Workload and the surprise factor

By Captain Ed Pooley

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I don't know how many HindSight Readers are familiar with the story of Goldilocks (a little girl) and the Three Bears – a baby bear and her mother and father. It includes a scene where, whilst wandering in a forest early one morning and rather hungry, Goldilocks comes across the Bear Family's cottage and looks through the window. With no bears in sight, she goes in and sees three bowls of porridge. She tries a little of each. Then she tries out each of the three chairs and finally, having found the bears' three beds and falls asleep. But not before she has decided that in each case, two of the choices are always too much in the direction of an extreme – too hot/cold, too hard/soft or too large/small and one is "just right'. For the majority of both controllers and pilots, the everyday exposure to workload is rather like that. There is an optimum, at each end of which are the extremes of 'too low' and 'too high'.

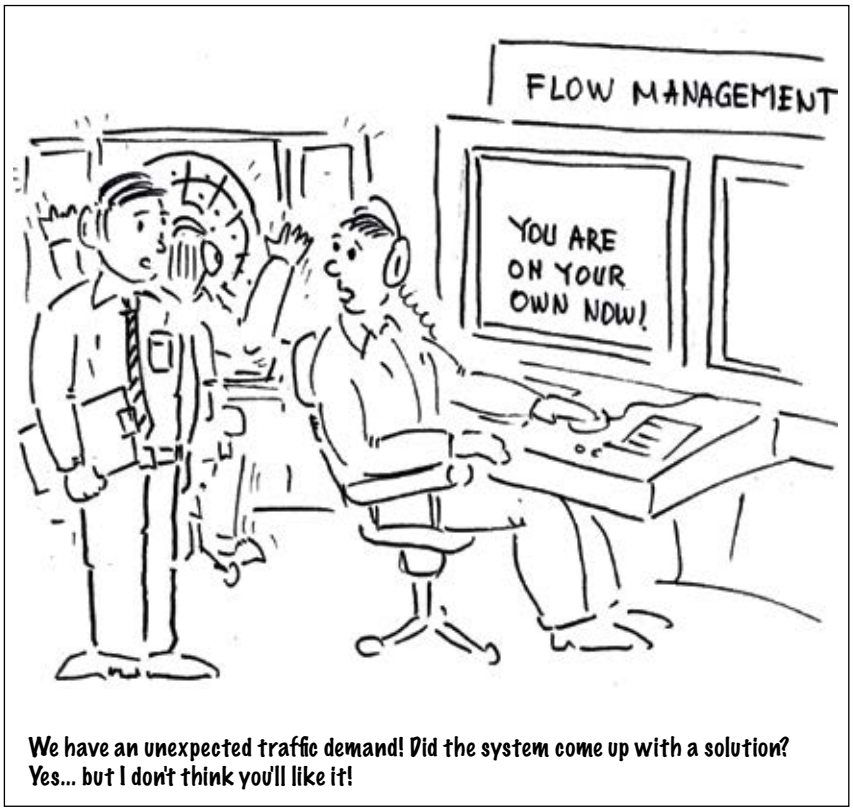
Workload on the flight deck is, on a normal day, predictably cyclical for every flight. Unless the flight which follows is a short haul turnround flown by the same crew, it is also necessary to consider the hour or so before the aircraft pushes back from the gate for which there is also some predictability. For any crew there is rather a lot to do during a period of time which is invariably a fixed number of minutes before STD – typically 60, 75 or 90 minutes[1]. This interval often has less to do with what is required than the need to keep the Flight Duty Period[2] to a minimum. Even before 'signing on' for a flying duty, if the aircraft commander is new to command, new to the aircraft

1- Long haul flights in larger aircraft are likely to be preceded by more generous reporting times.
2- This begins at the time that a crew member is required to report for duty and ends at engine shutdown after the final flight. It is often scheduled quite close to the maximum permitted. This is different to a Duty Period which can and does continue after this time as required – including positioning after flying duty.

type or variant, about to operate a variant within a common type rating which they have not recently flown or is unfamiliar with the route and/or destination and alternates, then they will almost certainly have undertaken some pre-flight preparation in their own time. Probably not too many controllers feel the need to do that unless OJT beckons!

So pre-flight is routinely high workload and can become very high workload if operational normality does not prevail with the overriding pressure being that these days, every late departure has to have a reason, the determination of which is a subject on its own. Needless to say, most Captains want to minimise the number of times they are the 'cause'.

Engine start to 10,000 feet is accompanied by a different but equally high workload. Then, almost always, comes the low workload period beginning above 10,000 feet and lasting until about the top of descent. Usually only the direct or indirect effects of adverse weather or the occurrence of an aircraft malfunction will interfere with this. Once descent has started, the routine workload slowly builds up to a maximum until after completion of the landing when it reduces to a intermediate level until engines off.



We have an unexpected traffic demand! Did the system come up with a solution? Yes... but I don't think you'll like it!

Of course this broad predictability is not guaranteed but this repetitive cycle is probably more constant than the variation in a shift as a controller. Nevertheless, normality for most controllers will have some 'baseline' variations in workload which can be anticipated at the beginning of a particular shift – although I'm sure that these baselines are rarely the same unless it's the same shift in the same position.

For both pilots and controllers, these routine expectations of workload variation will (for pilots) or may well (for controllers) encompass the full range of acceptable workload. But this at least represents a familiar 'normality', and whilst the challenges in the vicinity of these two extremes are rather different, they at least happen more or less when expected. Where to 'draw the line' when faced with overload can be dealt with procedurally by making reasonable assumptions about the point just before that where the performance of individuals may no longer be consistently safe and devising a reliable solution.

But there is an extra dimension to workload in respect of the high end of the spectrum and with it a heightened risk of overload. This is the fact that 'the

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system' in both the flight deck and in the control room must be able to cope with the particular case of a (very) sudden and (entirely) unexpected transition to high workload which demolishes in seconds the previous expectation that fluctuations in workload would continue along the anticipated path. Recovery – or at least containment – before overload is reached becomes the aim.

From the perspective of the party on the receiving end of a surprise, the trigger for this sudden change could be either 'internal' or 'external'. In either case the origin of the change could be 'technical/environmental' or 'human' – although inevitably, as in any endeavour with a human in charge, the latter tends to dominate. A sudden unexpected increase in workload on the fight deck or in the control room may fairly quickly result in the same condition for the other too. But of course both pilots and controllers can initiate an unexpected and sudden increase in their workload by their own inappropriate or unintended actions without any help from anyone else!

Some of the most common scenarios for sudden and 'out of the blue' high workload are as follows:

Trigger In	Condition	Cause	Workload effect for
Flight deck	Aeroplane control	Pilot	Pilot
Flight deck	Low fuel	External/Pilot	Both
Flight deck	Aeroplane malfunction	External	Both
Flight deck	Medical emergency	External	Both
Control room	ATC system malfunction	External	Both
Either	Traffic separation	Either	Both

The first of these stands out as the one where ATC is unlikely to be involved – although in respect of risk-mitigation, it has a lot in common with the last two. For the next three, there are procedures for both pilots and controllers to follow and in these situations, the response is at least similar in principle every time and the responses are procedurally prescribed, are covered in training and for real fairly often. The last two, however, typically demand rather more ad hoc decision making and there is much more chance that every situation will be different. Here, (and in the first case) the normal training system may have provided the least benefit.

Coping with any operational issue needs two approaches – prevention and recovery. Since prevention procedures will often have failed, the ability to recover is important and supportive training to increase the chances of this is therefore crucial. But in the case of a 'sudden' and 'unexpected' rapid transition to high workload, not every scenario can be anticipated. Training must therefore employ representative scenarios and assess the competence demonstrated in coping with them. I admit that it will be difficult if not impossible to directly include the self-caused high workload case but this should not prevent the development of overall resilience sufficient to stay out of more than momentary overload altogether.

To be effective, this training must be based on two guiding principles:

- A way must be found to 'hide' these 'representative scenarios' within a whole training exercise so as to introduce at least a little of the unexpected onset which would accompany the real thing.

- We all know how quickly news of each new training exercise gets passed round. To avoid this loss of surprise, a huge library of representative training scenarios must be developed so that the surprise they provide is as near to real as possible.

Of course the best place to practice this is in a simulator which replicates a real aeroplane or work station and for most pilots at least, this is possible. But I suspect that many controllers will not be exposed to quite such realistic training opportunities so that in itself will be an additional challenge.

And one final thought. Is the predictable consistency of a 'goldilocks' workload really what we want? Even if we define 'normality' as including the predictable and anticipated variation in workload, do we really want to stop there? Why did we become pilots or controllers? I suggest that most of us did so because there was also the prospect of an occasional unexpected challenge to rise to and meet successfully without needing a completely memorised or scripted solution.