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Special Report

The Supersonic Transport Race: The European Side

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THE SUPERSONIC TRANSPORT RACE: THE EUROPEAN SIDE

The Anglo-French developers of supersonic transport aircraft (SST) are in a close race with the USSR to be the first to fly a prototype. At this point it appears the Soviets could be the first to attain that goal, possibly even by the end of this year--although they apparently will not be a major competitor in the world aircraft market.

The British and French have settled some of their technical and economic differences about the joint Concorde project which had caused delays and at one time threatened to end British participation. They are now well on the way toward meeting their February 1968 target date for the initial flight of a Concorde prototype.

After the first test flights technical considerations will determine how soon the SSTs will be ready for commercial use. Both the Soviets and the British and French plan to have their respective aircraft in limited service by 1971. In the case of the Concorde, technical problems are likely to delay full service use perhaps by as much as two years or more beyond 1971.

The full scope of the technical problems likely to be encountered by a commercial airliner flying at twice the speed of sound will not be known until the SSTs are test flown. There are preliminary indications, however, that troublesome problems will be found in the operation and maintenance of the engine and the fuel system. There are also problems attendant on supersonic flight over populated areas, such as the effects of sonic boom, that have yet to be solved.

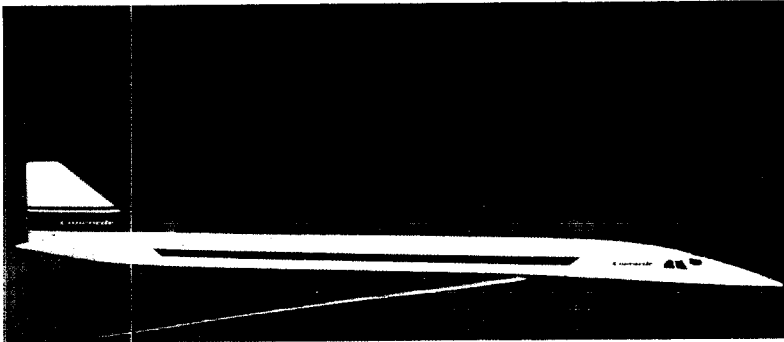
The Anglo-French Concorde

Political, as well as economic and technical, considerations have weighed heavily in decisions about the Concorde project. At the time of the

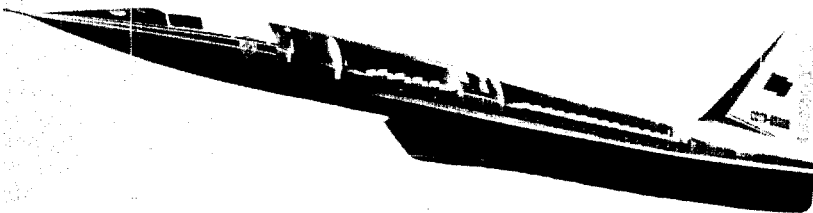
program's initiation in November 1962, Britain was seeking entry into the European Economic Community, and sought to demonstrate its interest by establishing other ties with the continental Europeans. The project

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The SUPERSONIC TRANSPORTS.....



The ANGLO-FRENCH CONCORDE



The SOVIET TU-144

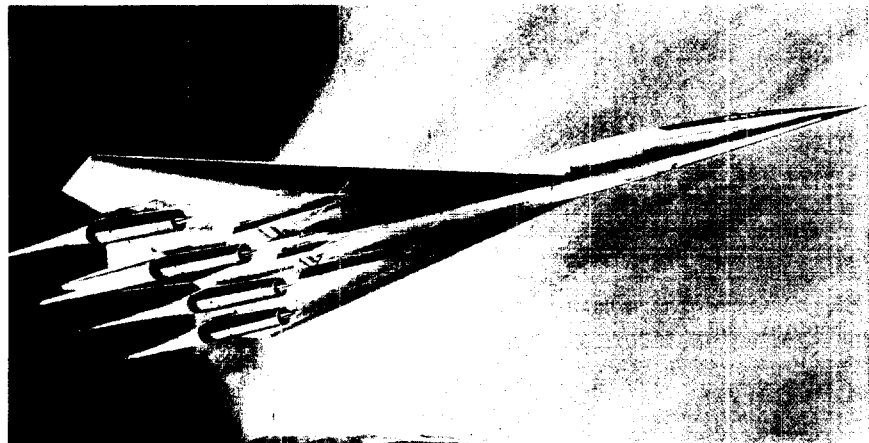
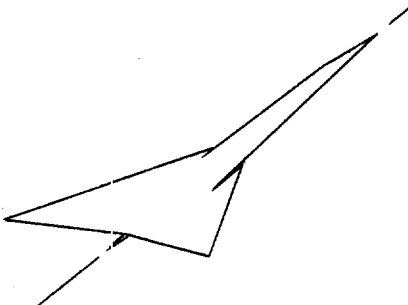
	CONCORDE	TU-144 ^b	BOEING 2707
PROGRAM COST	\$1.4 billion	—	—
PLANE COST	\$21 million ^a	—	\$40 million
PROTOTYPE	early 1968	late '67 early '68	late 1970 ^d
IN SERVICE	1971	late 1970-71	1974 ^d
TOTAL No. ORDERS	72 (36 US)	10-20 Aeroflot	115 (57 US)
No. of PASSENGERS	138	121 (80) ^c	280
LENGTH	191 ft.	189 ft.	306 ft.
GROSS WEIGHT	357,000 lbs.	286,000 315,000 lbs.	676,000 lbs.
CRUISE SPEED	Mach 2.2 1450 mph	Mach 2.2 Mach 2.35	Mach 2.7
CRUISE ALTITUDE	54,000- 63,000 ft.	up to 65,000 ft.	61,000- 68,000 ft.
RANGE	3500 n.m.	3500 (2500) ^c n.m.	4000 n.m.
METAL	aluminum	aluminum (some titanium)	titanium

a. Including \$5 million for spare parts

b. Soviet claims

c. Western estimates for the first prototype

d. FAA estimate -- no official US commitment



BOEING'S VARIABLE-SWEEP WING SST

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was also expected to help upgrade the UK's slumping, state-supported aircraft industry. In late 1964 the newly installed Labor government in Britain had serious reservations about the costs of the project and seriously considered withdrawing. London still harbors doubts about the Concorde's economic viability but seems committed to seeing it through.

The French, unlike the British, have never shown any doubts. President de Gaulle views the Concorde as an important step in demonstrating the technical competence required of a major power. He sees the project as a means to enhance French prestige by proving that a European aircraft industry strong enough to survive US competition can be created.

Points of Difference

The British and French still differ considerably on important technical and economic aspects of the Concorde project. Paris advocates an all-out effort to sell as many Concordes as possible before US competition comes to bear. London on the other hand, continues to believe that development of an expanded version of the present Concorde will be necessary to compete effectively with the larger Boeing 2707 SST.

The French believe the Concorde must be in service two and a half or three years before the US plane if it is to capture a reasonable share of the market. At French insistence, the first

prototypes will be a 126-passenger version and the preproduction aircraft a lengthened 138-passenger version. The French have flatly rejected any further increases in size or capacity, even though this seating capacity will be only half that of the Boeing 2707.

UK thinking follows a much different pattern. The British do not believe the planned production aircraft has the optimum economic potential. They want a vehicle with greater passenger capacity and more powerful engines, and believe that these technical adjustments should be made during the development and testing of the first prototypes. The French refusal to consider such design changes until after the smaller version is in service has heightened British reservations about the economic viability of the whole program.

The rising costs of the Concorde have also impaired cooperation between the two countries on the project. When the program was launched in 1962, its projected cost was \$450 million to be shared equally between the two governments. By late 1964 when Prime Minister Wilson took office the project's anticipated costs had risen to almost \$800 million. At that time London somewhat hastily informed the French it wanted to reappraise the program because of the rising costs and Britain's balance-of-payments problems, and implied it might withdraw. After a more considered review, the Labor

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government decided to continue to participate, mainly for political reasons. Britain is now once again trying to get into the EEC, and if it withdrew from the Concorde Project while EEC negotiations were in progress, De Gaulle would certainly cite it as proof that the UK was not sufficiently European-minded. The estimated cost is now up to \$1.4 billion, however, and it is clear that in any event London will continue to have doubts about the project on economic grounds.

In late 1966, the UK Treasury and the Ministry of Aviation for the second time in two years refused an inquiry into the cost-sharing arrangement between Paris and London, despite pressure from Parliament. Those who are pushing for inquiry, however, appear concerned not so much about the magnitude of the projected costs as about ensuring that the cost-sharing arrangement is equitable and fairly administered.

If the French are concerned about soaring costs, they have not shown it. De Gaulle's political motives probably override any qualms about diverting additional funds to the program. There has been virtually no public debate in France about pouring money into the Concorde, even though the French Government, like the British will probably recover only a fraction of its expenditures for research and development.

The difference over costs and design, however, have made

the partners nervous about each other's intentions. The French are not wholly convinced that the UK will not back out, and for that reason are trying to hurry the project along. The rapid pace of the program has in turn raised British fears that they are being dragged along in a dubious venture in which they really have very little say.

The Orders Game

The developers of the Concorde are, of course, very interested in the potential market for their plane. To amortize the tooling costs along, for example, will require sales of more than 130 aircraft. As for research and development costs, a portion of these is expected to be realized from a special levy on each plane sold. It is not known how much this levy will be, or how many planes would have to be sold before all costs could be written off.

As of 10 March 1967, sixteen major airlines had taken options for 72 Concorde (there are at least 115 options for the Boeing 2707). The options do not commit purchasers to buy the aircraft, even after it is certified for commercial service. The most recent options, for three Concorde, were taken on 9 March by the German airline, Lufthansa. Its decision was based partly on the "unexpectedly long period" of waiting for the American SST, but Lufthansa has options for three of these too. There may be other orders for the Concorde shortly.

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The sales manager for the British half of the project estimates that 100 Concorde's will have been optioned by the end of this year, 200 by 1975, and possibly 400 by 1980. He indicates that this market assessment was made on the "pessimistic" assumptions that sonic boom restrictions will prohibit flight over land, that tickets will have a 25 percent surcharge for supersonic flight, and that the US will have a highly competitive plane within three years after the Concorde enters service.

These estimates of potential sales appear overly optimistic, particularly that for 1980, especially if SST flights are restricted to over-water routes. The operation of the SSTs could be very profitable for the airlines, but this will depend on a high level of aircraft performance, and the Concorde has technical deficiencies which will have to be corrected. Many airlines have taken options on both the Anglo-French and the American SSTs, so that the comparative quality of the performance of the two planes will have a decisive impact on future sales. The Concorde project will almost certainly have to adjust its timetable if the plane is to be brought up to its optimum technical efficiency before it is turned over to the airlines.

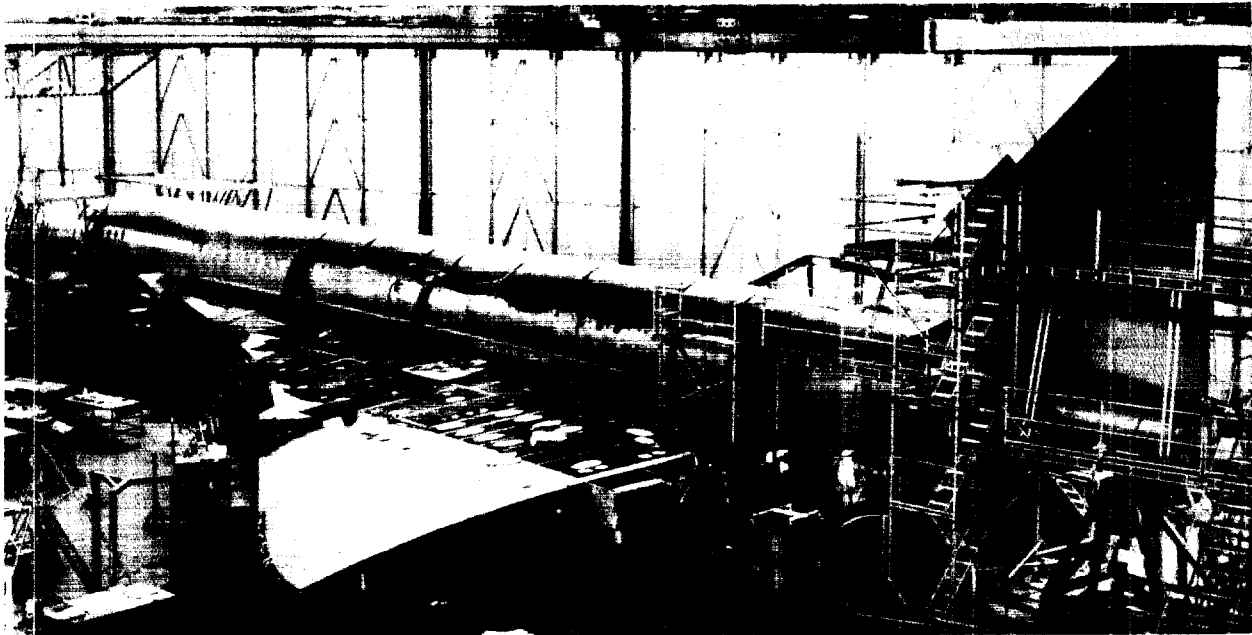
Production Progress

Cooperation between the British and the French at the production level has gone well. The British Aircraft Corporation

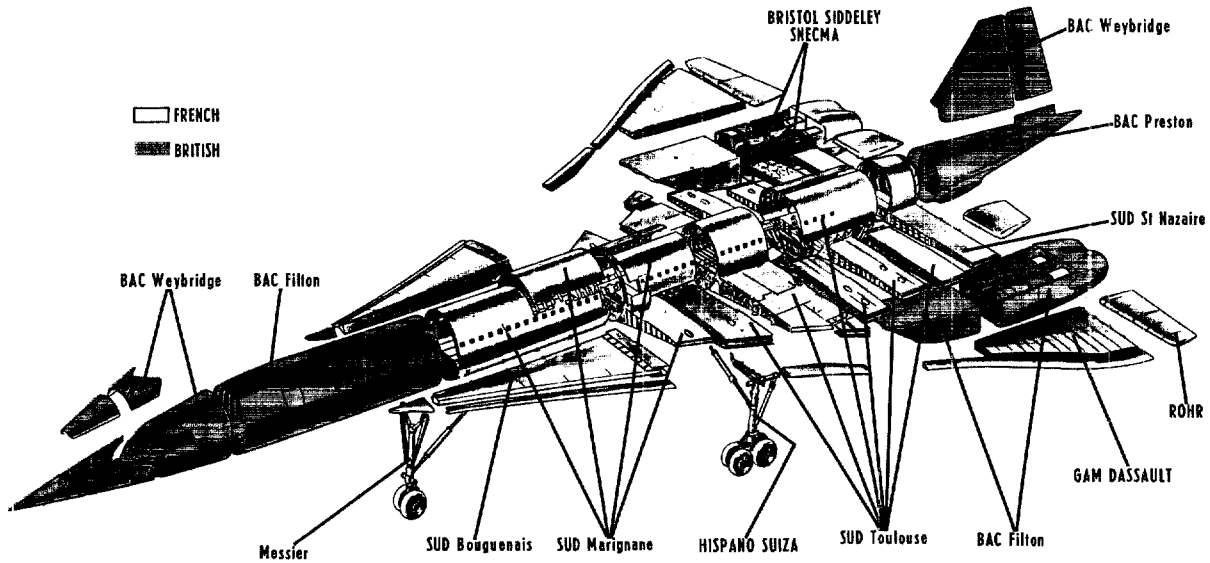
and France's government-controlled Sud Aviation have formed a company to produce and market the Concorde. Britain's Bristol Siddeley, and Societe Nationale d'Etudes et Construction de Moteurs d'Aviation (SNECMA) will produce the engine. The first prototype is being constructed in France with engines made in Britain. The first exchange of major components for the airframe was made in mid-1966 on schedule. Equally good progress is being made with the Olympus 593 engine, about a dozen of which were built last year. The French-built prototype is scheduled to be test flown in February 1968 and to be certified for commercial service by mid-1971. At present the developers are slightly ahead of schedule. Work on the second prototype, which is being built in Britain, is about six months behind that of its French counterpart.

The projected cost of \$1.4 billion is understood to cover the construction of the two prototypes, two preproduction aircraft, and two airframes for static tests, the tooling costs for these six planes, test flights up to the receipt of a certificate of air worthiness in 1971, and the construction of 80 Olympus engines. This figure also includes a contingency fund of \$225 million to finance two years of further development after certification to bring the aircraft up to its full planned performance and another of \$140 million to cover higher wages and other likely expenses.

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**A CONCORDE PROTOTYPE UNDER CONSTRUCTION
at Toulouse, France, 17 February 1967**



The DIVISION of CONSTRUCTION WORK on the COMPONENTS for CONCORDE

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Technical Problems

Technical deficiencies in the Concorde could delay completion of the project two years or more. All of the anticipated problems can probably be solved through normal engineering approaches, but the British and French have only lately begun serious study of some of these problems. If some of the deficiencies are not adequately corrected in the rush to get the plane into service, the Concorde could be an aircraft of very marginal performance requiring extensive ground maintenance time.

The initial service design is expected to contain shortcomings in range performance, in the operation of equipment, and in maintenance. The most serious of these problems are likely to involve the engine. The design changes made to date have required significantly more engine development than originally planned. The changes made to increase the thrust of the engines may mean that either the load (138 passengers) or the range 3,500 nautical miles of the vehicle will have to be reduced. Moreover, the development of new engines with even greater thrust must be started soon, if growth versions of the presently projected aircraft are to be ready in time to meet the demand.

There is also concern that the time between overhauls of the engine will be too short. Neither France nor the UK has a lubricant that is satisfactory for more than 100 hours of operations. The Concorde is programed initially

for a minimum of 500 hours between overhauls.

Another potential hazard relates to the fuel system. The French plan to use a sealant in the fuel system which US experience shows is not satisfactory in an SST. If this sealant is used, frequent draining, cleaning, and resealing of the fuel tanks would be required to prevent serious corrosion. This type of maintenance involves difficult procedures which necessitate a great deal of ground time. This would be unacceptable to the airlines, because of high rate of utilization is necessary to make operation of the Concorde profitable.

The airframe of the Concorde will be constructed of an aluminum alloy. The French have developed a new spot welding technique that will be used along with conventional riveted and bolted construction. The aim is to develop a structure with a flying life of 45,000 hours. The partners appear to have exercised very thorough quality control in the development of the airframe. Aluminum has basic limitations, however, and in order to fly faster than the Concorde's planned speed of 1,450 miles per hour, the airframe, or at least the most vulnerable parts of it, must be constructed of a stronger metal, like titanium.

There are other potential troubles for the Concorde, as well as for the US and Soviet SSTs, the seriousness of which will not be fully determined until the prototypes are test-

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flown. For example, there are uncertainties about the effect of drag--the resistance to movement brought to bear on a plane by the air through which it passes. The turbulence at the altitude the SSTs are to fly will be severe. One US Air Force test pilot compared supersonic flight at 70,000 feet with travel in a Greyhound bus going over a washboard road at 200 miles per hour. Certain American aeronautical engineers have doubts that the Concorde builders have yet taken these problems seriously enough into account.

Two further problems not directly related to technical performance are sonic boom and the limitations imposed by today's airport facilities. The sonic boom caused by an SST can shatter windows and do other physical damage that go beyond mere annoyance for people on the ground. Neither Concorde partner apparently gave this problem much consideration. Each simply took eventual public acceptance for granted, until tests conducted by the US Government demonstrated the seriousness of the problems of supersonic flight over populated areas. The British are now studying the problem, but what recommendations, if any, they have come up with are not known. The British say they would be satisfied to concentrate on putting the Concorde into use exclusively on over-water routes, but the French expect the plane to be used on routes over continental Europe.

Most airports do not have all the facilities necessary to

handle SSTs. The necessary landing strips, maintenance facilities, guidance systems and the like will be installed in time, but for at least a decade or so the lack of proper facilities will probably limit use of the SSTs. Airport noise will be another problem. The noise level of a supersonic plane flying at subsonic speeds is somewhat higher than that of today's largest subsonic jet airliners. The Concorde's developers believe the difference is not great enough, however, to preclude eventual public acceptance of the nuisance.

The Soviet TU-144

The Soviet Union may be the first nation to fly an SST, but apparently will not be a major competitor in the world aircraft market. The Soviets have not seriously competed for options on their TU-144. The Soviet statement that only 10 or 20 SSTs will be needed by Aeroflot, the Soviet civil airline, also suggests that the USSR does not plan to manufacture the TU-144 on a large scale.

The TU-144 prototypes will probably be unable to achieve the flight performance presently being advertised by the Soviet Union. Although the Soviets have announced that the TU-144 would have a range of 3,500 miles and a passenger capacity of 121, Western estimates indicate that the aircraft will not attain that capability. Its range may be as low as only 2,500 miles with 80 passengers, or 1,800 miles with a full load of 121 passengers.

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The USSR first displayed a model of the TU-144 in June 1965 at an international air show in Paris. This showing was followed by a propaganda campaign indicating that the USSR intends to be the first country to fly an SST. To achieve this end the Soviet aircraft industry is believed to be working to complete a prototype late this year, perhaps on the occasion of the 50th anniversary of the Bolshevik Revolution, or early in 1968. Even if the test flight is delayed until early 1968, Soviet SSTs could enter limited Aeroflot service by late 1970 or early 1971 provided the Soviets overcome the same problems that threaten to delay the Concorde's timetable. Like the developers of the Concorde, the Soviets will not be aware of the full extent of some of these problems until their SST is test-flown.

Future Developments

The developers of both the Concorde and the TU-144 will

continue to work toward getting a prototype into the air within a year. Their progress beyond that point will depend a great deal on the seriousness of the technical problems they encounter in test flights, on the extent to which corrective measures have been tentatively developed, and on the level of performance each developer will deem satisfactory for his aircraft.

The technical deficiencies will almost certainly prove formidable enough to delay certification of the Concorde beyond the target date of mid-1971. Whether the development of the TU-144 is also held up probably hinges on how well the Soviets have anticipated the expected technical deficiencies and developed possible remedies for them, a question about which very little information is available. (SECRET NO FOREIGN DISSEM)

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