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"THE SUPERSONICS"

Approximately 50 years ago, in his book entitled "Letters to the Family" Rudyard Kipling wrote the following:

> "There is a crafty network of organizations of business men called Canadian Clubs. They catch people who look interesting, assemble their members during the mid-day lunch hour, and, tying the victim to a steak, bid him discourse on anything that he thinks he knows.
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> The idea might be copied elsewhere, since it takes men out of themselves to listen to matters not otherwise coming under their notice, and at the same time, does not hamper their work. It is safely short, too. The whole affair cannot exceed an hour, of which the lunch fills half."

It is noteworthy that, as you can see, while the victims do not always look interesting, the Canadian Club procedure today is much like that of half a century ago.

I will try to maintain the validity of Kipling's description by "discoursing on something I think I know, and on matters not otherwise coming under your notice."

When this talk is over, you may say that I have been beating an already much pounded drum. That may be fair criticism, but the fact is that there still seems to be much confusion in the public mind about SUPERSONIC aircraft, and other new developments in civil aviation.

Some of this confusion seems to have stemmed from the fact that the SUPERSONICS, while they had been under design for some years, first became a matter of public interest almost concurrently with the announcement of the very large SUB-SONIC aircraft.

At this juncture perhaps I had better talk about the meaning of the word "SONIC" in this context.

In the early days, in fact until about fifteen years ago, aircraft speeds were measured in miles per hour, which everybody understood. Then, mainly for reasons connected with navigation, the unit of aircraft speed became a KNOT, or nautical mile per hour - a nautical mile being some 800 feet longer than the statute or land mile.

However, with the advent of the jets as we know them today, it became necessary to measure speed in relation to the speed of sound. Most modern jets are cruised at speeds between eight and nine tenths of that of the speed of sound, and there are instruments to keep pilots advised of this relationship, because for more than one reason it is important that aircraft not designed for the feat, be not allowed to approach too closely the speed of sound.

The speed of sound in still air is a variable which changes with temperature, altitude, moisture content, and some other things. That speed, under the conditions obtaining, is called MACH. ONE and may be regarded as roughly 660 m.p.h. under normal conditions.

Thus Mach .5 is half that speed, and Mach. 2 is double it.

Therefore, SUPERSONICS are aircraft designed to cruise at speeds in excess of the speed of sound, while all the commercial aircraft we know today are not so designed, and are called SUB-SONICS.

Aircraft with very large numbers of seats in them, that is 300 and up, are currently referred to in the trade as JUMBOS. They are sub-sonics.

The confusion I referred to earlier has arisen from the fact that the SUPERSONICS are large aircraft by modern standards, but by these same standards they are not going to have a large number of seats installed in them. primarily they are large because of the vast quantity of fuel they must carry.

I feel that I cannot give a very convincing answer as to why the development of SUPERSONIC commercial aircraft about six years ago began to appeal very strongly to aircraft manufacturers on both sides of the Atlantic. The best I can do is to say that traditionally the speed of commercial air transport has risen steadily over the years and since the 1960 jets were already closely

approaching the speed of sound, aircraft speeds could only make a substantial advance from that point by going through the sonic barrier.

The problem was tackled in very different ways in different countries.

In Western Europe, realizing the huge cost of the project, the French and British governments decided to act in concert, naming Sud and British Aircraft Corporation respectively as the manufacturers.

In the United States, the Boeing and Lockheed companies were invited each to make independent designs, on the understanding that one only would be selected by the government, after the plans had been compared.

Another major difference in basic philosophy quickly developed. Here it should be pointed out that one of the great problems associated with supersonic flight is the generation of high heat on the leading surfaces of the structure, due to air friction. It so happens that at speeds in the neighborhood of Mach. 2.5 this heat attains to levels which could seriously affect the strength of alluminum alloys.

The British/French design consortium, therefore, decided to limit the speed of their CONCORDE aircraft to Mach. 2.2, or some 1450 statute miles per hour under normal conditions.

By this decision they allowed themselves the use of the relatively cheap light alloys, the properties of which were well known to aircraft manufacturers.

The thinking in the United States was quite different. Here it was said that if the sonic barrier was to be punctured at all, it might just as well be done with gusto. Therefore the original design requirement was set at Mach. 3 or approximately 2000 statute miles per hour under normal conditions. (Later it was found necessary to modify this goal to Mach. 2.7 or 1800 m.p.h.)

This decision forced the American designers into the use of stainless steel and/or titanium in all areas subject to air friction heating. It also was a contributing factor in giving the Concorde a very substantial time lead over the U.S. entry, possibly as much as four years.

Another big difference in design philosophy was size. The Concorde is only 42 feet longer than our present DC-8s, and no bigger in cabin cross section than our Viscounts. In the States, the Boeing Company received the approval of the U.S. air authorities over the Lockheed to proceed with development. This design plan called for an aircraft having a variable geometry wing, and approximately double the length of the current DC-8. This means that it could fit between the sets of goal posts on a standard Canadian football field with only 24 feet to spare.

Perhaps a comparison of installed seats would be of interest: The present DC-8s have 139, the Concorde will have 17 less at 122 and the Boeing SST 140 more at 280.

It is unquestionably a fact that the U. S. S. R. is working and probably well advanced on the development of a supersonic transport, but I have no information about it, other than its probable name, the TU 144, which means that it is being built by the Tupolov organization. When I was in Russia in 1964 I asked as innocently as possible how they were getting along with SST's. My reply was another question: "Who wants them?"

To summarize: I know nothing about the Russian Supersonic and not a great deal about the Boeing Supersonic, other than the statistics of its design, so from here on I will confine my remarks to the Concorde, the prototypes of which only last month I saw in advanced stages of airframe construction at Filton, outside Bristol and at Toulouse, France.

In this business, when an aircraft has been under development for a long period of time, there is a steady flow of design information and progress reports into airline headquarters, and unconsciously there builds up in one's mind the belief that it is a rather nebulous affair for the very distant future. This is very definitely not the case. The first Concorde prototype will fly within the next eleven months, unless serious and unforeseen delays are encountered.

The Concorde will have two production lines, one in England and the other in France, but there will be no duplication of manufacture, as certain of its components are built in England, including the engines, and the other elements of its structure are manufactured in France.

A proportion of the British manufactured components will be kept in England to supply the British production line, and the remainder shipped to France. Similar action by the Sud company will keep both production lines supplied with the components for which French manufacturers are responsible.

There has been adopted a rather unique system of numbering the initial aircraft produced. The prototype at Toulouse, which by plan is about five months ahead of its British counterpart, is No. 001, whereas the Filton prototype is No. 002. These aircraft will never find their way into airline operation. Their primary function is to prove the basic design and to determine what if any modifications in that design should be applied to successive aircraft.

Next there are two so-called pre-production aircraft, which logically enough will be numbered 01 and 02. Their primary function will be to prove the validity of the modifications which have been developed as a result of flying experience with the prototypes.

Then come the true production aircraft, Nos. 1 and 2, which will also be used extensively in the flight test program, which so far as I know, at something in excess of 4,000 hours, far exceeds any testing previously applied to a new aircraft type.

Furthermore, all elements of Concorde design have had more high speed wind tunnel testing than ever previously attempted.

I for one went on this last inspection trip with some lack of enthusiasm for the basic idea of supersonic commercial transport, but, I like to think, with an open mind. I came home with the conviction that the Concorde has had a vast amount of good engineering and careful planning go into its design. It also seemed clear that manufacture was very well advanced and on schedule. In fact, when we were at Toulouse, 001 was being jacked up as a whole airframe, in order to have the undercarriage fitted.

What, you will ask, is going to be done in the next eleven months?

The answer is that that mass of extremely complicated plumbing, wiring and gadgetry known in the industry as the AIRCRAFT SYSTEMS now has to be installed in the bare shell of the airframe. This is equipment which passengers never see, but is just as important to the proper functioning of the finished aircraft as wings and engines.

I will now attempt to summarize what the advent of Concorde supersonic aircraft will mean to the airlines and their passengers, but first a little preamble seems indicated:

It is a generally accepted principle in transportation that higher speeds cost more money.

Paradoxically, civil aviation throughout its life has moved in the opposite direction. Generally speaking this has been possible because each increase in speed has been accompanied by an increase in the size of the aircraft, so that the operating cost per seat-mile has trended downward, and this has been reflected in lower fares, particularly on the longer routes.

The supersonics take a big step forward in the matter of increased speed, but as I have said, there will not be a corresponding increase in the number of installed seats, and therefore it seems clear that the operating costs per seat-mile will be higher than with currently operated sub-sonic jets.

Therefore, I think for the first time in half a century, the customer is going to have to pay more,to travel at supersonic speeds. For this premium fare he will get a trans-Atlantic crossing in three hours, which if he is so inclined, will allow him to do a day's work in London and sleep in his own bed before and after, thus eliminating a need to become acclimatized to the five-hour time differential.

The passenger will experience no particular sensation in straight and level flight as a result of the high speed. Cabin temperatures and noise level will be normal. Relative humidity will be low.

From an airline standpoint, the major difference will probably be the productivity of the aircraft, which will be able to make two round trip trans-Atlantic crossings daily between curfew hours of 11 p.m. and 7: a.m. Runway length requirements will be no greater than at present.

Due to the large quantities involved, refuelling techniques will have to be faster and more efficient than at present; due to the large investment in each aircraft, planning will have to be such that time on the ground is minimized.

It seems most unlikely that the supersonics will have the same impact on airlines and their economics as did the sub-sonic jets. The supersonics will, I think, tend to be a smaller proportion of the total jet fleet.

In conclusion, it seems reasonable to say that whether one looks forward to the supersonics with misgiving or excitement, the 1970's are going to see some very marked changes from the civil aviation which we know today.

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