The First Federal Civil Aviation R&D Facility

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Seventy-five years ago, on May 29, 1939, the Robert Hinkley, chairman of the Civil Aeronautics Authority, formally dedicated the CAA's Indianapolis Experimental Station (later renamed the Technical Development and Evaluation Center and then Technical Development Center). In 1938, the CAA had received funding to establish an aviation research center. The CAA acquired a site at Indianapolis, Indiana, through a long-term lease arrangement with the city. The facility, which the city of Indianapolis built in one year under contract to the CAA at a cost of $800,000, sat on a 1,000 acre tract of land adjacent to the Indianapolis Municipal Airport (later called Weir Cook Airport). The new facility had two 4,000-foot runways, allowing for landings in four directions. The hangar/shop area comprised a 150 feet by 120 feet building with a two-story 30 by 120 feet section for office and laboratory space.

Before construction of the Station, federal researchers at the CAA and its predecessor agencies had conducted civil aviation R&D at any number of airports willing to let them run specific flight tests and demonstrations of prototype navigation aids. The new station consolidated all R&D activities at one facility allowing for better coordination of research personnel at one location. With a single facility to consolidate activities, CAA accelerated its R&D program.

The early work at Indianapolis focused primarily on developing and refining navigation aids, such as the instrument landing system (ILS), very-high-frequency radio ranges, and radio transmitters and receivers. The equipment installed at the facility included a CAA-developed prototype ILS, an ultra-high frequency radio range, and runway landing lights designed to provide better visual assistance to pilots during bad weather landings. CAA assigned two research aircraft to the facility: a Waco with tricycle landing gear used in the ultra-high-frequency radio research and a Stinson equipped with conventional landing gear for use in the instrument landing research.

CAA's research aircraft NC-11, a Boeing-247, in front of the Indianapolis Experimental Station

Researchers demonstrated the first reliable ILS, complete with localizer, glide path, and outer and inner marker beacons, in 1940. A visitor to the Station in February 1940, there to watch tests of the ILS, described the facility as a place "where research was done on a variety of things from testing runway lights to firing dead chickens from a cannon toward a built-up windshield at a couple hundred miles an hour to see if the windshield could withstand the crunch

of a bird hit in flight." He continued, "The result was lots of blood and it was hard on the chicken carcass." The CAA's windshield experiments proved a perennial favorite for the press.

Early radar display being tested at the Washington air route traffic control center in 1948

In the immediate post-war period, the Experimental Station housed 14 engineers and 88 other workers. Most of their work focused on adapting military radio and radar advances for civil aviation needs. On May 24, 1946, for example, the CAA demonstrated publicly the world's first radar-equipped control tower for civilian flying. Raytheon had built the basic radar equipment for the Navy. Improvements to the military equipment included an improved search antenna and a feature that eliminated ground clutter by permitting only moving targets to appear on the screen. By means of radar screens, traffic controllers could see every aircraft for 30 miles around the airport, no matter how bad the weather.

The CAA not only hoped to significantly improve U.S. civil aviation safety, but also wanted to transition U.S. technology to the world. From October 10-23, 1946, CAA hosted 140 representatives from 28 nations at the Indianapolis Experimental Station. CAA officials hoped the three-week meeting would convince the Provisional International Civil Aviation Organization (PICAO, precursor to the International Civil Aviation Organization) to adopt the U.S.-developed navigation aids as the global standard. On November 23, after a three-week long meeting in Montreal, the PICAO Radio Technical Division recommended the CAA's localizer-glide path, or ILS, system and the CAA's very high frequency omni-directional range with distance-measuring equipment as the world standards.

In a 1951 article in its journal, the CAA boasted that the Technical Development and Evaluation Center had grown from a small office in the CAA's headquarters in Washington, DC, to a facility at Indianapolis of recognized, world-wide importance. The Center's work, according to the article, "[is] prominent in all technical discussions in the International Civil Aviation Organization in Montreal." Some of the Center's accomplishments included:

- A sandwich type windshield, consisting of glass and plastic, strong enough to withstand collision with birds in flight
- A simple stall warning device
- Fire resistant coatings for airplane fabric
- Flashing aircraft navigation lights
- Safer exhaust manifolds and vacuum pump systems
- Fire-proof oil tanks
- A flammability scale for use by industry in fire studies
- Instrument landing system
- Distance measuring equipment

- Slope line approach lights
- A means to measure airport pavement strength
- Cross-wind landing gear

IBM 650

By the mid-1950s, the engineers in Indianapolis began testing computer technology to aid with air traffic control. In October 1956, the CAA leased an IBM model 650 computer for installation in the Indianapolis ARTCC. In conjunction with other computer development work being carried out by the Technical Development Center, researchers assessed the value of the IBM computer for aiding in air traffic control duties.

Despite its ongoing achievements, because of limited funding and resources the facility's development projects often took longer than desired. In July 1956, Milton Arnold, a representative from the Air Traffic Association (ATA) surveyed the Center's diverse efforts and reported the Center was "geared by funds and facilities to the requirement of aviation in 1938, at best. There are some excellent . . . personnel in that division of CAA, but the overall concept of the . . . development program . . . is approximately 10 to 15 years behind in money, facilities, and staffing."

The Center's "disreputable-looking buildings," as one reporter described the facility in 1958, seemed to epitomize what many considered a decaying air traffic control system, unable to keep up with increases in air traffic, deploy quickly new air traffic control equipment, and, in general, prepare for the coming jet age. In 1956, a major accident spurred calls for changes to federal aviation regulations and for a stronger civil aviation research and development effort. On June 30, a Trans World Airlines Super Constellation and a United Air Lines DC-7 collided over the Grand Canyon, Arizona, killing all 128 occupants of the two airplanes. The collision occurred while the aircraft were flying under visual flight rules in uncongested airspace. The accident dramatized the fact that, even though U.S. air traffic had more than doubled since the end of World War II, little had been done to mitigate the risk of midair collisions. In the wake of mounting public pressure, Congress opened hearings to probe the general problems of airspace and air traffic control management.

In August 1957, President Eisenhower signed the Airways Modernization Act, which established the Airways Modernization Board and charged it with the development and modernization of the national system of navigation and air traffic control facilities. The board would serve as an interim organization until a permanent agency could be established to oversee civil aviation. With a clearly defined mandate and sufficient funding to undertake an expanded aviation research and development program, the Board decided to establish a new technical center. It selected a site near Atlantic City, New Jersey, from among more than 1,800 proposed sites to establish the National Aviation Facilities Experimental Center (NAFEC). Several factors contributed to the selection. The Navy was vacating its Pomona Naval Air Station and the opportunity for immediate occupancy and the use of existing facilities would save millions of dollars and months of time. Atlantic City also afforded test engineers a wide range of flying conditions and the proximity to both New York's high-density area and the open space over the

Atlantic Ocean permitted testing both in a complex operational environment and in an open airspace environment

When the new Federal Aviation Agency superseded the CAA and took over the duties of the Airways Modernization Board in December 1958, NAFEC became the technical arm of the new organization's Bureau of Research and Development. In 1959 the FAA closed the Indianapolis center and moved its development activities to NAFEC.