Most propeller aircraft in the 1920s had radial engines. In this configuration, the engine cylinders were mounted in a circular pattern. Most of these engines were air cooled by air flowing back through the propeller and over the cylinder heads (the tops of the cylinders sticking out from the engine). But this presented a problem, for the cylinder heads stuck out from the aircraft’s skin and created drag. In the later 1920s, the National Advisory Committee for Aeronautics (NACA) developed a covering, or cowling, for the engine that not only reduced drag but also improved cooling of the engine. It was a major technological breakthrough achieved through careful, systematic research and testing.

The idea for the NACA low-drag cowling originated in 1926 during a demonstration of the new Propeller Research Tunnel (PRT) at Langley Memorial Aeronautical Laboratory (LMAL) in Virginia near the Atlantic coast. The PRT was then the largest wind tunnel in the world and capable of holding a full-size airplane engine and propeller and the fuselage behind it (but not the wings). Several people witnessed a test of a Sperry Messenger airplane and immediately wondered if it was possible to cover the cylinder heads in order to reduce drag. The problem was that
covering the cylinder heads was likely to reduce the cooling of the engine, so any engine covering would have to be carefully designed.

Researchers at Langley started an effort to explore engine cowlings under the direction of Fred Weick, a young Chicago-born engineer. Weick designed ten different cowlings, from a partial covering to a complete covering of the engine. These were fitted to a Wright Apache biplane with a J-5 Whirlwind air-cooled engine. The goal was to produce a cowling that reduced drag but still cooled the engine as much as an uncovered engine.

The ten cowlings were tested on the engine in Langley’s PRT. Engineers measured drag, propulsive efficiency of the propeller (in other words, how efficient was the propeller at pushing air past the cowlings), and the engine temperature. The best versions of the cowlings were then modified, with the addition of vents and with changes in their shape. This was all done in a methodical manner. Eventually, the engineers decided upon a cowling design they designated “No. 10,” which completely covered the engine and its protruding cylinder heads, letting in air at the front. The air was then directed over the hottest parts of the engine and out the sides along the fuselage. What they also learned was that the shape of the airplane behind the cowling was important to understanding how to design the cowling in the first place—the cowling had to smoothly connect to the fuselage so that the air flowing over it was not disrupted.

The No. 10 cowling reduced drag by a factor of almost three. This was such an impressive improvement in performance that Weick chose to make the results public immediately so that industry could take advantage of them. In November 1928, Weick wrote Technical Note 301, directed at airplane manufacturers, which described the cowling. Weick stated that using a cowling that completely covered the engine was practical, but warned that “it must be carefully designed to cool properly.” The NACA’s Washington office announced that a cowling could be installed for about $25 per airplane and that the possible overall savings from the industry’s use of the cowling was at least $5 million (which was more than than had been spent on the NACA since its establishment in 1915).

Langley engineers then mounted cowling No. 10 onto a borrowed Curtiss Hawk AT-5A biplane that used the same Wright Whirlwind J-5 engine that had been tested in the PRT. The tests showed that the airplane’s maximum speed increased from 118 to 137 miles per hour (190 to 220 kilometres per hour) with the cowling. On February 4-5, 1929, Frank Hawks, a barnstorming pilot, flew a Lockheed Air Express equipped with a NACA low-drag cowling from Los Angeles to New York non-stop and established a new record. Hawks flew this distance in 18 hours and 13 minutes in an airplane whose top speed had been increased from 157 to 177 miles per hour (253 to 285 kilometres per hour). Gerry Vultee, of Lockheed, sent the NACA a telegram that stated, “Cooling carefully checked and OK. Record impossible without new cowling. All credit due NACA for painstaking and accurate research.” Soon many new speed records were being established with aircraft equipped with versions of the NACA low-drag cowling. In January 1930, the National Aeronautic Association awarded the NACA the Collier Trophy for the greatest achievement in American aviation in 1929.

The engine cowling was an important technological development. But its importance was not so much developing a thing as it was improving understanding of aeronautical design techniques. Airplane designers could not simply stick an “engine cowling” — a piece of tin—on any aircraft and have it work. They had to specially design a cowling for each aircraft. But once they understood the principles behind this device, and once they understood the method for developing it, they could design engine cowlings for existing and new aircraft and improve their efficiency. This then led to further research on the proper placement and cooling of propeller engines, particularly on large multi-engine craft, such as bombers. For instance, most multi-engine craft before the mid-1930s, such as the Ford Trimotor, had the engines mounted below the wings in pods (or “nacelles”). But further research at the NACA, using the same methods developed for the low-drag cowling development, demonstrated that the best place to mount the engines was directly in front of the wing, blended into it. Thereafter, planes like the B-17 bomber had engines that were fitted into the wing itself and achieved greater efficiency.

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