Did you say fatigue regulation?

By Stéphane Deharvengt

Fatigue regulation may appear to be a long and discouraging topic compared to lively accounts of operational situations where fatigue played a role. However, if you stay awake till the end, you might have learnt a few issues that really have an impact on how our industry has reached ultra-high levels of safety, by actually allowing pilots and controllers to manage demanding operational situations.

A case study, pilots' flight time and duty time limitations

A comparison of risky human activities shows that you cannot improve your level of safety if a certain number of evolutions are not accepted. One of those is the development of international regulation, compared to local rulemaking practices (Amalberti, 2003). This was the case when Europe embarked on developing harmonised regulation for airlines' operations with the adoption of JAR-OPS 1 in 1996. Interestingly, one section was missing, sub-part N for flight time and duty time limitations, the section which was supposed to cover fatigue issues. A few years after unsuccessful negotiations, the European Commission took charge with a view to reaching an agreement. Then it was the turn of the European Parliament to embrace this challenging task. To cut a long story short, it was not until the end of 2006 that a European regulation, the EU-OPS, was published with an applicability date of mid-2008. This regulation included the first Europe-wide requirements for flight time and duty time limitations. But the story does not end here, because in the meantime, EASA has been granted competencies in this domain and has had to publish its own regulation to replace EU-OPS. At the time of writing, the response of EASA to the comments received after the publication of the draft Implementing Rule for OPS has just been published (NPA 2010-14A, a 244-page document) and the final rule with its applicability date is still pending. Broadly speaking, it took us about 15 years to develop a regulation addressing rostering practices for aircrews.

Analysing the complexity of regulating fatigue

Over the years, aviation has been the place for technological and operational developments (e.g. aircraft range capacities, opening of new routes), but also changes in the economic and social context (e.g. new airline business models, shortage of pilots), and evolutions in safety management (e.g. training, occurrence reporting, oversight). Those factors have contributed to the establishment of differences in the accepted consensus between states and/or between airlines. In a fierce competitive environment, operational flexibility is traded for flexible usage of the pilot workforce in exchange for various compensations in a win-win situation, supported by enhanced on-board systems.

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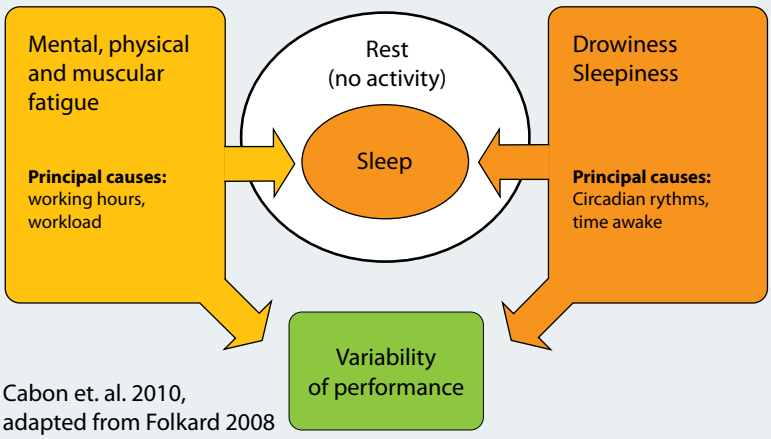

Cabon et. al. 2010, adapted from Folkard 2008

Nothing but normal socio-technical process at work!

On the other hand, managing fatigue in regulatory terms was understood as prescribing limits on maximum daily, monthly, and yearly working hours, and requiring minimum breaks within and between active operational periods. This was in line with the understanding that long unbroken periods of work could produce fatigue (what is called 'time-on-task' fatigue), and that sufficient time was needed to recover from work demands and to attend to non-work aspects of life. However, improved scientific knowledge evidenced additional causes of fatigue, such as the importance of adequate sleep (not just rest) and the daily cycle of the circadian rhythms. The scientific view of fatigue and how it is addressed in regulations is increasingly out of sync. In parallel, our knowledge of how accidents happen has improved, first with the introduction of human performance aspects, but more so with the notion of in-depth systemic defences, the famous Reason's Swiss Cheese model. Prescriptive regulations defining limits for the organisation of duty and rest periods are not only an inadequate simplification of operational life – if you're inside the limits you're safe, if you're outside you're unsafe – but constitute only a single line of defence in the overall strategy for maintaining safety.

To further complicate the issue, although laboratory experiments have shown decreased performance for fatigued individuals, investigations of fatigue effects on real situations, especially on aircrew work, suggest a complex and non-linear link between fatigue and safety: teams in a highly automated environment might be able to develop strategies to mitigate the impact of fatigue. Fatigue awareness is probably an important factor that might explain this complex link between fatigue and safety (Cabon, at al 2008): if you feel fatigued, you may be more prone to err on the side of caution, whereas if you feel alert, you might feel overconfident. This is the wake-up call for an improved organisational safety strategy.

This analysis conveys the difficulty in accounting for complex fatigue management strategies by operational people in a regulation that acts as one constraint among many in the socio-technical environment of airlines. No wonder then that any evolution is bound to awake interesting parties with a start, as evidenced by recent discussions about the proposed EASA regulation.

Evolution towards fatigue risk management egulation

In the wake of safety management systems (SMS) implementation, several airlines have implemented the concept of fatigue risk management systems (FRMS) in the context of ultra long-range flights or short-haul flights in Europe. This flexible approach to managing fatigue requires the identification of fatigue-related risks (e.g. use of predictive models for guiding scheduling, accounting for extended duty periods or reduced rests), the implementation of mitigation measures (e.g. adequate accommodation, individual lifestyle) and the monitoring of potential effects on operations (e.g. use of aircraft recorded data, reporting, normal operations monitoring). The system is based on a pragmatic review of operational practices augmented by scientific knowledge and tools. The FRMS regulatory approach can be seen as a concrete way for an organisation to adjust its practices by re-introducing safety as managed by humans in addition to safety as required by regulations: this is the organisational strategy for managing safety. The implementation process will obviously take time both for the operators and the regulators because of the complexity of the issue.

Are the lessons learnt applicable to ATM or other domains of aviation?

The differences for ATM are obvious: the regulatory system (there are no prescriptive safety figures for our rostering systems), the technological environment (automation and its constraints on proceduralisation are not there yet), team organisation (we're normally used to working with the same colleagues in a team), and so on. However, our understanding of the mechanisms related to fatigue impact on performance tells us that sleep and performance are mutually influenced by workload and working hours on the one hand and circadian rhythms and time spent awake on the other.

As humans adapt to the requirements of the tasks while managing their own resources, a regulatory process that accounts for such strategies is needed if we are to avoid unending disputes over how long a roster should be: science will be more useful in helping us design a strategy than for bickering about numbers. This far from easy or simple, but it is in line with the principles of SMS and the underlying concept of risk management: safety policy and allocation of responsibilities, risk management by the identification of vulnerabilities and implementation of mitigation strategies, assurance of safety by monitoring operational effects, promotion of continuous safety improvement.

The complementary nature of the various safety strategies in our industry (either at the level of the individual, the team, the middle management, or the organisation) is ultimately what makes it resilient. Food for thought, in case you have sleepless nights.