IBM Displaced

THE United States Air Force has now chosen to buy computers from Burroughs for the second phase of its programme of automation at its bases around the world. This is a plan to install linked computers in USAF bases to deal with problems of logistics. The contract was originally put out to tender last April, and was won by IBM with a bid of $114 million. Honeywell, which had submitted a bid of only $54 million, complained to the General Accounting Office. As a result of this, the Comptroller-General ordered the cancellation of the IBM contract, despite the Air Force's assertion that price was only one of five factors to be considered, and that only IBM, to use its own words, "satisfied these areas of response". All four manufacturers tendered again, and Burroughs' winning bid was to provide 135 of its "third-generation" B.3500 machines for $60 million.

IBM has confessed itself disappointed by the final decision, claiming the superiority of its products. The USAF, which announced details only of the winning bid on both occasions, seems unrepentant. It has confused a none too lucid issue by saying that the tenders for the second selection "were markedly different from the original submission in terms of capacities, speeds and, in some cases, processing techniques". It also claims that the delay caused by the intervention of the Comptroller-General cost $18 million, so that the American taxpayer need only congratulate himself on a saving of $36 million. Honeywell has pronounced itself satisfied that the original complaint has been shown to have been justified; the exercise seems to have lost Honeywell no favour with the US Government, for the company has just received an order to lease twenty-two computers, worth $8·5 million, to the Department of Defense.

Burroughs had won the contract for the first phase of the same programme, a $24 million order to provide computers for organizing supplies at air force bases, so that the USAF will doubtless find advantages in having standard equipment for base logistics. The first two systems of the second phase will be delivered in March, and two further systems will be installed at Sheppard Air Force Base, Texas, in April and May. These will be used for training. A test programme will begin at Langley Air Force Base, Virginia, in September and, if the results of this are satisfactory, the computers will be installed at bases around the world during 1969 and the first half of 1970.

Supersonic Plans

THE introduction of supersonic transport aircraft is bound to increase problems of air transport control and flight planning. As well as flying three times as fast as aircraft now in service, supersonic aircraft will fly much higher, at between 16 and 21 kilometres. Meteorologists, familiar with the problems of long-range forecasting, are already beginning to wonder how the supersonics are going to affect them. Some results of this process of looking ahead have now appeared in the form of a report from the World Meteorological Organization called *Meteorological Problems in the Design and Operation of Supersonic Aircraft*. The report is written by R. F. Jones, R. M. McInturff and S. Teweles.

The difficulties of the sonic boom are already familiar enough. As well as the regular boom which the aircraft makes, the report discusses the phenomenon of "superboom", which is thought to be caused by the simultaneous arrival at the observation point of shock waves from two distinct parts of the flight path. Overpressures as great as 3·6 mbar have been recorded in low level tests, nearly five times as great as the nominal overpressures which the SSTs are expected to produce. It may be possible to eliminate superbooms by avoiding turning manoeuvres or supersonic acceleration in level flight, but atmospheric turbulence may affect the issue by producing quite rapid accelerations and changes in aircraft attitude. Actual experience with the first supersonic airliners will be needed before the position is clear.

The actual incidence of the boom may also be affected by unscheduled changes of flight plan. The thrust of a jet engine decreases with increasing temperature—BOAC, for example, has estimated that a five-degree increase in temperature produces a 25 per cent deterioration in acceleration between Mach 1·1 and 2·0. And because the SSTs will fly much higher than existing aircraft, information about temperatures is relatively more scarce. Most of the handicap of higher temperatures is experienced in the trans-sonic phase of the flight, between Mach 0·8 and 1·2.

The problems of turbulence, and its effects on aircraft, are not well understood. One problem, as the report explains, is that aircraft in flight filter from the whole spectrum of turbulence those frequencies to which they are most susceptible. Thus results with one aircraft may not be duplicated with another. Short wavelength disturbances may affect the fatigue life of the aircraft without actually making passengers feel uncomfortable, while long wavelengths may move the aircraft bodily but smoothly, without imposing great strains on its structure. Between these two extremes there are wavelengths which cause the aircraft to roll or pitch. Some turbulence is associated with cloud structures, and may be possible to avoid, because heavy cloud formations can be detected by radar. Clear air turbulence is a more severe problem, and there is evidence that it will be experienced at SST cruising heights. In flight, warning devices may help, but only if they can detect CAT 100 miles ahead of the aircraft.

There will also be a danger of large doses of radiation, because at supersonic aircraft heights the atmosphere will be too rarefied to provide a protective screen. The report confirms the suggestion that galactic cosmic rays, a continuous background through which the SSTs will have to fly, will not be a hazard. But there does seem to be a danger if exceptional solar events such as solar flares are ignored. The report contains a calculation by M. Haurwitz, previously unpublished, which shows that for a hypothetical event of the magnitude of the event on November 12, 1960, passengers on a three hour flight at 21 km would receive a dose of radiation twice as large as that recommended for a whole year. Warning devices in the aircraft, and careful preflight planning, will be necessary to minimize the dangers. Another hazard is the presence of ozone in the atmosphere; even small concentrations are poisonous, and it is thought that concentrations of more than 0·1 ppm by volume

could not long be tolerated in the aircraft. Concentrations of this order are common at 15 to 18 km, and may occasionally be ten to fifty times as great; at 21 km a value 100 times the danger level may be encountered. Fortunately, ozone is easily removed by filters, which will be fitted to the aircraft.

Rain and hail are less easy to deal with. Hailstones, the report says, constitute one of the greatest dangers to supersonic flight. For this reason, it will be vital to avoid penetrating cumulo-nimbus cloud at cruising speed, and detection by airborne radar will be provided. But a supersonic aircraft takes 100 miles to change course by 90°, so the equipment will have to be reliable, and carefully watched.

Industrial Oceanography

A NUMBER of French industrial companies have formed a scientific and technical association for the exploration of the oceans, ASTEO. The association had its origin in a project of the development council of Aquitaine to establish a regional bureau of marine engineering. It was soon realized, however, that the task of co-ordinating the large number of industries and scientific techniques would require a national organization. The members of the new association, therefore, are companies from all over France, but the association's headquarters will be in Bordeaux. Naturally enough, several shipyards belong to the association, and two of the biggest French shipping companies, Messageries Maritimes and the Compagnie Générale Transatlantique, are also among the founder members. But there are a number of firms on this list with relatively few nautical associations: Hispano and SCNEMA, Nord-Aviation, Dassault and Sud-Aviation, the Compagne Générale d'Electricité, and SEREB (Société pour l'Etude et la Réalisation des Engins Ballistics), whose director-general, M. Charles Cristofini, will be the first president of the association.

Among the first aims of the association will be to review the possibilities for French industry in oceanography. It is also hoped to establish an information centre which would use the computers of the SEREB at Bordeaux or the Compagnie Générale d'Electricité at Marcoussis. M. Cristofini has taken care to emphasize that the association is in no way a competitor of the National Centre for the Exploration of the Oceans. Rather, the new association, some of whose members are also members of CNEXO, will complement the older organization.

In Britain the participation of diverse industries in oceanography is rather less formally ordered. This may be partly because certain large British companies active in oceanographical research, such as Hawker Siddeley and Vickers, have many subsidiaries or associates specializing in the techniques involved in this kind of work. Co-operation is within the company rather than between companies. But it is interesting to note that the British Aircraft Corporation has been working with Imperial College, and with the assistance of the Bristol shipyard of Charles Hill, and Normalair Ltd, on the development of an underwater house (Project Kraken). The Kraken house would be situated a hundred feet below the surface, and would allow divers to work at depth without having to undergo decompression. The Guided Weapons Division of BAC will be investigating the type of structure needed for the Kraken house, and working on the features necessary to support life. This is the first submarine excursion of this kind by BAC, though the Guided Weapons Division played a small part in the British Polaris programme.

The general objectives for Kraken—named after Tennyson's sea-monster—have been laid down by the Imperial College team led by Brian Ray. These are for a house capable of providing life support to a 4-man research team living at depths of 80–100 ft. for 2–3 weeks or more. There would also be an ample margin for visitors on shorter missions. This range lies just within the working range of the atmospheric gases. Most of the work on saturation dives (in France and the United States) has concentrated on greater depths and on oxyhelium saturation. Remarkably little is known about the effects of prolonged saturation with air under pressure. Thus a prime objective of the experiment is to gather physiological data on air saturation diving. The chosen depth range is practical in a number of ways. The cheap gas and modest depth will keep down mining costs. Much of Britain's continental shelf is within range for 100 foot diving platforms.

By living at depth much more work can be done than from surface dives, each one of which must be followed by lengthy decompression. Kraken's promoters believe that the practical value of the house will lie in the commercial fields of prospecting, of surveying and for research in support of fish farming.

The quarters that BAC has designed round these objectives are a structure rather like a railway coach divided in two internally. The all-purpose living area will be 14 foot long and permanently heated by a system of hot water circulating in pipes. The 10 foot work area will not be heated. There is no need for a pressure vessel hull since pressure inside and outside Kraken will be at equilibrium (varying a little with the rise and fall of the tide). The house will be permanently open to the sea through a hole in the bottom. Gas and power will be piped from the surface. The only thing still lacking is the money to build the operational house for next summer.

More Social Science

TOTAL research and development expenditure in the United States during 1968 will reach $26,500m—an increase of over $700m or of 3·3 per cent compared with the estimated expenditure for 1967. This is the New Year message from the Battelle Memorial Institute, whose last year's prediction for the 1967 expenditure was in fact 8 per cent below the current estimate.

The Federal Government is the largest contributor to research and development expenditure, and during 1968 is expected to provide $17,200m, an increase of 2·2 per cent on its support last year. Industry will spend $8,300m, an increase of 4·8 per cent, and the colleges and universities about $865 million, which at 8·8 per cent is the largest proportionate increase on last year's figures. The remainder of 1968 spending is made up by the $265 million which will be provided by other non-profitmaking institutions. The Battelle Institute points out that although the Federal Government is the major source of research funds, accounting for 65 per cent of the total, 69 per cent of all research