

SONIC BOOMS

by the Marquis de Amodio

AT a time when public opinion has been made fully conscious of the perils facing nature preservation and of the inherent threat of pollution, it is natural that people should seek to know more about sonic booms and whether they are likely eventually to harm men and beasts as well as damage historical buildings. Britain has been until recently comparatively free from booms owing to the wisdom of the Air Ministry in banning all supersonic overland flights. This ban is the reason why people in this country are not really familiar with booms nor fully aware of their consequences since they have, for the most part, only experienced them during specified tests. Such immunity has not always been the case on the continent, where the regulations have been somewhat different and where it seems that offending test and fighter pilots have sometimes been treated rather leniently.

So far commercial airlines are uninvolved with sonic booms though the roar of their powerful engines can, especially at night, be most disturbing. The Council of Europe stated in 1968 that during the previous year the communities near Orly had been subjected to 145,000 take-offs and landings, and that there had been 214,000 at Heathrow, amounting to nearly one per minute at peak hours. Yet in 1966 a conference held in London had already suggested that, prior to the certification of aircraft, noise should be taken into consideration. With the advent of the Tupoler, the Concorde and the proposed American S.S.T. [Supersonic Transport] the situation will undoubtedly be considerably altered for the worse. In fact, a section of the public has already risen in protest and there has been a distinct possibility that such aircraft would be precluded from flying over certain countries at supersonic speed. Should such restrictions extend throughout the world it would seem that supersonic aircraft could only reach their true cruising speed above the poles and the oceans, since even deserts and other uninhabited areas form part of some country's

territory. These states would most likely be unwilling to allow foreign airlines to enjoy any privileges, either because they themselves had as yet no such aircraft, or because it might create a dangerous precedent. That is why the outcome of the Concorde tests is so important, especially since the American aircraft is now a remote project and Russia's performance is, in accordance with national practice, treated as a closely guarded secret.

Most of the boom trouble in Europe arose from the successful tests which took place in Oklahoma, when three-quarters of the inhabitants of Kansas City asserted that they had not objected to eight booms daily over a period of six months. Furthermore, the buildings there stood up to these strenuous conditions, and this point was repeatedly publicised in Europe and overlooked the fact that historic towns and ancient buildings can in no way be compared with modern concrete structures. As a consequence, flying regulations were less strictly applied throughout the continent and incidents kept cropping up. Fortunately this laxity is not the case any longer and an enquiry, made during the summer of 1970 through the various preservation societies belonging to Europa Nostra and the Historical Castles International Institute, has shown that no complaints have arisen recently in Spain, Switzerland, Belgium, Holland and Italy. In Germany though there has been damage to windows, glass-houses and stained glass, and animals on fur-breeding farms have been killed by the booms. There have, thank goodness, been no claims for injuries to human beings. In these various countries there is now a firm conviction that the only places where booms are truly obnoxious are France and Britain, and this belief is due no doubt to the various articles which have appeared in the French and British press.

It must be remembered that booms are the direct consequence of an aircraft going from infra-sonic to super-sonic speed and during the reverse process. Sonic booms are equally influenced by height and temperature. At ground level they occur at 1,224 K.p.h., whilst at 10,000 metres they do so at 1,062 K.p.h., and at 12,000 metres a mere 900 K.p.h. suffices. The sound waves thus formed trail behind the aircraft in a cone-shaped pattern which extends over fifty miles when ground level is reached. Super-

sonic fighters practising evasive action or climbing at maximum power produce booms which are liable to become super-booms; that is to say, booms which are three times as loud as normal booms. Monsieur Jean Brocard, Chairman of the International Permanent Committee of Wind Tunnels within the framework of the International Association of the Aero-Space Industries, pointed out at the Vieilles Maisons Françaises Conference in 1970 that when a plane weaves and turns at supersonic speed it also produces super-booms and that, the larger the plane, the louder the boom. Height, however, reduces the sound so, since the Concorde is intended to fly at 55,000 instead of 30,000 feet, one can estimate that the booms should not exceed 10 Kgs. per square metre. The Concorde's opponents claim that one cannot get accustomed to the unexpectedness of such booms occurring at irregular intervals. The makers disagree and feel quite confident that they will, in any case, not only reduce the sound of the booms but also, in due course, the noise of the engines.

In 1969 Mr. James Winchester wrote that the loudest booms occur where the air is hot and that one boom has actually reached 70.4 Kgs. per square metre. He added that it was now established that it requires some 20 to 25 Kgs. pressure to break windows or create cracks in normal buildings, whilst the pressure created by a storm rarely exceeds 2.5 Kgs. per square metre. In the United States of America the N.A.S.A. [National Aeronautics and Space Agency] believes that it should soon be possible to reduce booms from the 10 Kgs. of the Concorde to something like 5 to 6 kilos pressure per square metre. This reduction would indeed be welcome since some doctors fear that booms may cause over a period of time not only heart failure but also mental disorders, and claim that booms are also liable to bring on ulcers. Such consequences are fortunately at present more or less remote but should there be, as can normally be expected, some five hundred supersonic airliners in use within the next twenty years, then it is absolutely essential that some positive progress should have taken place by then in controlling booms, engine noise and air pollution.

At present France appears to have been the country which has suffered the most and it may, therefore, be of interest to study

some of the problems which have arisen there. In 1965 all supersonic flights over Paris were forbidden, and elsewhere they were only allowed at over 30,000 feet. The French Government felt, however, that for purposes of national defence it was essential that its pilots should train at supersonic speeds on certain specified itineraries, and this view obviously entailed something more than level flights at a steady cruising speed. As a result, sonic booms soon became a constant source of litigation. In many cases the victims were unable to identify the offenders, and in some cases they were even unable to ascertain the owners of the aircraft. In 1965 there were no less than 1,743 complaints. In 1967, however, only 823 claims were made against the Ministry of Defence. In that year there began in the Bordeaux courts one memorable case which ultimately resulted in an award of 30,000 francs damages to the owners of the thirteenth-century Château de Fontvieille in the Dordogne. The plaintiffs for three years were unable to prove satisfactorily whether the plane which had caused the destructive booms belonged to the Ministry of Defence or to the makers, and could get no compensation until they could state who was responsible. Consequently, in 1969, the I.C.O.M.O.S. [International Council of Monuments and Sites] meeting in Oxford passed a resolution requesting that the onus of proof should henceforth lie with the Government concerned, which would have to prove that its aircraft were not the cause of the damage sustained. On various other legal occasions the defendants have questioned the strength of the ancient buildings which have collapsed and claimed that they had not been properly maintained or were too old—but how could ancient buildings be otherwise? Such a defence, however, could hardly have been made in the case of Strasbourg and Troyes, where the stained glass in the two cathedrals was damaged; nor in Vezelay, where sonic booms compelled the architects to shore up the abbey. Smaller structures have undergone even more grievous damage. The small thirteenth-century church of Fressines in the Deux-Sevres has been practically entirely destroyed, and during the summer of 1970 the stained glass in the fifteenth-century church of Ambierle near St. Etienne was broken. It would appear that there had been in this instance no less than seven booms on seven

consecutive days, and that four other beautiful churches in the neighbourhood had been equally imperilled. There could be no doubt concerning this particular case since Monsieur Antoine Pinay, the former French Premier, went there with members of the Departmental Council. Churches were not the only victims: the booms took a heavy toll from the owners of ancient châteaux and other secular buildings. As a result the Vieilles Maisons Françaises decided after a heated discussion at their annual conference in Meudon in 1966, at which there were 900 members present, that they would make an appeal to Monsieur Andre Malraux, the then Minister of the Affaires Culturelles. The next year, 1967, Maître Alain Bonnet founded the Association Nationale Anti-Bang, the object of which was to outlaw sonic booms. Maître Bonnet has pointed out that in France thirteen persons have already lost their lives and so have countless animals, not astonishingly if one remembers that mere thunder can destroy ducks' eggs. Even though both Maître Bonnet and the Vieilles Maisons Françaises agree that the booms have decreased during 1970 there are still, nevertheless, roughly 2,000 claims each year. In 1968 between 16th and 24th December a fifteenth-century home was subjected to no less than five booms, one of which was a superboom. This place, however, seems to have come through unscathed but, as has been rightly pointed out, one cannot always discover immediately the extent of the damage since cracks do not appear at once. The above house was situated in a region which abounds in beautiful châteaux and many of these have been grievously damaged. The fifteenth-century Château de Fenelon, one of the show places of the Dordogne, was very much in the news when a tower collapsed in 1966. There had been a boom but the authorities refused to admit any liability and the case is still *sub judice*. Other well-known castles and ancient mansions have suffered similar destruction during recent years.

New measures have now been taken, such as "Operation C.A.N.I.B.A.L. [Controleurs Automatiques de Niveau de Bang Local]. This consists in sound-recording boxes which have been placed throughout France. In England during 1967 there were some 12,000 protests following boom tests, and in 1970 the Concorde's tests brought about a renewal of protests. In Germany

the University of Hanover has created an Anti-Boom Technical Institute, and it has also been reported that a German inventor believes that he can prevent booms thanks to a device which he has patented and which is designed to be fixed in the front of the fuselage of an aircraft.

To face present-day facts, it is only too obvious that one cannot possibly turn the clock back, nor can one apply to the aircraft industry the standards which at one time required a man with a red flag to precede all motor vehicles. Therefore, even if overland supersonic flights were to be restricted, one can be sure that such a measure would not slow down the aircraft industry's effort to overcome both booms and engine noise as soon as possible. In America the creation of 'Aqua Ports' has already been advocated. These would consist of floating airports situated far enough from the coast to protect the seaside towns from all aircraft noise. Such suggestions require considerable funds, but so do interplanetary flights. One can rest assured that in due course aircraft will tend to become more silent since the makers' objectives are to increase their sales and to overcome objectionable noise.¹ Meantime it is undoubtedly the duty of all preservation societies to make certain as far as possible that Europe's priceless architectural heritage is not diminished by sonic booms. Future generations would hardly condone such a loss, especially since by then the increase in speed thus obtained would seem somewhat trivial.

¹ The new Rolls Royce Olympus engines, 593-3B, are now fitted with an aft thrust reverser nozzle which has very considerably reduced the noise. This is now less, both on approach and take-off, than that of the Boeing 707-320B or that of the Douglas DC 8-50. It is stated that there is no longer any smoke problem whatsoever.