

# The risk of Skill Degradation during the Covid-19 Crisis for Austro Control Operational and Technical Staff (external distribution)

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This paper is an exploratory investigation to look at Skill Degradation (*Abnahme der Fähigkeiten*) across Austro Control during reduced services and significant reduction of air traffic as a result of the Covid-19 crisis in Europe (and globally). It does not seek to make policy recommendations at this time, but to survey evidence on the topic. The scope of this paper is to identify what evidence there is to say when and how time out of practice affects skills, competence and performance. This review has looked at:

- How important the is length of break from everyday usage and operations?
- How this impact differs by type or practice, experience, mode-switching and department/unit type.
- Mitigating factors for any reduction of skills.

This paper has gathered evidence from the published literature in aviation, maritime, medical and military operations.

## Background

In late February 2020, it became increasingly apparent that a global pandemic would be declared. The country of Italy, neighbouring Austria went into a national lock down on 09 March 2020. This began a sharp decline in the amount of air traffic to Austria. Between the 09 March and 16 March, air traffic continued to decline as other countries began to impose more restrictive access. Austria was one of the next countries to close borders and went into a national lock down on 16 March 2020. By 30 March, with continued decline in air traffic globally, operations within Austro Control have reduced to approximately 25% of normal traffic levels (30 out of 800 movements at Schwechat and 500 out of 2500 in ACC). This level is predicted to last until at least May 2020 at the earliest.

The response to this significant loss of traffic, coupled with health and welfare responsibilities to impose physical distancing amongst technical and operational staff has seen a restructuring of the watch system and a contraction of the watch size. There has also been a total ban on overtime and extra hours for staff and a temporary freeze to training. All of this combines to create a reduction in the time controllers, technical staff and administrative tasks can perform normal duties and maintain regulation skills and services. Some clearer examples of complications relating to skill usage include:

- A return to full time operations for staff who have been serving multiple or other roles in the last year (posing a risk of skill fade)
- Key skills such as placing aircraft into 'holds' or managing 'stacks' in the Approach sectors are not being used at the moment due to loss of traffic
- Technical staff with reduced numbers maintaining only vital services which could lead to loss or degradation of other skills
- Natural loss of skill due to reduced watch hours, loss of confidence, distraction from external factors (e.g. the pandemic or worries about family)

It makes sense that time out will affect skills and competence. Understanding the impact enables the operation, Austro Control and the regulators to find ways to address any training or support needs.

This investigation is also carried out under the guise of a Just and Safe Culture. Austro Control recognises the need to be transparent and open in order to preserve the safe and efficient operation

of air traffic management. Individuals and the company are jointly responsible for the preservation of skills during this difficult time and this paper provides insights as to the potential risk and mitigations.

### **Research Questions and Strategy**

We want to find out:

1. Is there evidence to suggest that an individual de-skill over time out from practice and if so, over what period of time.
2. What factors affect skills fade and how – for example, age, specialty, supervision, level of independence etc.
3. What other factors should be considered during this time which could affect human performance?

This research used a systematic approach to identify and evaluate written evidence to answer the study research questions. Literature was sourced from online web-journals and publications. This evidence is combined with the expert opinions of the author who is a registered Psychologist and former Naval Commander with experience in skill degradation during long deployments at sea.

### **Summary of Results**

Overall, the topic of skill degradation as a result of disrupted and reduced operations in aviation has not been studied widely. There is a body of research looking at retention of skills within the Military and medical industries, however most studies focus on a ‘the gap since learning a skill’ – which is a concept known as the ‘forgetting curve’ (see below). There is also research looking at the opinions and experiences of people returning to work after periods away (for example due to maternity leave).

Overwhelmingly, the studies focused on operational personnel have come from the military and much of the theoretical basis for the understanding of skill retention and skill fade is from academic cognitive psychology experiments conducted largely on university students and volunteers. The quality of this research is quite high with strong validity and reliability of results. However, many of these studies use smaller sample sizes and report losses of participants between studies.

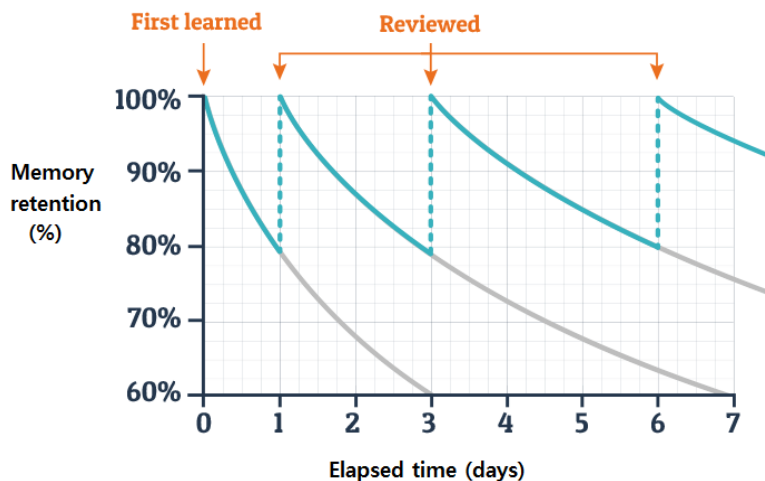
The military research is carried out on larger scales and also include other sources such as primary and secondary research into their own experiments as well as useful operational data. It should be noted that – almost all of the research focuses either on single skills, or aggregate operational performance and so sometimes lacks the transferability of results to our own industry. Furthermore, and most crucially, there is almost no research looking at major disruptions to operations and the effect of a combination of stressors and experiences (i.e. time as controllers) all occurring at the same time with the exception of some disaster relief and CISM type occurrences.

As a result, the applicability of all of these findings is not conclusive to the granularity required to provide weekly or daily assessment of skill degradation to our controllers. However, the results do provide some clear baselines and starting points for us to create solutions for the medium-longer term. An ‘operational risk matrix’ approach which is recommended at the bottom of this paper may be required if our operation remains degraded for a much longer period.

## Answering the Research Questions

*Is there evidence to suggest that an individual de-skill over time out from practice and if so, over what period of time. What factors affect skills fade and how – for example, age, specialty, supervision, level of independence etc.*

There is substantial evidence that time out of practice does impact on the individual's skills. Skills have been shown to decline over periods ranging from 3 to 18 months, according to a curve with a steeper decline at the outset and a more gradual decline as time passes. The amount of time between learning and losing a skill varies between skills and between individuals, with many mitigating factors (primarily using them every day). Most studies look at skill retention up to two years. There is no clear consensus about what length of break from practice ought to result in assessment of competence. This is dependent on the skill being assessed and their original training. We are lucky however in Air Traffic management that all of our controllers and technical staff are certified to competent levels and these are tested regularly as well as used often.



The forgetting curve, first proposed by Hermann Ebbinghaus in 1885 follows a very good formula which has been demonstrated repeatedly for more than 100 years:

*Retrievability of memory is inversely related to the Stability of the memory.*

In the case of air traffic controllers, the 'stability' of memories is enhanced by the experience of the controller, the

amount of training and refresher training they've had and the amount of time they have been plugged in recently. Therefore, to understand each individual controller or technician, we must consider how recently they used all of their skills as well as their overall experience. A controller plugging in once a month will be higher in risk to someone plugging in more often. However, skills not being used, such as holding or stack management will deteriorate for everyone if not used.

The most vulnerable are newer controllers who may not have had much practice on the skills that are now not being used. Their skill retention will fade faster.

### **What other factors may be in play?**

The stability of memories in ATM operations is directly related to experience, amount of training and regular usage. However, there are many other factors in play that we as an operation must consider. Firstly, it has been shown that the best way to off-set skill degradation from 6-18 months is to 'overlearn' skills. In the military and medical industries this is regularly done. For example, a typical warship at sea for a 9 month deployment will train the skills needed for the deployment intensively during the first month. However, most of these skills (such as fighting fires or floods) will not be used again for the entire deployment. But they are routinely practiced and overlearned throughout the deployment through simulated learning. Warships I have served on typically did two fire exercises, a flood exercise and three sessions of technical breakdowns every week to maintain basic skills.

Warfare exercises such as gunnery and aviation operations were done even more routinely as these skills are more complicated and require more significant development.

There is evidence to suggest simply keeping in contact with colleagues during breaks is vital for preserving skills. Cognitive association with colleagues who do similar jobs to you can refresh the neural connections between skills and tasks. For example, surgeons who take long breaks are encouraged and supported in maintaining contact with the community throughout their leave. At Austro Control, we have measures to do this through our newsletters and information. But perhaps, we could set up interactive friendship community for controllers and technicians to virtually 'hang out' in order to preserve skills.

A key concern from literature suggests that while younger controllers are at risk from skill fade because they have not used the skills very much in their careers, the bigger risk group are actually older controllers, especially those that may not have used many of the skills for sometime. This is because this cohort is susceptible to being out of practice combined with reduced attention and dexterity, especially where newer technologies are involved.

### ***Specific Skills already known***

Some key skills have already been identified by ATM as being a concern. They include the use of staff that are less current (discussed above) as well as the use of the 'Operational Director' and 'holding/stack management' skills. The latter two here are specific skills which involve the use of certain elements of HMI and procedures. As discussed, it is doubtful that the use of these skills will fade before three months of not using them. However, as part of the recommended mitigations at the end of this paper, these skills could be simulated for controllers who feel they may be out of practice. Supervisors should also be made aware to brief people in those positions of the potential for skill fade.

### ***Critical incident and stress***

Finally, although the obvious candidates for skill fade: age, experience, usage time, task type and routine vs unusual circumstance training all play a large part in the maintenance of skills, it is important to look beyond typical cognitive psychology research at the affect of this unusual situation on everyone. Disaster management and CISM research shows that Human Performance during this time is more influenced by an individual's ability to show **Adaptation**. Adaptation is a combination of two important factors: **Confidence and Resilience**. Our staff will be suffering from a loss of confidence and a degradation in resilience as result of the highly unusual situation. Any intervention to off-set skill fade must also focus on these two elements, and given that skill-fade begins to set in generally from three months onwards, it may be of more interest to the operation and company to implement a 'return to duty' scheme that focuses on rebuilding Confidence and Resilience just as much as Skills.

Experience from my own military deployments has shown that in times of crisis such as dangerous operations, most of the 'baseline' skills such as every day operation – e.g. using systems, clicking on the right things, observing attention indicators and HMI, communication, special tasks relevant to sectors all become automatic. This is the result of 'overlearning' and 'overexposure' which we put our controllers and staff through. What is the difference between safe, efficient and continuous operations and the loss of performance due to unusual situations is the recognition and training and non-technical skills such as confidence, resilience, community and culture.

### ***Introduction of new procedures and skills***

Given the discussion of all of the above, the introduction of new skills and procedures should be done with extreme care. Evidence suggests that it is not impossible to introduce new skills and procedures during times of crisis provided that adequate measures and risk analysis is done. It is known that 'multi-sector' planner is a new concept set to be introduced in May. The introduction of this particular role/task may actually benefit controllers during this time as it will stimulate them to consider and think about skills that they may not be using regularly. Furthermore, the point of multi-sector planner is to optimise usage of staff and human performance, and so with some extra considerations such as confidence and resilience training, this new skill could still be taught within the degraded operational tempo.

### ***At risk groups***

It is possible to deduce and arrange the most at risk groups from skill fade. This will allow ANSPs and other aviation groups to focus on which personnel need monitoring or intervention to prevent skill fade early. The following list is aggregated, of course individual differences are always present, and overall, the literature recommends that supervisors and managers should be conscious of the ability of staff at all times:

- Younger more recently qualified controllers
- Eldest controllers, especially those that might have been doing office work more recently and called back into Ops for the crisis
- Technicians without much experience operating alone
- Those more at risk for stress or fatigue from unusual situations (CISM or PTSD issues)
- Tower controllers with extremely limited traffic will fade first
- Followed by Approach controllers (due to more things not being done)
- ACC last (based on current task analysis and watch structure as well as currently higher workloads than other centres)

### ***Aggregated order of decreasing skills***

Across the literature, there are reoccurring themes of what types of skills fade first. As already concluded, there is substantial evidence that skills fade over time ranging from 3 – 18 months. However, these can be arranged in order of which skills fade first and important conclusions can be drawn to prevent this from happening:

In order of what fades first:

- Most recently learned skills that may not have embedded, e.g. New procedures or technical skills not used **(2 weeks – 2+months)**
  - n.b.: A good example here is rapidly changing personal procedures for hygiene measures – if operations keep changing the rules
- Larger procedures with multiple variables, e.g. standing agreements with more dimensions, especially if not used **(3-6+ months)**
- More obscure technical procedures, e.g. 'holding' or 'stack management' or 'LAN update procedures not used often' **(3-6+ months)**
- Muscle memory for human-machine interfaces **(6-9+ months)**

- Core job skills (12+ months)

## **Recommended Measures and Conclusion**

A review of more than 30 pieces of literature and expertise has shown that skill-fade will begin to set in from 3 months onwards. Young controllers and those approaching retirement are more at risk of this skill fade. Basic skills that are used daily will fade the slowest.

Skill fade is a complex phenomenon that is highly individual. It is influenced by a range of factors that are often those not considered by supervisors or management – such as confidence and resilience. The model of skill retention posited by military researches weights individual, organisational, task, training, interval and non-technical factors. Attempts to determine how these factors impact have shown they do influence the degree to which skills are retained, but how they interact has not been conclusively shown.

### **Recommended measures to off-set skill degradation and maintain human performance:**

1. Presentation of these results to all staff to make them aware of the risk of skill fade and the factors that can influence it. Distributed and monitored by Supervisors to ATCOs and ATSEPs
2. Supervisors to interview and monitor staff about their awareness of skill fade and to collect feedback on skills not being used.
  - a. Supervisors can ask controllers – what are you not doing at the moment? And report back to management (and SQ)
  - b. Certain tasks identified as not being used can be more closely analysed
  - c. The age and experience of controllers to be blended in watch composition and noted by supervisors so as to maintain a good balance of staff
  - d. Should the situation continue, skills not being used could be ‘refreshed’ through awareness campaigns, but simulator training is not recommended at this time.
3. Positive messaging on maintaining individual and group cohesion and community – ‘look out for each other’ and ‘keep in touch’ ideas.
4. As traffic begins to increase, staff to receive a half or one day educational course on Confidence and Resilience using a Confidence and Resilience system (more details can be obtained from Austro Control) of creating awareness, adaptive and confident controllers and technical staff.
5. If reduced services continue beyond three months – refresher training to be reconsidered. A qualitative analysis of the skills that are actually fading via a targeted questionnaire, task analyses and human-machine interaction data analysis will allow the operation to establish exactly what skills are fading for each centre and then target those skills. This will become a worthwhile (safety mitigation) endeavour for reduced service going beyond six months.

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Reference list can be provided upon request.

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