The chronology of workload

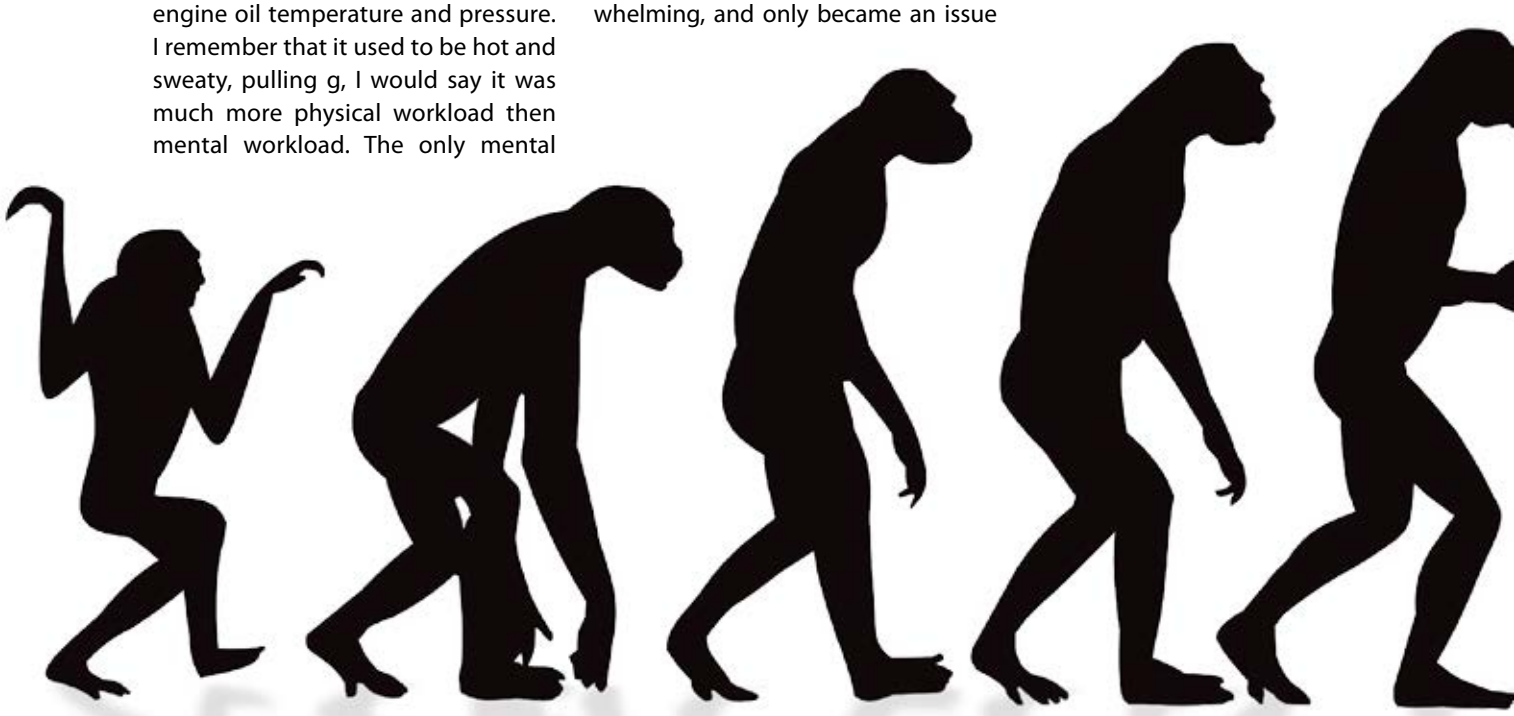
by Capt Shah Alam

When I started learning to fly in the military back in early 1980's in a Chinese-built PT6 aerobatic trainer, powered by a small radial piston engine, I didn't have any idea about workload...

We just had a short ATC and Met briefing in the morning, followed by a short briefing by the instructor and off we went for the sortie. We had to remember our checklist and the limitations by heart. I do not remember ever being told about workload as a threat as such. It was all stick and throttle action from start up onwards. Of course, there was no automation, no FMS, no EFB, no MCP to manage the flight. Flying was simply fun and 'success' was down to skill in handling and aerobatics. We didn't have much to do heads-down in the cockpit and I would not call it a flight deck! Flying was just looking out, doing your manoeuvres looking out with just an occasional glance inside to check your engine oil temperature and pressure. I remember that it used to be hot and sweaty, pulling g, I would say it was much more physical workload then mental workload. The only mental workload that I faintly remember was in navigation and instrument flying sorties. But I would not dare to call it workload compared to what I now have after flying for 34 years in military and in commercial aviation.

In fact we had a subject in the Air Force academy known as Airmanship, which is basically equivalent of present day aviation law and aviation physiology which mainly covered the medical and physiological aspects of flying. But we were never made aware that something called workload existed as such, our activity was just part of our human instinct like a normal day of any work. I presume it never came up as a factor because it was never normally overwhelming, and only became an issue if you had an emergency or a major failure.

My first real workload came when I started flying military transport in Russian built Antonov-26 aircraft. Before departure, we had to check the NOTAMS, Met Forecasts and Jeppesen navigation and approach charts. But the flying itself was still simple. No autopilots, manual selection of frequencies and courses to fly and straightforward ILS, VOR or NDB approaches. Hardly any airports had a SID for the departure and even if they did, it was invariably a pretty simple turn after takeoff to follow a outbound radial or course. We only needed to select the VOR or NDB frequency and the desired



course and it was then a simple matter of intercepting the course or radial by following the memory aids TDC (tail-desired-correction) or DHC (desired-head-correction).

When I started flying as a commercial airline pilot in the early 1990s, I was first introduced to automation in the form of autopilot and an EFIS control panel, we loved to proudly call them our 'glass cockpit'. Now we had fancy flat-screen panels called the PFD and the ND which replaced the age-old ADI and HSI. The flying itself became easier but the work to manage the flight started to increase. We now had to learn how to interpret the EFIS display and so on.

Next came my first introduction to the word 'workload' as applied to aviation rather than everyday household workload. My airline introduced mandatory CRM courses for pilots. We started seeing case studies on how some of the major fatal accidents had happened where workload had been a contributory factor. I began to get the impression that the more advanced and modern aircraft I flew, the more ATC was also using increasingly advanced technology to monitor the skies and the more my workload kept increasing. The skies all over the world became busier, airspace became more complex, rules more stringent and the rate at which new concepts and technologies were being introduced increased resulting in more to learn and learn and again learn. The age-old cockpit had now become today's flight deck with all the modern gadgets like TCAS, EGPWS, RAAS, FMS, ACARS, EFB. New procedures are being introduced to match with these state of the art cutting edge technologies. Next we started learning about RNAV, RNP, and now RNP-AR, all of this meant more learning and more pre-flight workload in the form of preparation for a flight to a little-known airport in your network.

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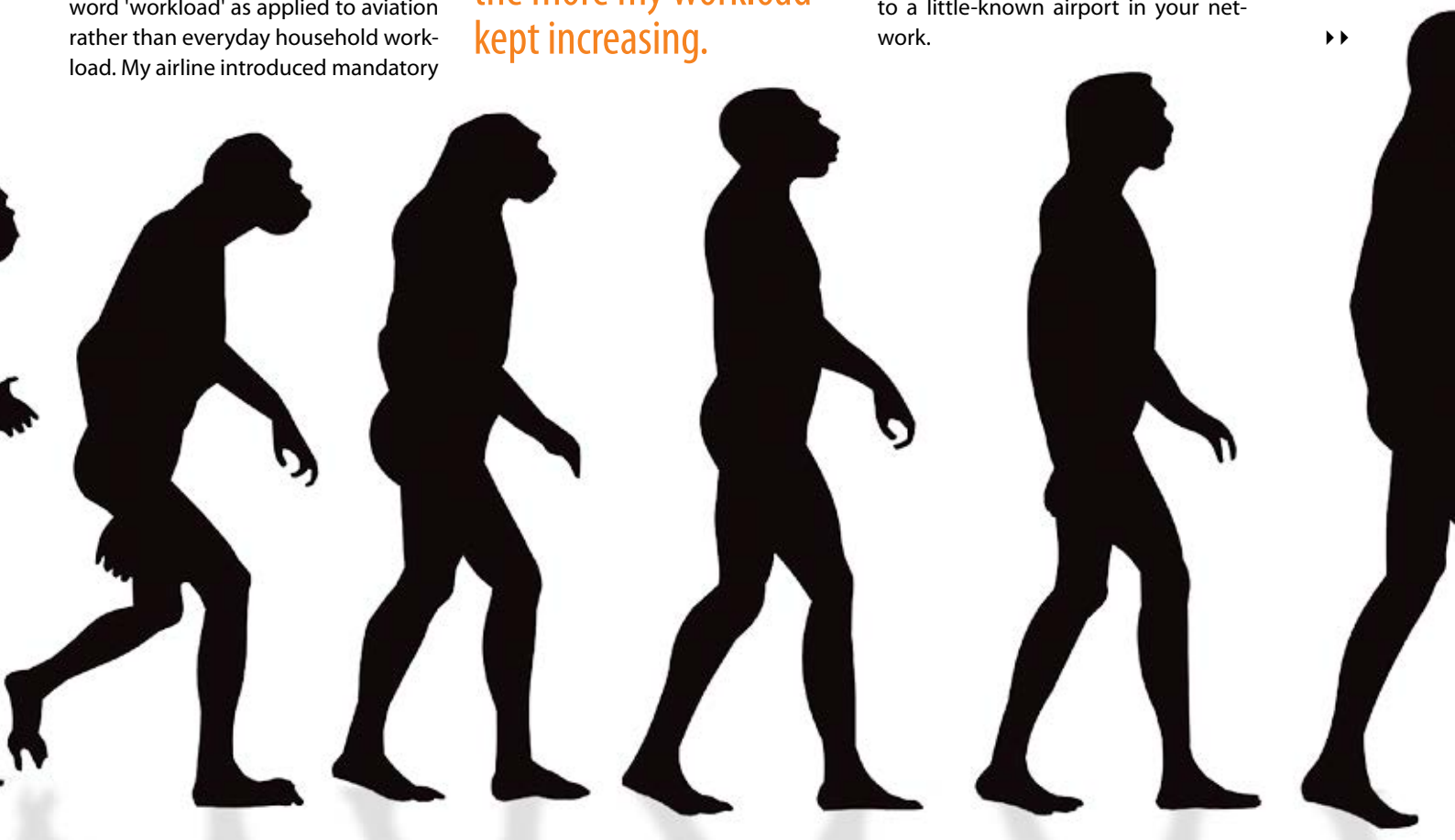
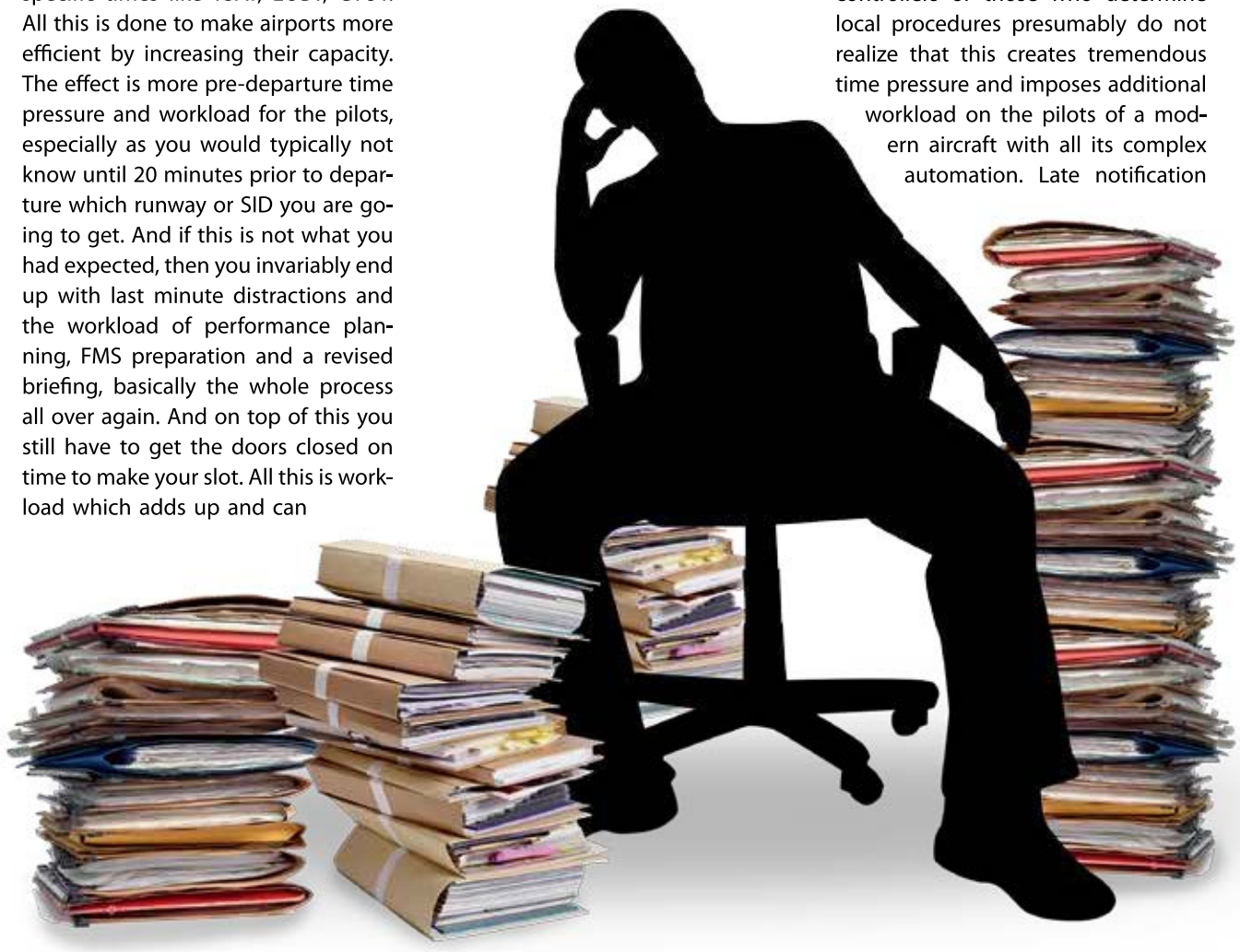


The chronology of workload (cont'd)

Now let me share what the present day workload of a typical transcontinental flight looks like. Nowadays, some of the major airports have page after page of charts and masses of airport briefing pages with technical information, much of which is not related to the operational needs of pilots. Sometimes there can be close to a hundred pages of SIDs and STARs each with a different name and chart number but really many are the same ILS approach with a small bullet note of procedure to make it a different chart as ILS X,Y or Z approach. There now seems to be a competition by the chart makers, in the skies by ATC and in the company to increase pilot workload. At major EU airports, you would now need to understand not only 'Slot time', but more specific times like TSAT, EOBT, CTOT. All this is done to make airports more efficient by increasing their capacity. The effect is more pre-departure time pressure and workload for the pilots, especially as you would typically not know until 20 minutes prior to departure which runway or SID you are going to get. And if this is not what you had expected, then you invariably end up with last minute distractions and the workload of performance planning, FMS preparation and a revised briefing, basically the whole process all over again. And on top of this you still have to get the doors closed on time to make your slot. All this is workload which adds up and can fray the pilots' nerves. They will now be at more risk of making mistakes in performance planning with the wrong flap setting for the changed Runway or the wrong V speeds. Situational awareness can degrade and this can increase the chances of taxiway or runway incursions. Now if you then add the cold weather deicing procedure at major airports you would have the real threat of workload. On the other extreme, some of the Asian airports will still not give you the departure clearance until you are taxing out and handed over to the tower controller. They will often not appreciate that the departure procedure needs to be inserted in the FMS, the MCP needs to be setup and the EFB needs to be organised for the departure procedure. All these are head-down actions during taxiing which add to workload.

Even with all these complications, the departure workload is much simpler these days than the arrival workload. Let us look at what happens in a major airport in Europe, Asia or the USA. The ATIS will typically give you two or sometimes three runways for arrival. If you do not have datalink and D-ATIS then you have to wait until within VHF range to plan your arrival and to brief the crew. You may well not know which arrival and runway you are going to get until after you have started your descent. For some US airports, you do not get confirmation of the landing runway until you are handed over to the approach controller. The controllers or those who determine local procedures presumably do not realize that this creates tremendous time pressure and imposes additional workload on the pilots of a modern aircraft with all its complex automation. Late notification



or change to a landing runway needs last minute FMS, EFIS, MCP and EFB setup followed by a briefing in a busy R/T situation when you are constantly being called by ATC for speed change, level change, frequency change and or heading change. This means high workload and the risk of degraded situational awareness due to head-down time of at least one pilot and chances of getting 'out of the loop' because temporarily, it is no longer possible for both pilots to monitor ATC. Then add to this the ATC-imposed speed control and maybe a high speed arrival until late followed by the stringent Company requirement for a stabilised final approach. Most controllers do not tell you the track miles while they are vectoring you so you do not know your profile till late which might lead to interception of the glidepath from above. Acceptance of an ATC request to maintain high speed for too long can result directly in an un-stabilised approach. Worst of all is when the last minute change of runway is during a visual or a non precision approach as occurs at some of the major US airports. Controllers there do not appear to realise that if pilots are not used to flying visual or non-precision approaches, thus the work load on the flight deck for both pilots increases significantly. The monitoring pilot's ability to cross check for errors by the handling pilot degrades in situations like this. Controllers also do not always seem to understand the energy management difficulty for pilots of large passenger jets in situations like these.

For some airport controllers, a different approach to their task is an appreciation of when and why pilot work load increases. Controllers need to recognise that pilots are mostly pretty well prepared and procedurally responsive to things which go as planned or if a change of plan is known early enough. The contrast between en route and terminal area pilot workload is marked. The former is generally low because management of the airspace is pretty much the same the world over whereas each individual major airports has it's own unique pre-departure procedure, arrival procedure, taxi procedure or taxi routes presented in an abbreviated form which itself creates extra workload for a pilot who is not familiar with it. He needs to looks at the briefing pages to check the standard taxi routing and any last minute runway change increases workload to the extent that positional awareness may be lost, and errors ranging from taking the wrong runway exit or subsequently taking a wrong taxiway or even a taxiway incursion at a hot spot may follow. Some might argue that hotspots are depicted on the chart, but checking that means reading the airport reference pages and their notes and explanations when you are still flying the aircraft and responding to ATC re-clearances for every 1000 feet of descent and to frequent changes of heading and speed, not to mention the workload created by the diverse use of aviation English around the world. Without being prejudiced we see the full range of possibilities from 'all American English' to 'Chinese or East Asian English'. So why can't we have an arrival procedure and a landing runway given to the pilot early enough to allow them to prepare well, when the flight deck workload is low instead of giving the changes in the terminal area. And if ATC is providing radar vectors, give the track miles to go automatically so that pilots can plan the energy management and the descent profile. Such practices add to safety by reducing workload and better situational awareness.

ATC must remember that pilots often do not operate to the same airport often. Having served almost four years in a major airline, I have not yet operated to all the airports served by my B777 fleet. So if I'm rostered to operate to a completely new airport in the US or in China then the preparation has to start days ahead to read the airport pages, taxi routes, special ATC procedures, expected arrival and departure procedure, Jeppesen charts, state procedures, the Operations Manual Part C and so on. Now add to this around 70-80 pages in the briefing package on the day consisting of page after page of NOTAMs which will mainly tell you where one taxi light is missing, or some of the markings are missing or some crane operating near the airport. This is real workload.

My hope that the regulators and airport authorities will some day harmonise the procedures at major airports and thus reduce the number of superfluous charts and briefing pages. ATC would always pass the expected departure and arrival routes and the runway early enough, maybe via datalink, for automation insertion and planning to reduce the workload and achieve safer skies.

Capt Shah Alam

is an experienced pilot who flew in the Bangladesh Air Force and with Biman Bangladesh Airlines for over 30 years. His airline roles included being a TRE and a CRM trainer and holding management positions as Chief of Technical and as General Manager Corporate Planning. He now works as a Captain on the Boeing 777 aircraft with Qatar Airways.