The 'Wasp-Waist' Plane

Description of What Is Termed Biggest Air Advance Since the Sonic Penetration

By RICHARD WITKIN

The announcement of the "wasp waist" fashion for planes, and what it does, apparently has provoked less comment than the latest Paris styles.

This is unfortunate because the new plane silhouette is a development of tremendous importance. Lieut. Gen. Donald L. Putt, Air Force Deputy Chief of Staff for Development, feels it is the "most significant advance in aeronautics since we first penetrated the sound barrier."

Recent evidence of swift Soviet progress in aircraft design has touched off wide debate over whether United States research is lagging so badly that our lead in air power is endangered. An advance as revolutionary as the wasp waist should not be overlooked in assessing the durability of our advantage.

The new design increases the speed of supersonic warplanes up to 25 per cent without any increase in engine power. A plane capable of 800 miles an hour with the conventional straight-line fuselage jumps to the 1,000-mile-an-hour category when its middle is tucked in.

Far Greater Range

Put an other way, the wasp-waist version can travel 800 miles an hour with no great fuel-consuming effort, and thereby can enjoy far greater supersonic range than its predecessor.

The new style has been variously referred to as the "wasp waist," "Coke bottle" and "Marilyn Monroe." A less colorful tag, the "indented" shape, is preferred by the man who developed it, 34-year-old Richard T. Whitcomb of the National Advisory Committee for Aeronautics. The wasp-waist style was made necessary by the difficult behavior of air when planes approached the speed of sound (760 miles an hour at sea level, decreasing with altitude).

A subsonic plane gives advance notice of its arrival. When its nose, or wing or tail hits the air, the impact is relayed forward at sonic speed, and the air ahead starts opening up to make way.

No Time to Get Ready

But when a plane nears sonic speed, the air does not have time to get ready because the plane is going as fast as the warning message. When the nose or another part hits an unprepared patch of air, the air is shoved aside violently.

The blow is transmitted to the next portion of air and the next, as far as ten or twenty times the span of the wing. The pressure equalizes in a 360-degree disc around the plane. If the shock area were visible, the plane would appear to be flying straight through the middle of a huge phonograph record.

Normally, there is one shock wave at the nose, another where the wing begins and others at additional points where contour changes. The most severe shock runs perpendicular to the plane's path at the rearmost tip of the wing.

The forces associated with this particular shock wave constitute the major part of the enormous drag increase that occurs when the plane nears the sonic zone. The average plane acts as though the pilot had suddenly loosed half a dozen parachutes hooked to the fuselage.

These rear-edge drag forces come from two interrelated sources. Air moving over the curved top of a wing moves faster than straight-flowing air because it must go farther in the same time. At subsonic speeds, the air behind the wing has time to adjust to speed changes. In the sonic zone it does not, and the air passing the rear edge is compelled to slow down abruptly. The resulting shock wave produces severe braking action.

A related factor is that, in the sonic zone, the speed of air passing over the wing keeps increasing up to the moment of abrupt slowdown. The higher the speed, the lower the pressure. Hence, the pressure aft is lower than the pressure forward, and the difference in pressure contributes powerfully to the overall drag.

Photo Is Clue

The clue that led to elimination of the wing drag was a wind-tunnel photograph of the shock wave at the rear of a swept-back wing. Mr. Whitcomb observed that the wave ran perpendicular to the fuselage instead of diagonally along the swept rear edge. He deduced that the shock was related to the wing's area rather than its shape.

To test the hypothesis, models were fabricated with the same fuselage shape as plane models, but with the wings replaced by bulges around the middle. This gave a resemblance to bullets. The bulges began and ended at the same points on the fuselage as the wing on the equivalent plane.

The area of the bulge at each point from front to rear was precisely the same as the area of the wing at that point—in other words, the area seen after slicing a knife through the wing from tip to root.

The bulging bullets were put in the National Advisory Committee's trans-sonic wind tunnel and the shock waves photographed. A shock wave was produced where the bulge started and another where it stopped. The waves duplicated those on the equivalent plane.

To eliminate the shock waves on a bulging bullet, the bulge is removed. Similarly, the tests proved, shock waves produced by the wings of an equivalent plane can be eliminated by removing an area of fuselage equal to the area of the bulge. The slimming is done along the section where the bulge had been trimmed—that is, the section where wing joins the fuselage. The principle is known as the "area rule."

Eases Into the Waist

Practically speaking, the pinched waist means that the air violently displaced by the wing now has a convenient place to go. Instead of pounding against a solid, unprepared mass of air to the outside, it can ease into the wasp waist.

If indenting is impractical because a vital organ is in the way, the shock can be eliminated in a slightly different manner. The bulging bullet can be smoothed by extending the line of the bulge instead of removing it.

This means adding a certain area to the fuselage, fore and aft of the bulge. Adding the same amount of body on the equivalent plane, fore and aft of the wing, results in an indentation at the wing section.

The area rule already has shaped the figures of two military planes, the Grumman F-11F-1 and the Corvair F-102A. Without the wasp waist, the interim version of the F-102A could not meet its design specifications and penetrate the sonic region. With the wasp waist, and the same Pratt & Whitney J-57 engine, it exceeds sonic speed without straining.

The Chance-Vought F8U-1, soon to go into production, also has profited by the breakthrough.

The indented shape should also speed the day of the supersonic airliner. It has been widely thought that airliners might not exceed sonic speed for decades, if then, because the price paid in engine power needed to drive into the sonic zone would make commercial operations uneconomical at such speeds. But the area rule largely removes the problem.

Available evidence indicates that the United States has a two or three-year lead in this fundamental design field. None of the new planes that the Russians have been at such pains to display has an indented figure.

It is mandatory that the United States ask itself whether its development pace is dangerously retarded in view of Soviet progress. Officials are particularly concerned that the current research and development program may not be nearly large enough to match the Russians in the critical guided-missile field.

But the preparedness goal will be better served by carefully assessed facts than by exaggerations designed to sell a point of view. An aeronautical advance as radical as the wasp-waist principle is a solid answer to extremists who have been lamenting that all is already, or nearly, lost.

Plane Taking Specialist To Denver Blows Tire

Special to The New York Times.

LOWRY AIR FORCE BASE, DENVER, Sept. 25—Fire trucks and crash wagons met the aircraft bringing Dr. Paul Dudley White, Boston heart specialist, to Denver to treat President Eisenhower.

The Military Air Transport Service aircraft carrying Dr. White from Boston had a blowout in the tire of its nose-wheel when it landed here at Lowry Air Force Base. Smoke poured out as the tire touched the concrete runway, and the fire engines rushed toward the taxiing aircraft.

The tire had been chewed to bits, and the airplane was not able to taxi to the headquarters building where a landing ramp could be used. When the aircraft came to a stop, Dr. White used a crash ladder carried by one of the trucks to descend from the airplane.

He was met by James C. Hagerty, White House press secretary, and Col. Robert Schulz, Presidential military aide. The group went at once to the Fitzsimons Army Hospital.

Seoul Joins World Red Cross

GENEVA, Sept. 30 (Reuters) — The Red Cross Society of South Korea has become the seventy-fourth member of the League of Red Cross Societies, which has its headquarters here. The North Korean Red Cross Society has not yet applied for membership.

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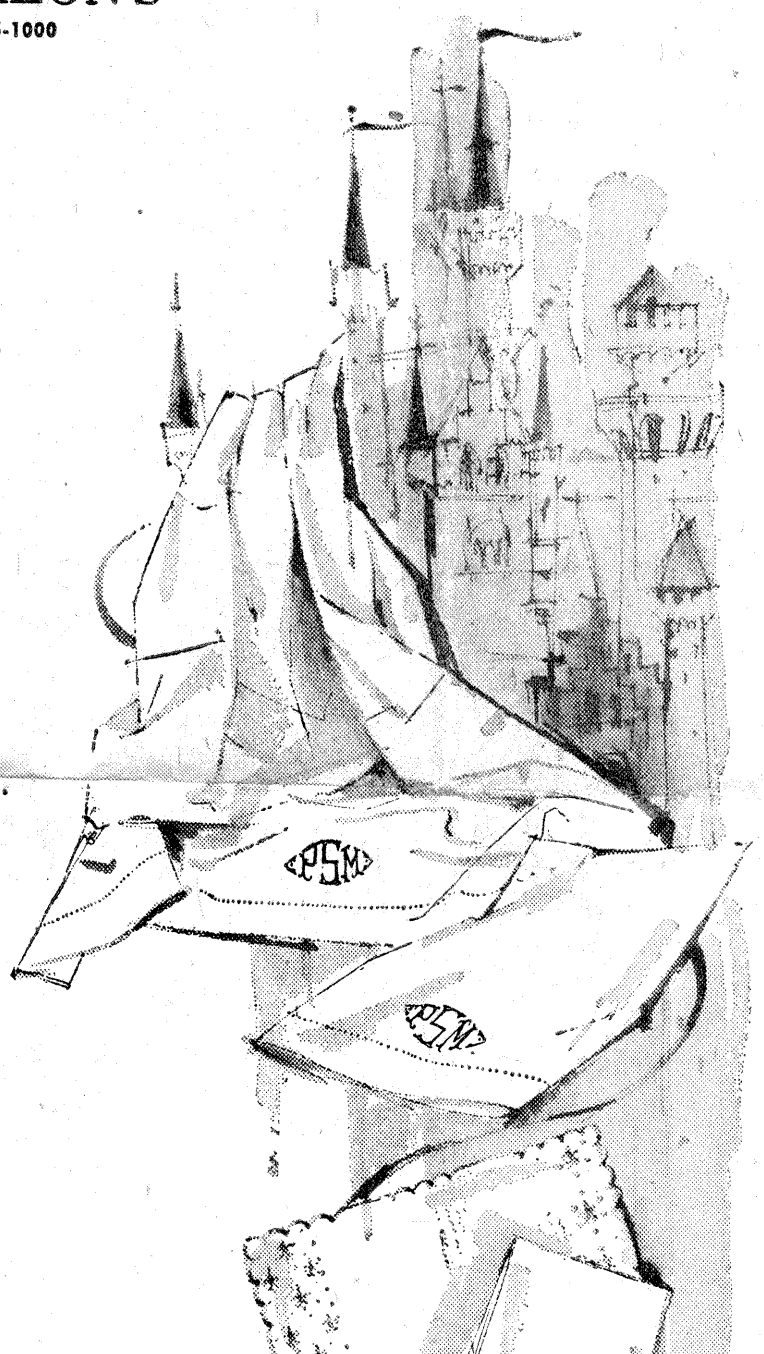
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