



JET STREAMS

“Any piece of air space is only as safe as the most dangerous pilot in it!”

JET STREAMS not, in this case the efflux from the tail pipe of a jet engine, but those incredible meteorological phenomena encountered from time to time by those which frequent latitudes around the “thirties” and at altitudes, surprisingly enough, also in the “thirties”, the latter, naturally, being thousands of feet above sea level.

The jet stream could be likened to some gigantic, invisible stratospheric serpent, being a narrow core of air snaking and dipping its way across land or sea in the upper atmosphere or lower stratosphere in an easterly direction due to the rotation of the earth. Its speeds are high enough to be more often associated with those of the tornado, typhoon or hurricane.

Temperatures within this core decrease rapidly towards the centre on the polar side and less rapidly on the equatorial, with the result that an isothermic cross section of the core would resemble an irregular oval.

In an era before the advent of INS and GPS, when navigation was still an art, the navigator had to resort to every snippet of relevant information he could glean from the elements, particularly during daylight ocean crossings when the only assistance he could utilise from the firmament had to be from the sun and sometimes the moon.

It was said at that time when instantaneous ground speed read-outs were an absolute luxury, that jet streams could be followed if heading east or avoided if heading the other way by deliberately crossing the core and closely observing the OAT; the point at which the lowest

OAT was observed would be the centre of the core. But in practice, however, due to a jet stream’s snaking and dipping, this was easier said than done.

For those fortunate enough to have Doppler, (Doppler being an ingenious system which transmitted and received pulses to and from the surface below, the difference in frequency between the two being converted to an instant read-out of ground speed and drift angle), this process as well as other aspects of the navigational art, were much simplified by having those two paramount factors being presented as it were on a platter.

In illustrating the chaotic effect jet streams can have on aviation, it is related here how in the wee hours local time of one October morning way back in 1973 when even electronic pocket calculators much less cell phones, satellite navigation and electronic approach charts were a novelty, we set heading for Sydney from Perth. The synoptic chart in the weather folder depicted a jet stream to the north of track with winds of some 60 to 80 knots, which would be unlikely to affect us and otherwise nothing significant en route.

This route over the Nullabor Plains of Western Australia, south of the Gibson Desert, brought home the vastness of that outback with nary a light to be seen between the few centres of habitation. Added to this, an eerie silence would prevail over the ether for the Aussies commendably use radio as intended and not as a means of chatter.

At top of climb at flight level 370, the

Doppler ground speed indicator was registering a healthy 540 knots, a good 80 knots above our true air speed at that stage of 460 knots – the forecast jet stream was further south than expected.

Approaching Whyalla on the Spencer Sound, the Doppler which, by then, had been hovering at 600 knots ground speed, went up to 620 and then gave up, putting itself in memory mode as it was programmed to do in the event of poor returns being received from its pulses. I accordingly reached into my flight bag for my ancient rotating slide rule flight computer, a rare occurrence since navigators and first officers usually abounded for such mundane tasks, except that in this case we had neither a navigator nor a third pilot.

After struggling to free the dial on the instrument, stiff from lack of use, I came up with a startling result – at Mach 0,82 and OAT of -60°C , we still had a TAS of 460 knots and according to our time over Whyalla, the ground speed of 620 knots thus obtained, verified the Doppler reading before it went off. According to my venerable instrument, Mach 1 under such conditions stood at 560 knots and even though the magical speed of sound at sea level may have been in the region of 660 knots since that speed is dependent purely on air temperature, our ground speed was actually supersonic at that altitude!

We landed at Sydney some 50 minutes ahead of schedule with not a soul to meet the “supersonic” 707! Needless to say, on the return leg, despite remaining as low as flight level 310 and obtaining clearance to fly on a more southerly route in

the hope of the stream moving north to where it was supposed to be, that persistent core of high speed air might well have been possessed of evil intent the way it followed us and turned a scheduled four hour leg into something closer to five!

CRITICAL POINT

And then there was the daylight crossing of the South Atlantic to Rio de Janeiro which bore all the ingredients of a frustrating navigational exercise – broad daylight and no moon meaning only sun shots available for celestial navigation; an inaccurate weather report forecasting 4/8 cloud at 1 500 feet for our arrival; head winds of some 30 knots across the Atlantic with no mention of the jet stream that lay in wait for us, and a glassy sea from which the Doppler system could pick up no return.

As we passed Rooskop (near Walvis Bay) on the west coast and set heading on a great circle track for Rio, we had already lost some five or six minutes on flight plan, and with the “Howgozit” fuel consumption chart – plotted to portray fuel consumed against distance covered – already heading into the red, the stage was set for an interesting crossing of the South Atlantic.

As we approached critical or equal time point, the point at which, time-wise, we would be equidistant from both destination and point of departure, heading ever further out over that vast ocean and with Doppler sulking in memory mode, I as aware of a growing sense of foreboding.

I went back to consult with Al B., the navigator. Working on sun shots alone, Al had been able to obtain a reasonably accurate indication of longitudinal position and therefore ground speed since we were on a westerly heading.

From this he could estimate an approximate wind component which he “guesstimated” as minus 90 knots derived from the paltry ground speed he had reckoned at 370. My forebodings had not been unwarranted for we were in the grip of a jet stream, losing time and fuel by the minute! A decision had to be made quickly, for by then we were approaching the point of no return; the end of the umbilical cord; that point after which there would be no return to point of departure.

If the wind we were bucking held or even increased, we would make Rio with precious little in reserve. To gain time, I asked Al to work out a PNR for Cape

Town with normal reserves and no diversion, for we had Langebaanweg, the air force base, to the north with its excellent GCA controllers should Cape Town undergo another of its mercurial weather changes. While he was thus engaged, I resolved that should we not have flown out of the jet stream by whatever point Al came up with, I would have no hesitation in making for Cape Town from there.

It so happened, however, that before reaching that last point of diversion to Cape Town, Doppler came back on, giving a ground speed reading of 430 knots, in keeping with the forecast wind and indicating that we had finally rid ourselves of the irksome stream, and so we continued on track.

Since H/F communication with Rio had been extremely poor throughout the crossing, our first actual weather report was received on VHF, only some 160 miles from the coast. This report gave 8/8 cloud at 300 feet with visibility reduced in light rain. Although the weather was deteriorating and our reserves all but depleted, the situation still did not warrant undue concern, provided that is, we had a direct ILS approach and did not have to overshoot.

The instrument let-down at Rio must be one of the longest anywhere, taking 23 minutes in a stepped descent from 12 000 feet, the minimum sector safe altitude, to touch down at the 30 foot field elevation. An overshoot would involve a climb out over the sea back to 12 000 feet followed by another lengthy descent procedure, a gas guzzling exercise which we did not relish.

I delayed my descent, timed to reach the holding beacon at 12 000 feet, deprived by thick cloud of the spectacular views afforded in visual conditions of the Pao de Azucar (Sugar Loaf) and the Corcovado, that gigantic statue of Christ, arms outstretched, reputedly facing its twin across the Atlantic in Lisbon.

Entering the holding pattern for our first and hopefully last orbit, there were only two aircraft ahead of us, a Varig DC-8 intercepting the ILS and an Air Force DC-3 which had diverted from elsewhere. Judging by the latter's obvious vagueness regarding frequencies and descent altitudes, he was ill-prepared for an instrument approach to Rio, but was eventually cleared to intercept the ILS and changed to tower frequency.

Relieved that the lumbering old ship, we departed from the holding pattern and

proceeded with the long descent to 4 500 ft at 14 miles DME, whereafter we, in turn, were cleared for the ILS approach and changed to tower frequency.

On doing so, however, we tuned into some sort of garbled altercation in Portuguese between the tower and the “Dak” which should by then have been just about on the ground. Nevertheless, we were then cleared on to final approach and advised that the cloud base had lifted. We crossed the outer marker at 2 000 feet and I cross-checked the DME at 7 miles – we were spot on and thereafter were cleared to land off the approach.

“AIRCRAFT DEAD AHEAD...”

As I concentrated the ILS, we broke cloud at about 800 feet, which provided us with our first glimpse of the ground and the wet sheen of the runway ahead, the first officer called urgently: “Aircraft dead ahead, above and closing fast!”

I involuntarily shoved the nose down and broke to the right, the only course of evasive action available to me, for that lumbering old DC-3 loomed ahead and above, landing gear and full flap extended, obviously desperately attempting to catch up with the glide slope well below it.

Taking matters into my own hands, I yelled to him on the tower frequency, “Air Force ---, Air Force ---, break left, break left, there's a 707 right up your ass. Repeat break left, break left.”

Fortunately he complied with alacrity, enabling me to regain the centre line, the glide slope and land, leaving behind a situation of pandemonium judging by the Portuguese invective that continued until we changed to ground control frequency after turning off the runway.

It later transpired that the DC-3 had somehow got himself totally disorientated during the let-down procedure and instead of overshooting out over the sea in the prescribed manner, had informed the tower that he was established on the ILS. When he eventually did find the localiser he was hopelessly too high for the glide slope, hence his frantic descent. I was naturally furious, for had the cloud base been slightly lower, or our point of interception higher, we would never have seen him in that thick cloud.

The incident once again emphasised that old adage: “A chain is only as strong as its weakest link,” or in this case, “Any piece of air space is only as safe as the most dangerous pilot in it!” →