October 1957, Glenn History Collection.

substantial progress through the orderly but vigorous conduct of research in well-planned facilities," he said. Abbott instructed presenters to briefly contextualize their topic and its history, note the current concerns, and describe the NACA's steps toward remedying the issue. The scope of post-war NACA research was much broader than in earlier times. The visitors could not be expected to be versed in all topics. Abbott stressed the streamlining of information so that guests could grasp the general concepts in each field without becoming awash in details, technical language, or mathematical symbols. He encouraged the use of simple charts, models, and equipment.[30]

> "BY THE MID-1950S, THE EFFORTS TOWARD DEVELOPING HIGH-ENERGY PROPELLANTS, PARTICULARLY LIQUID HYDROGEN, WERE PRODUCING REAL RESULTS."

In March 1953, the NACA announced that its three laboratories would rotate the duties of hosting the inspections. These new Triennial Inspections would highlight the work of the host site but would also include a stop from each of the other two laboratories. (The new Muroc Flight Test Unit was not included.)[31] Traditionally, Lewis held its inspections over three consecutive days in late September or early October; Langley over three alternating days in mid-May; and Ames during two days in mid-July. Lewis hosted events in 1954 and 1957 under this system. In addition, Lewis conducted a one-day inspection on 22 May 1956 to showcase its new 10- by 10-Foot Supersonic Wind Tunnel.

Lewis's most famous inspection was the 7–10 October 1957 event held literally at the onset of the Space Age. Lewis had been working on propulsion and aerodynamic issues regarding missiles and rockets since the mid-1940s and was starting to pursue electric propulsion. By the mid-1950s, the efforts toward developing high-energy propellants, particularly liquid hydrogen, were producing real results. Although Lewis was also unveiling its new Rocket Engine Test Facility (RETF), the NACA was wary of overstepping its aeronautical mandate. On Thursday, 3 October, John Victory led a group from Headquarters through the final dress rehearsals. During at least two stops, Victory interjected when references to spaceflight were mentioned. The RETF stop even included a display of stars and satellites in its exhibit.[32] Victory ordered the frustrated researchers to strike those lines from their talks. The next evening, the Soviet Union launched Sputnik. When the inspection began on Monday morning, the original talks were in place, and Lewis was praised by the nearly 1,600 attendees for its readiness for the space race.[33]

Over the next year, the National Aeronautics and Space Administration (NASA) was created, with the NACA serving as its core. In January 1959, NASA announced that the new agency would continue the Triennial Inspections, beginning with an event at Langley in October 1959 featuring Project Mercury.[34] The inspections, however, would slowly fade away as NASA evolved. Langley held another in May 1964, but there were no further inspections at Ames.

30 Ira Abbott, "Improvement of Laboratory Inspections," memorandum, 14 June 1949, Glenn History Collection.

31 "Change Schedule for Inspections," *Wing Tips* (20 March 1953).

32 Robert Graham, interview by Sandra Johnson, 30 September 2005.

33 Virginia Dawson, *Engines and Innovation: Lewis Laboratory and American Propulsion Technology* (Washington, DC: NASA SP-4306, 1991).

34 "Info from Headquarters," *Wing Tips* (30 January 1959).

Lewis, which was preoccupied with several new development programs, did not host another inspection until October 1966. The event was part of a yearlong celebration of the Center's 25th anniversary. The three-day inspection, Lewis's first since 1957, drew 2,000 invited guests.[35] The visitors witnessed the presentations at the major facilities; viewed the Gemini VII spacecraft, a Centaur rocket, and other displays in the hangar; and saw demonstrations of the new 500-foot-deep Zero Gravity Research Facility.[36] For the first time, the guests were hosted in the Development Engineering Building's auditorium instead of the Administration Building. In his opening comments, Deputy Director Eugene Manganiello remarked on the dramatic accomplishments made since the last inspection nine years earlier and noted the controversy over the references to space leading up to the 1957 inspection.[37]

Langley held another inspection in October 1968 as the Apollo program was gaining momentum. The circumstances were much different five years later, when NASA decided to revive the inspections at its three Field Centers, starting with Lewis. The Apollo program was completed, and NASA's budget was plunging. Lewis was hit particularly hard. The termination of the nuclear propulsion and power programs and the lack of involvement in the Space Shuttle design led to the loss of hundreds of jobs at the Center in the early 1970s. In response, Center management attempted to transition into new fields of research, such as terrestrial energy and energy-efficient engines. The September 1973 inspection, named "Technology in the Service of Man," was an effort to sell Lewis's capabilities to a host of industry, government, and military groups. The nine stops featured cleaner, quieter aircraft engines; solar power research; and the Centaur rocket. Nearly 900 invited guests attended the event over the three days. The staff and their families heard the talks the following weekend, and the public was invited the weekend after that. In total, approximately 22,000 people attended the 1973 inspection talks.[38]

Although post-inspection comments were exceptionally positive, John P. Donnelly, Assistant Administrator for Public Affairs, questioned whether "[w]e got our money's worth." The positive impact of the inspection on the Center was undeniable, but Donnelly felt that "the people who count"—members of Congress—were not present in sufficient numbers.[39] The nature of the inspections had changed dramatically since the end of the NACA, and the target audience shifted from the aerospace elites to Washington power brokers. Although a subsequent inspection was planned for Langley and a future event at Ames, the 1973 Lewis event appears to have been the Agency's final inspection.

In 1977, Lewis began issuing annual research and technology reports that comprehensively described the Center's accomplishments during the past year. Although a bit briefer, the descriptions were similar in nature to the talks given at the inspections and included a large quantity of images. These reports are disseminated widely throughout industry, universities, and government institutions, but they cannot replace the interaction with and among the aerospace leaders that took place while attending the inspections.

35 "Thousands To View Lewis Work at Inspection, Family Day," *Lewis News* (30 September 1966).

36 Lynn Manley, Lewis Research Center Press Release 66-54, 16 September 1966.

37 Eugene Manganiello, "Lewis' Role in Support of NASA Missions," 4 October 1966, Glenn History Collection.

38 Walter Olson, "Technology Utilization and Public Affairs," *Lewis News* (11 January 1974).

39 John Donnelly to Deputy Administrator, 20 December 1973, Glenn History Collection.