Lost in modernity

by Jean Pariès

Having reached a veteran's age, may I indulge myself with a personal memory?

In 1992, I was invited by Dan Maurino, then the head of ICAO's programme on Human Factors and Flight Safety, to give the closing address to the second World Symposium he was organizing in Washington DC. In these cases, one generally accepts with a flush of pleasure, then bitterly regrets. So, I was suffering the agony of the white page, when I remembered that the first ICAO Human Factors symposium had been held two years earlier in a country that no longer existed (USSR), and in a city which had changed its name (Leningrad). I decided to talk about the challenges of change for safety. The world is changing at an impressive rate, I said in essence, so what will aviation look like in 10 or 20 years from now? What are the safety challenges we will have to meet? Is there a plane today that foreshadows this future? I was then immersed in the investigation into the crash of an Airbus A320 at Mont Saint Odile near Strasbourg, France. I bravely answered: I think this aircraft exists, it is the Airbus A320. I heard something like an offended whisper run across the meeting room. Designating an aircraft which had raised so much controversy and had suffered so many accidents in its introductory years as an archetype of the future was probably a bit provocative. Twenty years later, I believe it was a rather good guess. But anyway, the point I want to make here is that, whatever the answer, I unknowingly asked the question which is underlying this issue of Hindsight: what is a "modern" aircraft? Is it possible to speak of "modern aircraft" as there are “modern times” or “modern art”? Doesn’t it simply mean the air-

Lost in modernity (cont'd)

This is your Captain speaking. My representative on the aircraft this evening is your Cabin Service Director. I wish you a pleasant flight and I will do all I can to ensure a safe and on-time arrival at your destination. If you have any concerns about the operation of the aircraft, just let me know via the on board cabin crew team.

craft which have recently left the assembly line? Well, obviously, some have an entirely new design, some are evolutions from older models, while they may benefit a "new" cockpit or newer engines. Which are "modern"?

According to the Merriam-Webster dictionary, "modern" means either "contemporary" or "up-to-date", i.e. involving recent techniques, methods or ideas. I think modernity also often includes the dimension of a disputed change from what existed before (a quarrel between the ancients and the moderns..). But what is new is not necessarily modern. Modernity further implies a "sustainable change", that is to say, a change that sets the path of future changes, and defines the general trend for a new way of doing things. So we move from one modern time to the next one, from one "age" to the next one, in different time scales. Where will our current modernity take us? Let's take a step back. A big step: let's look at things at the scale of the history of mankind. A whole series of revolutions triggered transitions from one age to the next, and changed our relationship to the world: carved stone, fire, agriculture, bronze, iron ... According to the philosopher of sciences Michel Serres, three of them were even more important – writing, printing, and computers – because they have changed our relationship to knowledge. Writing made it possible to archive knowledge outside human memories (to outsource long-term memory) and to access it without the constraints and fragility of oral transmission. With printing, it became possible to provide a mass access to that external memory, without needing to cross the closed door of a few privileged libraries. With computers, both long-term memory and the central computation unit were outsourced. And with Internet and other networks, the entire knowledge of the world is theoretically accessible to virtually everyone. And Michel Serres goes on: it would be a waste of time and energy to try and keep that knowledge inside our students' brains. Sooner or later, it will be lost, as were lost, all along mankind's history, all those skills suddenly rendered useless by the corresponding socio-technical revolution.

What if we apply this kind of vision to aviation? I guess a first outcome is that what defines an aircraft's modernity is its cockpit, because it is where the handling of knowledge (cognition) lies. A second outcome is that modern aircraft are potentially connected to all the knowledge in the world. And they will use it to calculate present and future actions, and execute them. They know, or will soon know, the weather, the traffic, airport accessibility, the price of fuel. They will incorporate a complete digital simulator of themselves, and know their internal status through omnipresent detectors and monitors. They will know their performance limitations, and their likely evolution, and match it to their model of the environment. They will fly, navigate, and communicate intentions and trajectory forecasts with an accuracy of just a few seconds. They will define and negotiate with their "colleague" aircraft, and with what will stay as the ground-based component of the traffic management system, the

best navigation trade-off between safety, fuel efficiency, weather, environment, and passenger comfort. So what will be left to human operators: pilots, controllers?

"What is left to the human brain?" asks Michel Serres. He answers: creativity, imagination, serendipity, ethics. Let's translate this into operator language: sense-making, adaptability, judgment, common sense, airmanship, survival instinct. Is it enough to save human jobs in cockpits or control rooms? It's more than enough: it is essential! Because there is something the analytical computation of "intelligent" computers will not, for still a long while, be able to cope with: the unexpected, the irreducible uncertainty and unpredictability of a flight, of thousands of flights interacting within a worldwide network. Airport delays, blocked runways, flocks of birds and other kinds of flying objects, unprecedented combinations of failures, passenger emergencies, volcanoes, wars, terrorist attacks, and so on. But it means one should not fight the wrong battle. Needless to say, as long as the current generation of aircraft flies, as long as autopilots fail and disconnect, or do surprising things, there will be a need for pilots with manual skills enabling them to back-up. And since Lisanne Bainbridge's "ironies of automation" in the early 80's, we have known that maintaining those skills is both a need and a real challenge, as they are atrophied day after day like unused muscles, with pilots watching when things go well and suddenly required to fly when things go wrong.

But in the longer term, most "manual flight" skills will inexorably be lost. Lost in modernity. The next generation of "modern" aircraft will probably be "fly-by-autopilot" only. The issue will not be manual skills, but automation reliability: a failure of the "permanent autopilot" will not be an option anymore. Nevertheless, the next generation will share with the current one an extended version of the "ironies of automation". I call it the "ironies of predetermination". The "modern" safety strategy seeks the anticipation of all potential threats, and the predetermination of all the needed responses (automation is only the ultimate form of predetermination). This strategy makes the system more and more reliable within its envelope of designed-for uncertainties, and more and more brittle outside it. The competencies needed to cope with the unexpected at the front line are lost in this continuous effort to eradicate surprises. There is no "fundamental surprise" in the simulator, only listed emergencies. But the real world is irreducibly unpredictable, and safety strategies should rather get people both prepared… and prepared to be unprepared! Front-line operators should be trained to cope with the unexpected. Human-machine cooperation should be revisited in the next (cockpit, control room) generation to better support human operators in their fundamental role: managing the unexpected, managing uncertainty, making judgments and decisions. They should be provided with a clear display of their current position within the operational envelope, as well as of their margins for maneuver. A paradigm shift is needed. There may even be a word for it: resilience engineering.

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graduated from the French National School of Civil Aviation as engineer, and then joined the DGAC for several positions dealing with air safety regulations.

He was a member of the ICAO Human Factors & Flight Safety Study Group from its creation in 1988. In 1990, he joined the Bureau Enquêtes Accident as Deputy Head, and Head of Investigations, where he led the technical investigation into the Mont Saint-Odile Accident, 1992. Currently Jean is CEO - of Dédale SA.

He holds a Commercial Pilot Licence with Instrument, Multi-engines, Turboprop, and Instructor ratings and a Helicopter Private Pilot Licence.