Forming the intention to do something in as little as a few seconds ahead of the present has the effect of engaging prospective memory, which is something none of us is terribly good at. It is difficult to monitor a situation actively, maintain an intention, determine when the time is right to perform it, and remember the full and correct content of that intention spontaneously with no external prompt. The probability of success is perhaps fair when workload is fairly low but decreases with the number of concurrent tasks being managed. Like pilots, controllers probably underestimate their vulnerability to errors of omission in these situations.

To reduce the chances of forgetting a deferred intention, pilots sometimes explicitly (or subconsciously) set cues to alert them when it is time to perform it. Controllers do it too:

"I WAS WORKING A BUSY SECTOR... I TOOK A HANDOFF ON AIRCRAFT X... DESCENDING FROM FL300 TO FL250… I NOTICED THE AIRCRAFT WAS HEADED FOR [A RESTRICTED AREA] … I DIDN'T HAVE TIME TO CALL THE CONTROLLER [WHO HANDED OFF THE AIRCRAFT]… I FIGURED I WOULD TURN THE AIRCRAFT WHEN IT CROSSED INTO MY AIRSPACE. THE AIRCRAFT NEVER CALLED ME… THE OTHER CONTROLLER PUT THE AIRCRAFT ON THE WRONG FREQUENCY… THAT WAS TOO BUSY TO ANSWER HIM, [THE AIRCRAFT] WENT BACK TO [THE ORIGINAL CONTROLLER] AND THEN FINALLY TO ME. BY THAT TIME HE HAD FLOWN THROUGH [THE RESTRICTED AREA]." (ASRS REPORT 651026 – MARCH 2005)

In this instance, the controller relies on a predictable cue (pilots establish radio contact with ATC when crossing airspace boundaries) to remember to perform an action (turn the aircraft away from a restricted area) that has to be deferred because she cannot accomplish right at that moment (there is no time to call the other controller). Associating (encoding) an intention with an event (cue) expected to occur at about the time when the intention will need to be performed is very good practice – it simply requires monitoring for that event to take place. Monitoring, as we already saw, however, is a tricky activity that requires discipline so that one can periodically self-interrupt ongoing activities to check on the event being monitored. That discipline is especially vulnerable to being inadvertently "dropped" during multitasking situations. To make matters worse, noticing the non-occurrence of an event is much harder than noticing its appearance. In this instance, when the cue (incoming call from aircraft) does not occur as anticipated, there is nothing to signal its absence – as a result, the associated intention is inadvertently overlooked.

Pilots deal with perturbations by multitasking – controllers do it too!

These are just a few examples to illustrate that, like the cockpit, the ATC operating environment is inundated with "normal" perturbations to an otherwise highly proceduralised workload. Inclement weather, pilot requests, incorrect readback, similar call signs, splitting of sectors in real-time, working more than one position, noise, fatigue and congested radio frequencies - and the list goes on - can all intervene. Pilots deal with perturbations by multitasking – controllers do it too! Multitasking renders all humans vulnerable to errors, and this vulnerability is often poorly recognised. In our work with pilot operations, we have been suggesting ways to reduce the probability of errors brought about by multitasking. Further research is required to gain a better understanding of this inevitable feature of complexity in the ATM environment in order to eventually suggest ways to ease the effects of multitasking in air traffic control operations as well. ■

Setting cleared altitude – What happens in the multi crew flight deck?

The way cleared altitude is selected and associated changes are made to FMS Modes is predicated on the way responsibilities are shared between the 'Pilot Flying' (PF) and the 'Pilot Monitoring' (PM)...

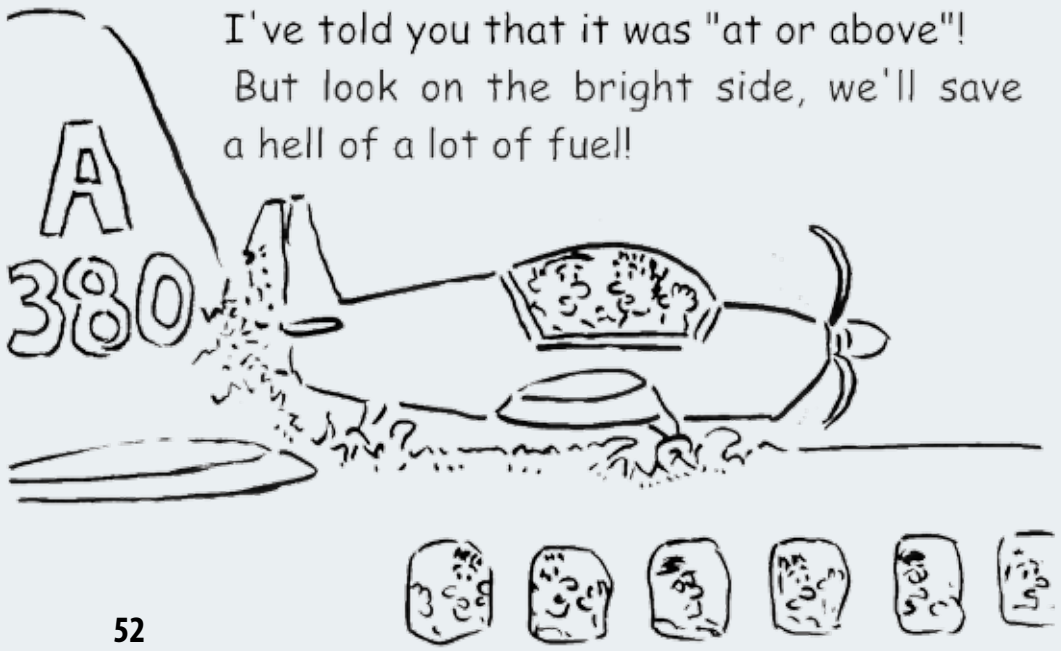
By HindSight Editorial Staff

Just to remind everyone, the PM used to be called the 'Pilot Not Flying' (PNF) and this designation may still be found. However, it was considered that this term was both negative (what does he do!) and also ignored the most important part of the PM role, which is to oversee (or monitor) the successful management of the flight without having to also focus primarily on the control of the aircraft.

However the cleared altitude is set, the 'Selected Altitude' should always show the current cleared altitude or level. And since most aircraft are flown most of the time through an Autopilot (AP) and not by the Pilot 'manually', whatever is set as the selected altitude will be what happens provided that it is either 'Armed' (the aircraft is on the way to a new vertical clearance) or 'Locked On' (the aircraft has captured the set altitude/level and the aircraft is being operated in an AP Mode which takes this set altitude/level as a controlling input (the usual case)).

Now we can look at how the cleared altitude is usually set – whilst remembering that the exact method will always depend on the SOPs of the aircraft operator. The important point is how the setting and checking of the cleared altitude is achieved. The first setting will be on the ground prior to take off. The PF will have led an interactive brief with the PM on the initial departure route which in most cases will be an SID with vertical as well as lateral requirements pre-defined and with the initial vertical clearance therefore carefully set by the PF and cross-checked by the PNF. Subsequent en route vertical clearances will be heard by both the PF and the PM and are then set by the PF and cross-checked by the PM, who must also read back the clearance to ATC and may still be required to write it down too whether or not this is a useful action at the time.

The precise order in which the PM carries out their tasks at each airborne re-clearance may vary. Usually, the PF will reset the cleared altitude/level straight away which will allow the PM to read back the clearance to ATC by reference to this revised setting having cross-checked the action of the PF. Sometimes, the PF will not be so quick to reset, so the re-clearance will be written down and acknowledged to ATC by the PM before it has been entered. The order in which the PM writes down and acknowledges a re-clearance as well as where the setting of the new altitude/level by the PF fits in to this is often the origin of a difference between what is read back and what is eventually set. Some operators will permit the PM to set a new cleared altitude on receipt provided that a positive confirmation



that the correct action has been taken is obtained from the PF as soon as practicable and it has been suggested that this method can reduce the occurrence of differences between what is said and what is done since at least the primary actions of setting and acknowledging are taken by the same person.

One of the real weaknesses in the shared roles of the PF and the PM is when either one of them is not listening out on the ATC frequency. Most operators now require that the main ATC frequency is monitored when airborne without simultaneous selection of other radio or intercom channels so that such monitoring is effective (although an exception may be made for monitoring of 121.5). This means that cabin crew communications, passenger public address, reception of ATIS data and company/handling agent communications require that the pilot involved leaves the main ATC frequency to the other pilot for short periods. Typical SOPs require that a return to the main frequency after such tasks is accompanied by an 'update'. But of course there has been no cross-checking during the period of absence.

And finally, some operator SOPs for the setting of cleared altitude are just not as rigorously specified as others and even if they are, and taking the normal case when both pilots are listening to ATC, those pilots, like everyone else, don't always do what they are supposed to do, intended to do or thought they were doing... ■