The degree of alignment or order in the mesophase decreases with increasing temperature until at the nematic–isotropic transition point it vanishes. These changes can be explained theoretically by deriving the pseudo-potential resulting from all the interactions between one molecule and the remainder. Electron resonance has shown that a model for the potential based on dispersion forces is inadequate. Furthermore, direct determination of the form of the pseudo-potential suggests that repulsive forces may dominate.

Professor E. J. Ambrose (Chester Beatty Research Institute) discussed the biological importance of mesomorphic states in terms of the function of the cell membrane and the cell surface complex. Several examples were shown of cell membrane changes in animated and still form. Discussion gave rise to the suggestion that carcinogens can interfere with the liquid crystal structure of the membrane.

SONIC BOOMS

Seismic Effects

from our Geomagnetism Correspondent

THE debate on the merits and demerits of civil supersonic flight takes place at several levels—sociological, psychological, financial and even philosophical—but all too frequently in the absence of reliable scientific data. McDonald and Goforth (*J. Geophys. Res.*, **74**, 2637; 1969) have attempted to remedy this deficiency as far as sonic booms are concerned by simply observing ground particle velocities produced during the supersonic flight of existing military aircraft. The basic characteristics of the four military aircraft monitored are shown in the table together with similar details of Concorde and the proposed Boeing SST for comparison.

CHARACTERISTICS OF FOUR MILITARY AIRCRAFT, COMPARED WITH CONCORDE AND BOEING SST

Aircraft	Length (metres)	Weight (kilograms)
F104, operational fighter	16·6	6,800
B58, operational bomber	30·3	52,200
SR71, experimental reconnaissance	32·7	59,000
XB70, experimental bomber	57·1	136,000–182,000
Concorde, civil	62·7	166,000
Boeing SST, civil	91·0	303,000

Particle velocities were measured on portable seismograph stations set up at Edwards Air Force Base, California (EAFB), the Tonto Forest Seismological Observatory near Payson, Arizona (TFSO) and the Uinta Basin Seismological Observatory near Vernal, Utah (UBSO). In addition, modified observatory equipment was used at TFSO and UBSO. In all, 183 missions were monitored at EAFB. Eight missions at TFSO and three at UBSO allowed a comparison of sonic boom seismic effects over different geological units; and a deep vault at UBSO made possible a study of signal attenuation with depth.

What emerged from an analysis of the field data was that both the magnitude and areal extent of the seismic effects were extremely limited. Horizontal displacements were largely confined to the boom pressure envelope, and vertical displacements to the upper few metres of the Earth's crust. Maximum ground particle velocities were associated with the leading and trailing edges of the acoustic N waves; and the overall maximum particle velocity observed in the whole series of experiments was 600 microns/second. Up to overpressures of 25 kg/m^2, the maximum particle velocity varied linearly with maximum overpressure but was independent of aircraft altitude, speed and type, temperature, wind velocity and relative humidity except in so far as these factors influence the overpressure itself.

McDonald and Goforth find it instructive to compare the observed maximum particle velocity of 600 microns/second with publicly recommended maximum levels of vibration. The US Bureau of Mines, for example, recommends a maximum peak particle velocity of 50,800 microns/second. Similarly, the US Corps of Engineers, the New York State Power Authority and the States of Massachusetts and New Jersey only consider particle velocities of less than 25,400 microns/second to be safe. In short, the maximum particle velocity observed by McDonald and Goforth on relatively loose materials was less than three per cent of currently acceptable building damage standards.

The nominal overpressures (but not the overpressures from "superbooms" produced by the simultaneous arrival of two or more booms from different points in the flight path) expected from Concorde and the Boeing SST are less than 25 kg/m^2, that is, within the range of overpressures monitored by McDonald and Goforth. The anti-SST lobby is thus not likely to be very happy about these results, but will no doubt point to the wealth of evidence for physical damage already produced by military supersonic overflying in the USA. Presumably the explanation for the conflict here is that damage is limited to particularly weak structures such as historic buildings and particularly vulnerable sub-structures such as windows.

MATERIALS

Abrasive Wear

from a Correspondent

DELEGATES to the Materials Science Club conference at the National College of Agricultural Engineering, Silsoe, on July 16 and 17 found that there is an important link between the life of both motor car tyres and agricultural ploughs, the design of toothpaste and such down to earth matters as shoe leather. The link is, of course, abrasive wear, a somewhat neglected topic that is currently recognized to have fundamental significance in materials science and metallurgy, and which provided the theme of the conference.

The term abrasive wear was not interpreted narrowly, for some of the different modes of wear that may qualify as abrasive still require exploration. First, the wear process was discussed as far as possible in physical terms. R. C. D. Richardson (National Institute of Agricultural Engineering) defined abrasion as the removal of material by hard particles on a minute scale by a cutting process. The angle of attack is of great importance in that it either causes a groove on the surface or the surface is chipped, as in true abrasion.