ONE day last December, a triangular-winged jet fighter climbed into the sky at Edwards Air Force Base, military flight test center in California's Mojave Desert. The Convair F-102A, an all-weather interceptor on which the Air Force was pinning a lot of its hopes for air defense, was testing a new principle of aircraft design of vital importance to supersonic planes.

The F-102A was wearing an all-but-imperceptible change in its configuration: its body was pinched in at the wing juncture, giving it a "Coke-bottle" or "wasp-waisted" effect. On the success or failure of this new look hinged the future of hundreds of millions of dollars' worth of new airplanes and perhaps years of time in building an adequate Air Force.

The F-102A's mission that day was to prove it could fly faster than sound, not a very spectacular assignment in an era when supersonic flight is regarded as commonplace. Actually, though, a number of airplanes, which from a design standpoint should have been supersonic, had not been able to live up to their press notices.

The Convair F-102, a forerunner of the F-102A with a conventional, unpinched fuselage, should have been easily supersonic. But a phenomenon of high-speed flight about which design engineers knew very little was holding it back.

The wasp-waisted design of the F-102A was an effort to master this phenomenon.

On that December day, the F-102A climbed higher and higher. Suddenly, while the plane was still climbing, the needle flicked past Mach 1 (the speed of sound).

The F-102A had the same general design and the same Pratt & Whitney J57 engine as its subsonic predecessor; wasp-waisting had made the difference, had pushed it past the speed of sound.

This design innovation, which was termed by a top Air Force general the most important advance in aeronautics since penetration of the sound barrier, was developed by a young scientist, Richard T. Whitcomb of the National Advisory Committee for Aeronautics, the top government air research body. The importance of Whitcomb's brilliant research was underscored last month when a committee of 20 representatives of all phases of aviation voted to award Whitcomb the coveted Collier Trophy.

The Collier Trophy, one of aviation's highest awards, was donated in 1911 by the late Robert J. Collier, editor and son of the founder of Collier's magazine. It is awarded annually for "the greatest achievement in aviation in America, the value of which has been demonstrated by actual use during the preceding year." (In addition to the successful F-102A testing, the Grumman F11F Tiger, a Navy interceptor, has demonstrated the value of the Whitcomb principle.) Whitcomb will be presented the trophy at a dinner in Washington on December 17th, when the aviation industry will celebrate the 52d anniversary of man's first powered flight, made by Orville and Wilbur Wright at Kitty Hawk, North Carolina.

Whitcomb's achievement was to overcome the phenomenon which had been putting a brake on high-speed aircraft and which is known as "transonic drag." Drag is the resistance of the air to an oncoming object; transonic describes the speed region where a plane approaches and passes the speed of its own sound (about 600-800 miles per hour).

At low speeds, drag is a minor problem, because the air is pushed out...
A supersonic mystery which was crippling U.S. air power was solved by a new shape for planes—wasp-waists. Its designer won this top award of the way of the airplane very gradually. In the case of a plane moving at transonic speed, however, the air is pushed aside abruptly and violently, creating shock waves which sharply increase the amount of drag.

Until Whitcomb's work, engineers knew very little about transonic drag. Consequently, some planes which in design theory were capable of supersonic flight actually could not fly that fast because they had not been provided sufficient engine power to overcome the drag. In those cases where the planes had enough power, supersonic flight was achieved only at a great cost in fuel consumption.

Whitcomb discovered that the shock waves could be eliminated or greatly reduced by indenting, or wasp-waisting, the fuselage at the point where wing and fuselage join, giving the shock wave room to dissipate by flowing inward toward the body of the plane where previously it had been thrust violently outward. It took Whitcomb three years to evolve his complicated formula known as "area rule," which governs the precise amount of wasp-waisting required in a given airplane.

"Area rule," which can increase a plane's speed by 25 per cent, is being applied to practically all supersonic aircraft in development. And the great power reduction and operating economy "area rule" affords may knock years off the timetable for supersonic airliners, Whitcomb thinks.

"Dick" Whitcomb, now thirty-four, is a sandy-haired, blue-eyed bachelor ("Never had time for a private life"), who hails from Evanston, Illinois, and now lives in Hampton, Virginia, a few miles from NACA's Langley Aeronautical Laboratory, where he is assistant head of the lab's Eight-foot Transonic Tunnels Branch. The NACA job is the only one he has ever had; he joined Langley in 1943, immediately after graduation from Worcester (Massachusetts) Polytechnic Institute.

Have the Soviets yet discovered "area rule"? Whitcomb says cautiously: "There has been no indication of it in the photographs of new Russian airplanes we have seen."

If they have not, Whitcomb's "area rule" becomes even more important. It may mean an advantage of a year or two in "buying time," the most important aim of all military research.

THE END

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