



THE AUTO FLIGHT SYNDROME

THROUGHOUT THE history of passenger flying, the lot of the airline pilot has been fraught with change and it could be said that in the commercial aviation jungle as in all jungles, it is a case of adapt or die.

To this end, the average line pilot spends an amazingly large proportion of his time in classrooms and simulators either being trained on new equipment or having his proficiency put under the microscope in addition to being probed, pummelled and X-rayed by the medical fraternity at regular intervals.

The time I spent in that occupation was no exception and from being introduced to the intricacies of early pressurised flight, airborne radar, VOR/DME and integrated flight instruments to the almost cynical, amused observation by a then young man of the then – to him – old codgers battling to adapt to the changed techniques of jet flight, was a wonderful experience. Usually, equipment close to the cutting edge of the technology of the day was operated by virtue of the fact that, in order to remain competitive and viable, airlines were, and still are, forced to keep abreast of advancing technology.

However, that young man, so amused by the antics of the old codgers adapting to the jet era, was himself one day to become an old codger battling against all his instincts to find reason to place his trust in computerised, fully automated flight.

Prior to the advent of the 747 in these climes, one of the 707s I flew was fitted with the fully automated and independent Inertial Navigation System (INS) which, unlike the later satellite-reliant GPS, was completely self-sufficient and part and parcel of the avionics package of the new aircraft which boasted no less than three independent units per aircraft.

The object of equipping a 707 with INS was not only to evaluate the new system, but also to familiarise crews with its operation.

This was a wise precaution since, despite its phenomenal accuracy and reliability, like all computerised systems, certain vital parameters had to be fed into the device for it to operate as designed. Among these was accurate ramp position co-ordinates at the parking bay prior to start, not only in degrees but also in minutes and seconds.

In other words, prior to commencing its aligning process, unlike GPS, the device had to be told precisely where it was.

At that time, the only means of acquiring such an accurate ramp position was by calling in a surveyor, much less having it displayed on boards facing each parking bay as later happened. Accordingly, the crew on this occasion inserted their own estimate of the position which turned out to be so far in error that it later served only to confuse the INS computer when it began up-dating its position on a couple of accurately plotted VOR/DME installations and thereafter ceased to operate.

Needless to say, the navigator, still carried at that stage, earned his stripes on that trip!

On yet another occasion, the crew diverted westwards around a group of Cbs off the coast of Senegal en route to Las Palmas. This was achieved by selecting the autopilot from “INS” to “HDG” (heading) mode and moving the heading cursor to that required.

Having completed the diversion, however, whoever was flying at the time neglected to punch in the aircraft's new position, simply “0” on the way point scale, and enter from there to the following way point before re-selecting the autopilot to “INS” mode.

When this oversight was eventually detected, they were well on their way to New York as opposed to the Canaries!

The shame faced captain was later heard to remark within the hearing of the smug looking navigator, “I still prefer these gadgets to navigators because they don't suffer from hangovers, don't steal my girl friends or tell weak jokes and never answer back!”

Having not been a member of either of those crews, however, it has to be said that both incidents are reported here only by virtue of what was circulated via the grape vine.

Nevertheless, the advent of the Boeing 747 series saw not only navigators being retrenched, but many pilots being introduced to their first taste of fully automated flight. Many, including yours truly, remained sceptical of this development for a long time, for the auto flight systems as they then were, were subject to severe limitations.

For instance, the autoland capability was limited to a maximum cross wind component of ten knots and required a Category III instrument landing system (ILS).

In this regard, the following ILS categories applied at the time:

■ **Category I** involved operations down to 200 feet DH (decision height) as read on a radio altimeter and RVR (runway visual range) of not less than 800 metres as derived by either transmissometers or visual observation of the number of runway lights clearly discernible.

■ **Category II** involved operations down to 100 feet DH and RVR not less than 400 metres, and

■ **Category IIIA** involved operation with no DH limitation and RVR not less than 200 metres. (This was later extended to Categories III B and C which extended to zero/zero, blind automatic landings).

RULED OUT

Be that as it may, the Category III requirement for auto landings in addition to the cross wind limitation, ruled out many of the airports served by the airline due mainly to undulating terrain on the approaches which caused wild oscillation of radio altimeters.

These included destinations such as Mauritius, Seychelles, Hong Kong, Rio de Janeiro, Las Palmas, Lisbon and the curved Carnasie approach at Kennedy (New York) among others, with the result that many pilots tended to regard the autoland system as something of a usually useless, but very expensive, toy.

The introduction of that fully automated flight era also held a previously unforeseen hazard for those pilots sufficiently enamoured of the system to practice it at every opportunity – they were in danger of losing their “feel” for the aircraft and consequently finding themselves wanting due to lack of practice when manual approaches were necessary!

Personally, I much preferred doing manual approaches in marginal conditions for the simple reason that I was in control, whereas during auto approaches, it was at times difficult to stay “in the loop”.

If one did not keep one's hands and feet on, closely monitoring the approach or was distracted, (so easily done when the autopilot is flying), it was possible to find oneself temporarily “out of the loop” as it were and not knowing precisely at what stage of the let down one was at.

Despite there being two completely independent autopilots, both coupled, so that in the event of one malfunctioning, it would be overridden by the other, it was, at least to me, an eerie feeling being flown by a couple of computers in IMC, no matter how ingenious they may have been.

Furthermore, the auto system had to be nursed, restricting localiser interception angles to not more than 30 degrees at an ample distance out beyond the outer marker to ensure that glide slope interceptions were only accomplished from below the slope.

Thus, when ordered to expedite by air traffic control, as so often happens at busy airports, it was a case of back to manual control.

A further source of unease during auto approaches was the fact that those computers could not anticipate. Whereas a human familiar with local conditions at any particular airport could anticipate potential undershooting for various reasons such as wind shear or downdraughts, those machines had first to experience any deviation from the desired flight path in order to detect that deviation

before correcting it.

At times this resulted in inordinately large power applications invariably followed by the throttles being almost completely retarded, leading to the feeling that the system could easily be caught out and end up on the back side of the drag curve! In this regard there has been more than one recorded incident of jet aircraft landing short of runways with their throttles wide open!

This situation, of course, was further aggravated by the eight seconds those big fan engines required to accelerate from idle to full power. In fact, behind the times or not, I treated auto approaches and landings with great circumspect, much as one would those done by an incompetent co-pilot when one never knows what to expect next, ever ready to take over should things get out of hand!

In my book at least, manual approaches and landings properly executed were infinitely smoother and more relaxed than the auto version, and so reserved the latter for ideal, calm conditions only.

Remember how Neil Armstrong had to take over and land manually during the first lunar landing?


FFRATS

Another innovation in those early days of fully automated flight, was FFRATS (Full Flight Regime Auto Throttle System) which controlled engine power at the press of a button, even applying and aligning the power settings of the four engines during take-off, provided, that is, the computer had been fed with the correct information such as air temperature and atmospheric pressure beforehand.

As usual, with the innovation of any new system, FFRATS required adaptation by crews in operating techniques, in this case the abort procedure. With the system engaged for take-off, during an abort pilots had to re-programme themselves to disengage the thing before throttling back. If this was not done, when the hand was subsequently lifted from the throttle levers to raise the speed brakes, the FFRATS computer would simply open them again as it was programmed to do!

This could have been the cause of a 737 overshooting the end of the runway at Washington International following an abort during a snow storm. The aircraft ended up in the icy waters of the Potomac River with several fatalities.


In addition, the FFRATS computer could not cope with reduced power take-offs. (It was common airline practice at light weights, to take off at reduced power in order to conserve the engines and extend engine life). →



AIRLINE CONTROL SYSTEMS

OFFERING YOU THE EDGE IN LEADING AVIATION SOFTWARE @ AFFORDABLE RATES

- ~ More than 18 years of aviation experience
- ~ affordable IT expertise
- ~ a 'paradigm shift' in aviation, initiated from the southern tip of Africa.



CRS & GDS

Manage and 'own' your inventory
Distribute through 5 different channels

DEPARTURE CONTROL SYSTEM

Modern state of the art technology for:-


- ▣ Passenger & Baggage processing
- ▣ Departure Control Procedures

YIELD MANAGEMENT & REVENUE ACCOUNTING

Tools to
Maximise Revenue and Minimise Costs

FINANCIAL CONTROL

- ▣ Control payments
- ▣ Accurate audit trail of each transaction.
- ▣ Never struggle to recover your revenue



AIRLINE TIME TABLE DESIGN MODULE

Click-and-drag to create your seasonal timetable, with ATC and/or Airport departure slots

DETAILED BUSINESS MODELLING

Accurate timetable cost/revenue analysis
A powerful tool for timetable viability comparisons

AIRCREW MODULE



Automatically creates high efficiency levels for crew schedules
Mathematically calculate aircrew pool size requirements

DECISION SUPPORT REPORTS

Multi dimensional Crosstabs
Cubed Data or Pivot Tables.

DAILY OPERATIONS CONTROL

- One central application manages
- ▣ Operational reports
- ▣ Last minute crew changes



24 Victoria Link, Route 21
Corporate Park, Nelmapius Drive, Irene
Tel: 0861 101004, Tel : +27 (0) 12 345 8508
Fax: +27 (0) 12 345 8480
e-mail: willem@airlinecs.com

LEARN TO FLY...

**Book Your
Introductory Flight
at only R250.00**

Private Pilot's License

Night Rating

Ground School

Instrument Rating

Multi Engine Rating

Commercial Pilot's License

Instructor Rating

ALTP License

Turbine Rating

Simulator Training



BLUE CHIP AVIATION, MAIN TERMINAL BUILDING
WONDERBOOM AIRPORT, PRETORIA
E-pos: bluechip@bluechip-avia.co.za
Webblad: www.bluechip-avia.co.za

Tel: +27 (0) 12 543 3050
Fax: +27 (0) 12 543 1826

Shortly thereafter, PMS (Performance Management System) was retrofitted to the earlier 747s. Such was the ingenuity of this system that it continually monitored weight, atmospheric conditions and fuel consumption, indicating when, traffic permitting, it was expedient to step-climb to the next flight level, usually four thousand feet above the last.

In fact, the first time I operated one of the PMS retrofitted aircraft from Ilha do Sal to London, after engaging the autopilot at 1 500 feet after take-off, neither throttles nor controls were manually manipulated again until turning off the runway after landing.

AUTO FLIGHT AGE

The age of fully automated passenger flight was upon us, further heralded by the introduction by Airbus Industrie of the first fly-by-wire passenger aircraft.

This meant that the pilot no longer had direct control over the control surfaces; all such inputs were electronically transmitted to a computer which then decided whether and by how much to move the said surfaces – should a pilot make an inappropriate demand he would simply be overridden by the computer!

This led to a series of unfortunate incidents and accidents, some fatal, with the A320, ostensibly the most advanced passenger aircraft ever built. Some of those, attributed to the auto flight system or misuse thereof, were revealed in the British 'Black Box' which was screened in South Africa by TV3 in the 1990s.

In that series, one of the non-fatal incidents involving a Rumanian A320 in 1994 over Paris, was graphically portrayed. For some reason, the system went into "Go Around" mode, raising the nose so high that the aircraft stalled and fell over on its back, after which it recovered and repeated the performance not once but four times!

During this display of involuntary aerobatics, unable to control the monster, the pilot was yelling "How did it get into this mode? What is it doing now? How do I stop it?"

This episode had a happy ending, however, for control was regained and the machine landed undamaged, engendering new respect for the integrity of an airframe never designed for aerobatics!

Despite those tragedies and incidents, sight should not be lost of figures released by the American NTSB (National Transport Safety Board) to the effect that despite a thousand fold increase in air traffic since 1947, passenger fatalities in accidents have not increased!

Furthermore, should one randomly board a passenger aircraft anywhere in the world every day, it would take 26 years to be

involved in an accident from which one would probably survive anyway!

In retrospect, in those early days of automatic landings, the new feature may not have been that popular with pilots but it was useful in one respect – in the event of a heavy landing, the autopilot could always be blamed when apologising to the passengers!

AN INCIDENT

As an adjunct to these recollections, it might be of interest to relate how, one night west of Dakar, en route to Lisbon from Johannesburg, my then 16-year-old son was sitting beside me in the right seat of an SP model 747, flying with me on what I thought to be an educational trip to Portugal since we would have a full week there at our disposal.

The lad was mad about flying and spent many hours building and flying his beautifully constructed control line models in addition to pouring over every piece of aviation orientated literature he could lay his hands on. Thus, as he sat in that right seat, I was aware that he was dying to feel the controls.

Now the SP version of the 747, in the interests of increasing range and improving hot and high take-off performance, is some 60 tonnes lighter and 60 feet shorter than its larger derivative, but with the same wings and engines.

This results in somewhat different, livelier handling characteristics and a revised landing technique due to the shortened fuselage.

Cruising at some 40 000 feet and Mach 0,86, holding a precise altitude is not the easiest of exercises for a trained pilot let alone a youngster who, although having flown light aircraft, was not fully trained.

I accordingly showed him the somewhat complex seat adjustment procedure of the aircraft and when he was comfortable, told him to put his hands and feet on the controls and feel the minute but precise control inputs from the autopilot.

After some 30 minutes of this, after asking whether he had the hang of it and upon receiving a thumbs up, I disengaged the autopilot. The youngster had no trouble maintaining the wings level despite the absence of a horizon, but his height varied more than a bit either way. Since his corrections were encouragingly smooth, I left him to it.

After a while, however, I sensed a presence behind me and turning, beheld an extremely irate Senior Air Hostess standing in the doorway of the flight deck with her arms akimbo.

In reply to my enquiry as to whether there was a problem she hissed: "Captain, the passengers at the back are all puking!" →