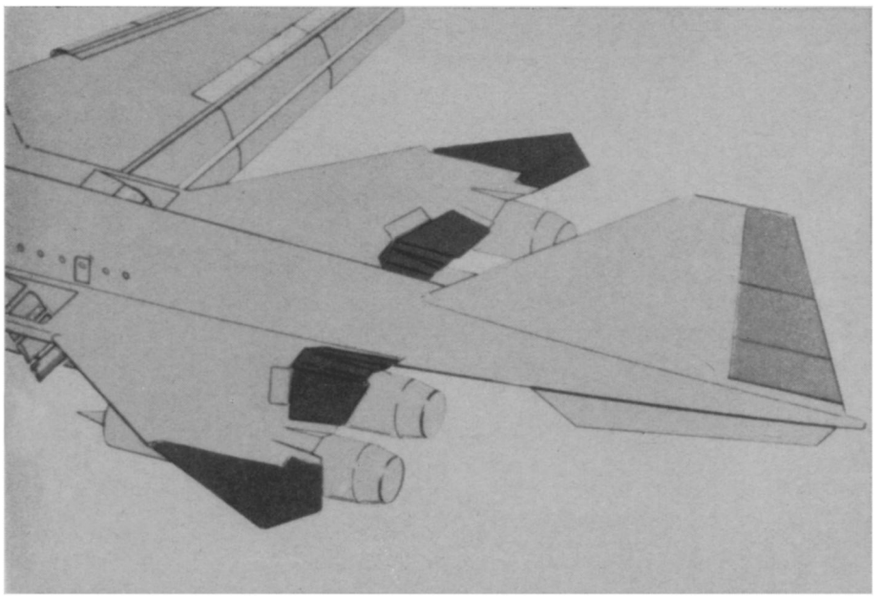

Boeing

Movable control surfaces on the SST's tail (dark areas) may change or vanish.

SST TOO HEAVY

Definite fix comes unglued

"We have a very definite fix on the prototype design," said Fred Maxam, the Boeing Co.'s director of engineering for the supersonic transport. That was last December (SN: 12/23/67, p. 610), after he and his colleagues had spent months reworking the SST blueprints from stem to stern, adding 41 passenger seats, 47 feet of fuselage and tail, a baby wing near the nose and numerous other refinements. The relief in Maxam's statement was obvious.

It didn't last long. The trouble began Jan. 15, when Boeing presented the Federal Aviation Administration with 4,000 pages of graphs, charts and other data—a paper picture of the SST as it would look and perform with all the preceding months' changes built in. The FAA, with a committee of airline representatives, spent more than five weeks poring over the mountainous report, until, at Boeing's request, the agency announced that the already-lagging SST development schedule would be slowed down by another year.

"The Federal Aviation Administration has agreed to the proposal . . ." is the way the press release read, but the FAA wasn't just doing the company a favor. Boeing's "paper plane" report revealed several serious difficulties with the design, including some 25 tons of excess weight and handling problems that might, though probably only under admittedly rare conditions, cause the pilot to lose control of the aircraft.

The slowdown announcement had barely left the FAA's SST outbasket, when reports began to appear that the big obstacle was not the design at all, but the war-torn, barebones budget. The $223 million requested by the Administration for the SST in fiscal 1969 is little more than half of what had once been the goal for this point in the program, and the slowdown could conceivably let the sum be cut in half again.

All parties concerned, however—the FAA, Boeing, Senator Henry M. Jackson from the company's home state of Washington—formed a united front, saying that the decision was 100 percent non-political.

Either way, the technical problems are formidable. Easily the biggest one is weight. At least 50,000 pounds will have to be taken care of "any way Boeing can get it out of there," says Maj. Gen. Jewell C. Maxwell, SST development director for the FAA. This is a seventh of the plane's empty weight.

Some of Maxwell's technical advisers estimate that only 60 percent or less of the excess will be removable by actual trimming of metal; the rest will have to be compensated for in other ways. To get even that much, Boeing's engineers will have to do some ingenious paring, in such places as around the frames of the seats and in the non-load-bearing bulkheads.

Another possibility is that Boeing will decide to use different titanium alloys in the airframe than those now planned. This would require great care in making a selection, since some of the lighter alloys are more susceptible to corrosion and crack propagation, particularly in salt air.

Even if the weight-trimming program is every bit as successful as the FAA specialists think it can be, there will still be another 10 tons or so to make up for.

One of the best ways of doing this is to reduce drag. Each one percent reduction in drag may improve the aircraft's efficiency as much as knocking off a ton and a half of extra weight. Boeing is already looking at several ways to do this, including lengthening the wing and adding wing area where the leading edge joins the fuselage.

Another source of weight-compensation is the SST's four jet engines, which still have the capacity of being upped in thrust from their present rating of more than 60,000 pounds. General Electric plans to give them their first test firing this month.

On a plane the size of the SST, both the wings and the fuselage will bend of their own weight. The 318-foot fuselage will be flexible enough to move up and down at least three feet. If the wings could be made completely rigid, says an FAA engineer, though this is impossible in practice, the hydraulic system used to control them could be cut from 15,000 to 10,000 pounds.

Though perfect rigidity is only a theoretical designer's dream, the lack of it is the source of the other major problem, besides weight, plaguing the SST. Because the SST's wing area is concentrated so far back along the fuselage when the wings are swept back for supersonic flight, the center of aerodynamic lift is very close to the tail. This central lift point is essentially the fulcrum of the plane when it is in flight, which means that the SST's tail has only short leverage through which to apply its controlling and stabilizing influence. Therefore the control forces on the tail must be very strong if it is to work efficiently. Unfortunately, on the present design they would be so strong that at high speeds, combined with high loads such as during a sharp turn, the horizontal tail might well bend and twist so violently that the pilot would lose control of the plane.

There are other problems as well. "We'll look at things as broad as a whole new wing," says Maxwell, though that does not extend as far as eliminating the variable-sweep design.

The year's slowdown will push the first flight of even a prototype version into late 1971 or early 1972, by which time the Anglo-French Concorde may well be in commercial service. Airlines will not be able to get their hands on the U.S. plane until four years after that.

Might this latest redesign mean that the SST will have a reduced sonic boom, making it more suitable for use over land? "Listen," Maxwell says, "we haven't looked at an overland airplane since the competition days."