

## AIR TRANSPORT . .

error of  $2\frac{1}{2}^{\circ}$  or even  $2^{\circ}\text{C}$ . Any requests of standard errors of  $1^{\circ}\text{C}$  are not likely to be met; this is about the level of the accuracy of the observations, anyway.

"Before I leave temperature it is worth considering the method of presenting the forecast information. Nowadays the forecast documentation is in the form of several fixed-time constant-level charts with temperatures inserted at representative spots. Probably the part of flight for which temperature will be most critical is the transonic phase, which will normally take place in the upper troposphere. Flight planning this phase may be simplified if a vertical temperature cross-section along the presented route is provided. This should be practicable in the early days when routes and flights are fairly limited in number. After that most flight planning is likely to be on a computer-to-computer basis, and meteorological documentation for areas could perhaps be much simplified.

"A factor of importance to the designers of SST aircraft is the occasional occurrence of large temperature changes in short distances. An extreme figure of  $10^{\circ}\text{C}$  in 1 n.m. has been recorded near cumulo-nimbus. Temperature changes alter the Mach number, with a consequent need for the geometry of the air intakes to be altered. The design has to be able to cope with rapid changes. There is no possibility of forecasting the occurrence of localised large temperature gradients in advance."

Probably the man who gave the pilots most for their money at the symposium was a pilot himself, MR AL WHITE, manager, flight research and development, TWA, who was formerly the project pilot on the XB-70—the world's largest supersonic aircraft. Mr White's subject was "Flight Planning, Navigation and Diversions for the SST."

Speaking freely of his experiences on the XB-70, Mr White led off by saying he did not think that the basic principles of operations would change with the advent of the SST. The critical phase would be that during climb and acceleration. Pilots would have to maintain a really precise climb schedule and it was during this time that the ratio of power available to power required was at its minimum. The best weather information available would be required so that pilots could minimise turning and achieve best thrust values. They will also need assurance before break-release that the climb will be able to be performed as planned, without any further restrictions.

On weather, Mr White stressed the importance of accurate temperature forecasts and the desirability of CAT predictions. He said that wind components at 60,000ft were relatively small, possibly even as low as 10-15kt over the north Atlantic in summer.

He stressed that turning should be kept to a minimum, because of the deterioration in performance occasioned by turns at high Mach numbers. "SR-71 pilots," he said, "are flying around, and back and forth across the USA at frequent intervals and there are often several at one time in the pattern

at Edwards AFB. They find they don't like turns in the pattern. Altitude changes are very much easier to effect . . . In the XB-70 we found that the altimetry was not so good, and in the SR-71, with today's information, the pilots would not want anything less than 5,000ft vertical separation. Some work must be done on altimetry."

About the descent, Mr White said that in the XB-70 the procedure was to decelerate at cruise altitude to the descent CAS, and descend at this constant speed. "There may be a better way to do this," he added, "using computers to achieve better drag characteristics during the descent."

After going over the details of the XB-70 climb schedule in response to a question from the audience, Mr White said that the pilots on the project had asked for a "climb-schedule" function on the flight director. "We were groping for the correct attitude to achieve the required climb speed, and at the same time attempting to meet the required airspeed bleed-off rate. We felt that the XB-70 had inadequate attitude indication . . . This became critical during the cruise at Mach 3, when a one-degree pitch change could lead to excursions from the desired altitude of as much as 5,000ft."

The cruise stage had produced other problems in the XB-70. They had found that near cumulo-nimbus clouds, temperature changes of as much as  $10^{\circ}\text{C}$  per mile could be met regularly. On one flight a  $40^{\circ}\text{F}$  change in a mile was recorded at 65,000ft. "This is in two seconds," said Mr White, "and it obviously has a dramatic effect on Mach number and airspeed. You think you must be going uphill, so you push the nose down. With the speed effect you will fly the aircraft right out of its envelope.

"There may be pressure changes as well. In my experience we have had Mach number going one way and altitude and rate of climb going the other. The result: confusion. We were trying to fly at 70,000ft at Mach 3—right in the corner of the envelope. If we began chasing the altimeter we ran into 5,000ft height excursions without difficulty. We decided to fly at 72,000ft at a constant attitude and allow the altimeter to keep changing. This was the reason for our asking for a better attitude indicator. But the real problem is altimetry. The pilot is not getting the proper information to enable him to do the job which he can do if he has the right information."

In response to a question about handling qualities of the XB-70 without auto-stabilisation, and the effect of fold-down wingtips, Mr White said that there was no problem about handling the aircraft manually, provided the pilot remembered always to lead with the rudder in turns. He ended his contribution by answering the question about wing-tips by saying, with his refreshing frankness: "Be very thankful you don't have fold-down wing-tips in a commercial aircraft. The big disadvantage is that if the tips happen to jam in the 'down' position you have no hope of making a clean landing. You just bale out."

**Vanguard Conversions** Aviation Traders are to manufacture freight doors for five BEA Vanguards which are to be converted to an all-cargo layout. ATL will install the doors on at least two of the aircraft—the first of which will arrive at Southend for conversion next October, with the second following in February 1969. The contract is worth about £500,000.



Mr B. M. Williams, who has been appointed chief executive and a director of British Eagle International while continuing as managing director of Eagle Aircraft Services, for whom a general manager is being appointed

**More IATA Members** Air Malawi and Zambia Airways became members of IATA from January 1.

**Crash near Denver** A Frontier Airlines' all-cargo DC-3 crashed on December 21 after take-off from Stapleton International Airport, Denver, and caught fire. It was on a flight to Rapid City, South Dakota. The crew of two were killed.

**Lufthansa Buys Südflug** All the shares of Südflug International, the German non-scheduled carrier, have been turned over to Lufthansa. They were previously held by Herr R. Buckle, president and founder of Südflug (50 per cent) and by the tour operators, Scharnow and Touropa (25 per cent each).

**Accident in Thailand** On December 27 a Thai Airways DC-3 (HS-TDH), on a scheduled flight from Bangkok to Chiangmai, about 500 miles north of the capital, undershot the runway when landing in poor visibility, broke up and caught fire. Three persons, including the pilot and co-pilot, were killed; there were 28 passengers and three crew on board.