



# Selected Safety Issues for Staffing ATC Operations

European Air Traffic Management (EATM)





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# EXECUTIVE SUMMARY

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This booklet provides a summary from the 'Study Report on Selected Safety Issues for Staffing ATC Operations' DAP/SSH+2006 (140).

The lessons learned from the fatal accidents that occurred in the beginning of the century highlighted concerns and issues related to staffing in Air Traffic Control (ATC) units, i.e. Single Person Operations (SPO), staffing during all operations, and position handover. In the Strategic Safety Action Plan (SSAP) developed by EUROCONTROL as a response to the Linate and Überlingen accidents, a specific work package was identified to address issues on adequate levels of staffing, which has led to this study on selected safety issues for staffing ATC Operations. The referred work package has been approved by the Provisional Council to be continued and fully delivered under the European Safety Programme for Air Traffic Management (ATM) under its Activity Field 5, 'Safety Management Enhancement'.

The purpose of this study was to review practices and trends for the staffing in ATC Operations that focused on the following safety critical issues:

- 1) Staffing in degraded systems operations.
- 2) Staffing during workload extremes.
- 3) Staffing during night work.
- 4) Single Person Operations (SPO).
- 5) Position handover.
- 6) On-the-Job Training (OJT).

The aim when addressing these safety critical issues was to obtain a description of the potential hazards and their appropriate prevention and mitigation strategies. The study focuses on staff working in current operations (e.g. Air Traffic Controllers (ATCOs), supervisors, On-the-Job Training Instructors (OJTIs), flight data, and in general ATM staff occupying an operational position in the Ops room). Excluded are engineers and technicians who interact with live operational equipment. Although it was acknowledged that these categories are important, their inclusion was considered outside the scope of this study. The staffing issues were investigated in the ATM domain as well as related industries.

# 1. INTRODUCTION

## STAFFING CONCEPT

Staffing in ATM is defined as resourcing ATC Operations with competent (see 'EUROCONTROL Safety Regulatory Requirement 5 - ESARR 5' [2002]) staff at all required operational positions to provide a safe, orderly and expeditious flow of traffic within the capacity declared by the Air Traffic Service (ATS) unit, including periods of known or unknown workload extremes and/or degraded system operations. This implies the following requirements of the staff involved:

- to have an appropriate mix of experience,
- to be fit for duty,
- to be legally qualified,
- to be motivated (see 'ESARR 3' - EUROCONTROL, 20003).

*Note: Safe staffing may simply be to staff all operational positions required to be open at any one time. Whereas, unsafe staffing is when not all operational positions are staffed to the right level when required.*

Factors that impact staffing are summarised in Figure 1.

The overall hazards associated with staffing in ATM are:

- **Over- and under-staffing:** Not enough staff to handle properly the traffic, leading to safety occurrences including accidents. Over-staffing may lead to boredom and hence distraction. Also staff may be needed for other tasks.
- **Traffic variation:** High-traffic volume may fall into periods when humans are not at their biological peaks. This is influenced by factors such as length of duty and when the peak volume occurs in regard to circadian rhythm.
- **Competency/recency:** Competency to open required sectors or to combine certain sectors and recency for controllers, in particular part-time controllers.
- **Lack of redundancy due to Single Person Operations (SPO):** Lack of available redundancy for normal and degraded operations.
- **Teamwork:** The quality and efficiency in the different mix of positions, right mix of people and coordination between sectors including the extent of cooperation and assistance available and provided within the team.
- **Overconfidence:** Controllers 'can do' mentality i.e. the mentality to do the job whatever the circumstances.
- **Fit for duty:** (fatigue, drugs, alcohol, medical). Awareness of fitness for duty state. Balancing personal and professional life and scheduling free time.
- **Health:** The impact of working shift overtime and the nature of the job on the individual.

- **Loss of job satisfaction:** caused by over- or under-staffing, dropping traffic, rosters or management and social issues.

These hazards may vary depending on the different configurations of operational positions (number of working positions required), type of traffic, pattern of traffic, Letter of Agreements (LoAs) and local procedures. The overall outcome could be the same but it is apportioned on different causes depending on en-route, approach, and tower environments.

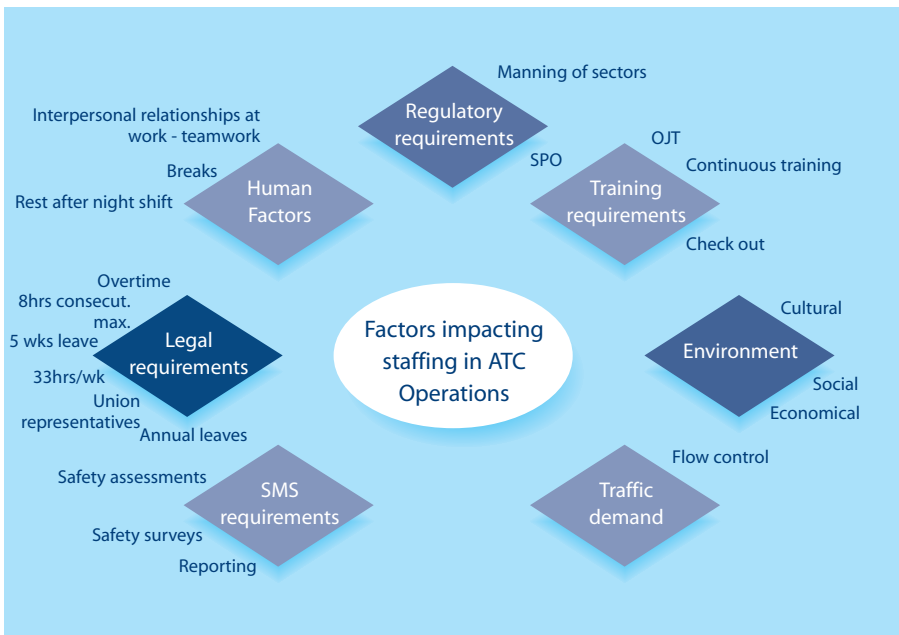


Figure 1: Factors impacting staffing

# 2. DEGRADED SYSTEM OPERATIONS

## 2.1 INTRODUCTION

The conditions that operational staff face can be considered as either within or outside the limits of what constitutes 'normal operating conditions'. Conditions 'outside' these limits can be classified as degraded system operations.

Degraded system operations include both:

- predictable conditions: outside normal operating conditions, e.g. routine maintenance and identified degraded modes of operation for which a contingency plan is foreseen.
- unpredictable conditions: e.g. system malfunctions for which there is no contingency plan.

## 2.2 HAZARDS

- **Staff awareness and preparedness:** Staff might be unaware of and unprepared for degraded operations both under predictable and unpredictable conditions. The impact is that supervisors and controllers' workload, particularly cognitive workload, may be affected.
- **Staff understanding:** Staff may not understand the technical implications of the system degradation, which may involve possible unknown scenarios. For example, it might be difficult to remember how to work with the fall-back system.
- **Suitably qualified staff:** The right number and mix of staff to work the positions may not be available.
- **System opacity:** System alerts are inadequate. A challenge for individual(s) to become aware of the level of degraded mode of the system.

## 2.3 PREVENTION AND MITIGATION STRATEGIES

### PEOPLE

- **Backup staff available:** Adequate access to operational and technical backup staff.
- **Cyclical refresher training:** Training (including simulator training) for operational staff on understanding the impact of and response required in all types of degraded modes.
- **Holistic risk assessment:** Planning for predictable degraded mode should include risk assessment on a holistic basis rather than separate assessments of fragmented areas.
- **Culture of empowerment:** Develop a culture of empowerment to deal with issues not covered in checklists and contingency plan. Clarify roles of all operational staff for these situations. Consider assigning operational command authority to a position/person where appropriate.



### EQUIPMENT (INCLUDING TOOLS)

- **Standardise system components:** The system components (i.e. same interface, functionality) should be available at all operational positions.
- **Contingency plan and checklist:** A contingency plan and checklist for operational staff on degraded modes should be available at operational positions. A contingency plan should make provision for supervisory intervention, especially during planned degraded modes. If no supervisor is available, procedures should exist in the contingency plan to support the controller.

### PROCEDURES

- **Checklists:** Use the checklists to implement the contingency plan.
- **Coordination between departments:** Clear procedures on coordination and communication between the relevant departments (e.g. operations and engineering) during degraded modes (planned or unplanned).
- **Managing capacity:** Adapt capacity to match actual staff levels and degraded mode(s).
- **System safety assessment methodology:** Use safety assessment methodology such as extensive system assessment/testing prior to commissioning new software versions.
- **Adjacent units:** Notify adjacent units of major planned degraded modes. Consider involving adjacent units in the contingency plans to manage the risks associated with degraded modes (planned or unplanned).

# 3. WORKLOAD EXTREMES

## 3.1 INTRODUCTION

Controller's workload in this context refers to cognitive workload. It is generally agreed that controller's workload is a subjective and individual response by a controller to given task load situation, and that either personal factors (e.g. skill, experience, stress) or contextual factors (e.g. time pressure, noise, stressors, distraction, organisational change issues) can all influence workload.

The greatest staffing challenge during workload extremes (that is in high/low-workload situations) is matching available workforce to the current traffic level. A mismatch between the two can impact controller fatigue, and perhaps even jeopardise safety. However, it is clear that the high-workload situation is not the only one for concern; low-traffic periods carry their own risks (e.g. reduced vigilance and therefore possible failure to notice critical events).

## 3.2 HAZARDS

- **Demand exceeds expectation:** This will only be an issue in situations where the controller/unit is working at capacity. Sustained excess demands may require greater intervention.
- **Suitably qualified staff:** The right number and mix of staff to work the positions now required may not be available.
- **In-flight emergency:** An in-flight emergency will increase the workload (cognitive and physical) of both the individual and the unit.
- **Workload:** Extended low workload impacts on an individual's arousal states (see Section 8).'
- **Fatigue:** Fatigue from continuously working at one's cognitive limits.

## 3.3 PREVENTION AND MITIGATION STRATEGIES

### PEOPLE

- **Procedure design strategies exhausted:** Whenever the procedure design strategies are exhausted then strategies to match the workforce with workload extremes are needed, e.g. increase operational positions and/or decrease traffic.
- **Active operational supervision:** Supervisors should manage staff based on individual and/or team performance limits at a given moment in time, taking into account time on position, duration of shift, and workload context.
- **Supervisor should manage the time leakage:** There should be enough ATCOs to cover the peak and a shift schedule should be built which prevents staff surplus when the peak is over (managing time leakage). Supervisor should be aware of other resources that are available to call in at short notice. Supervisor should manage his/her operational staff to the minimum required and



should be aware of staff on additional tasks which can be tasked in the Ops room if need be.

- **Staffing level:** Define minimum staffing levels and observe them.
- **Stand-by staff:** Staff on stand-by should be within easy reach of a unit.
- **OJT training:** Supervisor should consult the OJTI to decide how much OJT (if any) should take place when there is peak workload (see Section 7).
- **Environment:** Minimise or eliminate environmental distractions during peak workload.
- **Refresher training:** Training should include simulations at a higher level of traffic i.e. 120% of expected peak and emergency training on in flight emergency responses for operational staff.
- **Workload:** Recognise that low workload has its own hazards. Consider approving extra curricula activity to manage this situation.
- **Fatigue management:** Monitor against ATCO fatigue.

#### EQUIPMENT (TOOLS)

- **Traffic prediction tools:** Appropriate traffic prediction tools should be available - in particular for tactical workload management.
- **Actual workload measurement tool:** Appropriate actual workload measurement tool for supervisors should be available.
- **Support tools:** Consider introducing support tools to improve vigilance during low workload e.g. system alarms.

#### PROCEDURES

- **During the peaks:** Traffic levels should be timely managed and coordinated with relevant stakeholders.
- **Traffic prediction tools:** Make use of appropriate traffic prediction tools.
- **Monitoring workload and performance limits:** Supervisors should monitor the workload and performance limits for all staff in their area of responsibility, and take appropriate action as necessary.
- **Procedures:** Management should review recurring peaks in terms of impact on existing LoAs and procedures.

# 4. NIGHT WORK

## 4.1 INTRODUCTION

“It is common knowledge that work efficiency during the night is not the same as during the day” (as cited in van den Heuvel, Fletcher, Paradowski, and Dawson, 2003, p. 8). There are several staffing aspects related to night work. Traffic levels differ during the night. Staff have biological challenges concerning performance and vigilance. Night work, from a staffing perspective, is usually part of a shiftwork system where staff have to rotate through shifts including night shifts in order to meet the task demand. For further information regarding the effects of shiftwork during night work see EURO-CONTROL, 2004a.

## 4.2 HAZARDS

- **Suitably qualified staff:** The right number and mix of staff to work the positions now required may not be available. Smaller pool of staff to select from (controllers who may not work at night, controllers not fully rated, etc.) Lack of competency / recency to handle situations that occur at night and infrequently.
- **Traffic levels:** Low-traffic levels can lead to reduced vigilance, i.e. loss of concentration and risk of not reacting (in time). High-traffic levels may lead to stress.
- **Tiredness:** Tiredness, especially during early morning build-up.
- **Fatigue:** Fatigue may induce loss of situational awareness that may lead to safety occurrences.
- **Night shift paralysis:** A temporary but incapacitating paralysis known as ‘night-shift paralysis’ appears to be a special form of sleep paralysis that occurs when night workers manage to maintain a state of wakefulness despite considerable pressures to sleep.
- **Staff efficiency measures:** Reduced staff due to costs.
- **Ergonomic factors:** Reduced levels of illumination and environmental noise i.e. lights/sound.

## 4.3 PREVENTION AND MITIGATION STRATEGIES

### PEOPLE

- **Roster design:** Roster design should reflect fatigue risk management principles.
- **Risk mitigation:** Utilise risk mitigation process for staff replacement and staff management.
- **Education:** Educate individuals (including during refresher training) creating awareness of health and lifestyle issues.
- **Rest facilities and napping:** Make use of rest facilities including for strategic naps. Various studies have also demonstrated that napping might improve objective performance and alertness,



and decrease feelings of sleepiness. It is recommended to authorise and encourage napping as a strategy to reduce fatigue-related problems. It should however be noted that performance might also be degraded in the period immediately after waking up (i.e. 'sleep inertia'). 'Immediate' is relative, in that this can last from a few minutes to several hours. In addition, the successfulness of napping is largely dependent on individual factors (e.g. factors like motivation, age, and also the roster itself). Findings indicate that a ten-minute nap does not involve sleep inertia effects (van den Heuvel et al., 2003). In general, however, the research findings regarding naps and sleep inertia are somewhat contradictory and limited, and it can be concluded that napping appears to be a useful strategy, but this issue is complex and requires more research to determine appropriate napping strategies for various circumstances.

### EQUIPMENT (TOOLS)

- **Rest facilities:** Provide rest facilities.
- **Water dispensers:** Provide water dispensers in or near Ops room.
- **Support tools:** Consider introducing support tools to improve vigilance during night work e.g. system alarms.

### PROCEDURES

- **Managing rest facilities:** Develop processes for managing the use of rest facilities including for strategic naps.
- **Ops room environment:** Provide a mentally stimulating environment for night shift - stimulating sound/light activities.
- **Supervisor absence:** In the absence of a supervisor, supervisor type duties during night shift should be allocated.
- **Breaks:** The management of breaks should include break frequency, length and rotation considerations. To maintain vigilance and alertness, research recommends incorporating frequent breaks. (However, refer also to handover/takeover issues where frequency is discouraged.) (van de Heuvel et al., 2003).
- **Staff/capacity management:** Supervisor should collapse and de-collapse sectors in response to unexpected demand (lower or higher). Supervisor should also call in additional staff if required (e.g. in response to negative weather forecast or unscheduled demand). Collapsed sectors should be co-located wherever possible.

# 5. SINGLE PERSON OPERATIONS

## 5.1 INTRODUCTION

In the context of this study, it is recognised that there are two types of Single Person Operations (SPO) in ATM:

- position staffed by a single person (sector operated by one person),
- an Ops room staffed by a single person, for a given laps of time during a 24-hour period.

SPO can either be planned (design conditions) or unplanned (it is considered an unmitigated hazard). This report does not advocate SPO and only aims to summarise hazards and prevention/mitigation associated with SPO should they exist. However, it is recommended that a detailed risk/safety assessment is carried out prior to deciding on the implementation of SPO.

## 5.2 HAZARDS

### POSITION STAFFED BY A SINGLE PERSON

- **Task load:** Task load too high, which leads to having to perform concurrent tasks.
- **Distraction:** Unexpected occurrences may distract ATCO's attention.
- **Lack of redundancy:** Staff incapacitation in case of workplace incidents/accidents, illness, toilet relief. Operational imperative of the replacement of staff involved in aviation incident/accident.
- **Threats and errors:** Non-detection of threats and non-recognition of an error.
- **Team interaction:** Decreased team interaction, which means that passing on wisdom is reduced - degrading collective wisdom and potentially affecting competency in the long term.

### OPS ROOM STAFFED BY A SINGLE PERSON

- **Task load:** Task load too high, which leads to having to perform concurrent tasks.
- **Distraction:** Unexpected occurrences may distract ATCO's attention.
- **Lack of redundancy:** Staff incapacitation from workplace incidents/accidents, illness, and toilet relief. Operational imperative to replace staff involved in aviation incident/accident.
- **Fatigue:** Individual fatigue is not detected.
- **Fitness for duty:** Individual fitness for duty is not detected.
- **Threats and errors:** Non-detection of threat and non-recognition of an error.
- **Competency:** Unnoticed proficiency / competency degradation.
- **Team interaction:** Lack of transfer of wisdom (loss of mentoring capability), degrade collective wisdom due to less team interaction. Nobody to check up with.



### 5.3 PREVENTION AND MITIGATION STRATEGIES

It is considered that the prevention and mitigation strategies are applicable to both SPO situations (position staffed by a single person and an Ops room staffed by a single person). For prevention and mitigation strategies related to the people category a distinction is made between for planned (design conditions) or unplanned (it is considered an unmitigated hazard) SPO.

#### PEOPLE

##### Planned SPO

- **Contingency plan:** Have a contingency plan should the SPO staff member become unavailable at short notice.
- **Competence assessment:** Regular competence assessment and stringent recency requirements.
- **Training:** SPO performed in simulated training environment.
- **Fatigue factors:** Train operational staff to be aware of fatigue issues.

##### Unplanned SPO

- **Response:** Appropriate measurements should be taken to alleviate the SPO situation as soon as possible.
- **Contingency plan:** Have a contingency plan, should the remaining ATCO become unavailable at short notice.
- **Training:** SPO performed in simulated training environment.

##### Equipment (tools)

- **SPO concept and system design:** Appropriate system design should be in place.
- **Equipment:** Standardised functionality of the equipment.

#### PROCEDURES

- **Risk management approach:** Risk management approach to developing standardised procedures for SPO. Equally, within the unit safety case, contingency plans should be developed for planned and unplanned SPO. Traffic levels are a key element to include in this risk assessment.
- **Standardised procedures:** Standardised procedures throughout all sectors.
- **Operational supervision concept:** Operational supervision concept that supports SPO.
- **Just culture:** A legal and corporate framework should be adopted that supports a just culture for incident reporting. This is particularly important for Ops room staffed by a single person as there is little understanding of the rationale to report and follow up on occurrences to ensure lesson learned<sup>6</sup>.



Prior to making a decision to introduce SPO, a risk assessment should be undertaken to validate the decision (see ESARR 4 - EUROCONTROL, 2001). Equally, within the unit safety case, contingency plans should be developed for unplanned SPO.

# 6. POSITION HANDOVER

## 6.1 INTRODUCTION

“... just because I have told someone, they may still not know what I know” (Cumming & Bradbury, 2003, p. 3). Position handover can be defined as “the accurate reliable communication of task-relevant information across shift changes, thereby ensuring continuity of safe and effective working” (Lardner, 1996, p. 3), or as “the requirements needed for the safe transfer of the understanding of the operational situation from one team/person to another team/person”. In ATC, shift handover can be triggered for instance by the end of a given controller’s shift, or by ‘bandboxing’ (in which sectors are combined for operational reasons). Controllers generally spend a fair amount of time (out of regulation as well as necessity) on the process of handing over to ensure that the incoming controller has an adequate overview not only of the traffic situation but also the control strategies of the outgoing controller.

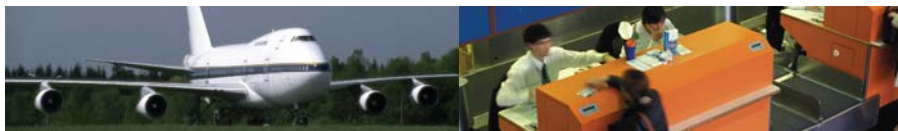
## 6.2 HAZARDS

- **Information exchange:** Inadequate exchange of information being passed to the new shift, e.g. incorrect assumptions/expectations.
- **Reliability of information:** Information is distorted during successive handovers. For example, different teams may interpret/apply certain procedures in a different way.
- **Disregard for procedures:** Not following the checklist or procedures.
- **Checklist complacency:** Omitting items on checklist when using checklists routinely.
- **Distraction:** Errors are introduced; vigilance is compromised.
- **Simultaneous handovers same sector:** Everybody on the same sector hands over to someone else at the same time. The result is that everyone is new on the sector.
- **Simultaneous handovers several sectors:** Staff working on several sectors hands over to other staff at the same time. The result is that everyone is new on a number of sectors.

## 6.3 PREVENTION AND MITIGATION STRATEGIES

### PEOPLE

- **Handover time:** Allow sufficient time for handover.
- **Training:** Handover should be practised during all phases of training including refresher training.
- **Roster design:** Time for position handover should be built into the roster.
- **Availability and preparedness:** Operational staff should make themselves available and prepare for the takeover (e.g. familiarisation with new procedures, environment, weather, expected



demand, work plans, etc.) prior to approaching the operational position.

- **Workload and information transfer:** Where available supervisor should be responsible for determining timing. All handover/takeovers should be conducted at a time when doing so will not compromise the information transfer (i.e. during demand troughs). Supervisor may monitor transfers in complex situations.
- **Staff assessment:** Operational staff assessment should include handover process on a regular basis.

### EQUIPMENT (TOOLS)

- **Checklist(s):** Checklist(s) should be available at all operational positions.
- **Handover form / briefing note:** Standardised handover form should be available to describe critical information e.g. weather, facilities, staffing, and equipment status.
- **Reminders:** Consider introducing support tools to provide reminders to the controllers (e.g. bleep).

### PROCEDURES

- **Follow checklist:** As a routine task, operational staff should follow the checklist. A 'uniform' way of working for all members having the same endorsement which should reduce the problems where teams have distinctly different ways of working.
- **Handover form:** The handover form should be completed.
- **Signing off/in procedure:** Signing off and signing in procedure should be in use to acknowledge that everything is done.
- **Adjacent operational positions:** Avoid simultaneous handover of adjacent operational positions.
- **Number of handovers:** Where possible minimise the number of handovers (need to compromise between need for regular breaks and need to minimise hazardous activity like a handover/takeover).
- **Sector opening:** Minimise the number of handovers before/after sector opening (e.g. when sectors are collapsed or de-collapsed). All handovers/takeovers should be conducted at a time when doing so will not compromise the information transfer.

# 7. ON-THE-JOB TRAINING

## 7.1 INTRODUCTION

On-the-Job Training (OJT) is defined as the integration in practice of previously acquired job-related routines and skills under the supervision of a qualified On-the-Job Instructor (OJTI) in a live traffic situation (ESARR3).

OJT has long been recognised as critical in the training of an ATCO and of a major consequence in his/her overall formation. The EUROCONTROL deliverable 'Air Traffic Controller training at Operational Units' (1999) provides recommendations and guidelines for the organisation and conduct of ATCO Unit training. It proposes the introduction of a structured approach to Unit training with a transition phase (after basic institutional training), a pre-OJT phase, using global and analytical simulations and the OJT phase where the emphasis is on student coaching. This section deals with the OJT-related staffing issues.

## 7.2 Hazards

- **OJTI judgement:** OJTI misjudges when to take or hand over control.
- **Vigilance and distraction:** Missing critical events because the OJTI is not actively participating in what is going on and OJTI assumes that the trainee is more skilled than he/she really is or OJTI is distracted by an event.
- **Mental fatigue:** The mental workload to maintain situational awareness and check on the student/trainee's situational awareness is high and may lead to fatigue when no or little intervention from the OJTI is required.
- **OJTI's coaching competence:** Trainee training is inadequate or incomplete.
- **Number of trainees in the Ops room:** The system is potentially exposed to more errors because there are too many trainees at the same time in the Ops room.
- **Number of trainees in the system:** Active controller proficiency declines because too many trainees in the system are taking available console time.
- **Simulator training:** Trainee arrives in the live environment not yet ready for the live environment due to insufficient or lack of simulator training. Potentially too many issues for the OJTI to deal with.
- **Simulator versus real operation:** An unmanaged mismatch between the simulator exercise timing and the time on the position in the real operation. Trainees lose their concentration after the same duration they are used to in the simulator.
- **Change of instructors:** Trainee has become programmed to what his/her previous OJTI expected. New OJTI has different expectations especially during a shift. Handover issue (both the posi-



tion and the trainee's status).

- **Roster plans:** Not enough time is rostered to allow OJTI and student/trainee to brief for duty and debrief the sessions. This leads to insufficient preparation and distractions during the end of shift when debriefings are conducted on the shift. Also the staffing/roster may be planned such that the OJTI and trainee 'cover' two operational positions.

## 7.3 PREVENTION AND MITIGATION STRATEGIES

### PEOPLE

- **Ratio OJTI to student:** As far as practicable, have a single OJTI or a small group of OJTIs allocated to a student (from the pedagogical and organisational point of view).
- **Number of OJT sessions in Ops room:** Restrict number of OJT sessions in Ops room at any one time to avoid trainees in adjacent positions.
- **Number of OJT students/trainees in the system:** Restrict total number of OJT students/trainees in the system at any one time.
- **OJTI training:** OJTI training should include extensive training in 'active monitoring', awareness of distraction issues and in the art of intervention.
- **Trainee's proficiency level:** All trainees should reach a required proficiency level prior to plugging into a 'live' position.
- **Training issues:** Some training issues identified in the live environment should be resolved off-line e.g. in simulator environment.
- **Supervisor:** Where possible a supervisor should be available during OJT to manage the environment.
- **OJTI change:** Avoid changing OJTI during the OJT session.
- **Duration of OJT session:** The OJT trainee/student should be exposed progressively to training sessions of a duration similar to session lengths expected in the live environment. This should also be controlled from the OJTI's viewpoint as it is hard to maintain concentration and situational awareness while observing a trainee, especially for a prolonged amount of time.
- **Roster planning:** It should be clearly stated that OJTI is responsible only for the trainee and his/her performance and should be planned in roster to work on the same single position as a trainee.

### EQUIPMENT (TOOLS)

- **Pre-OJT or unit training simulator:** Organisations should attempt to utilise the highest fidelity simulator available.
- **Position ergonomics:** Ergonomics of the position should be such that it allows the instructor to

easily observe all aspects of the position. Appropriate tools should be readily available for the OJTI to enable him/her to intervene rapidly.

- **Checklist and progress list:** A checklist and progress list for communication between OJTIs about trainees.

## PROCEDURES

- **Standardised checklist and progress lists:** Ensure that OJTIs use standardised checklist and progress lists.
- **OJTI training:** ESARR5.2.1.8 states that before granting an air traffic controller authorisation to provide operational training as an OJT instructor, ensure that the applicant has:
  - a minimum of two years experience in the rating discipline in which he/she will instruct;
  - a minimum of six months experience in the rating on the specific sector or operational position on which the instruction will be given;
  - completed an appropriate OJTI course and passed any associated assessments required.
- **Assessment of OJTI's competence:** Ensure regular assessment of OJTI's competence in the instructing role (see EU ATCO Licensing Directive 26/2006 Article 118).
- **OJT sessions:** Avoid ad hoc OJT, i.e. OJT should be formalised, planned, structured, and integrated with employee orientation (see ESARR 5).
- **Roster plans:** Provide an operational roster allowing OJT to give adequate briefing and debriefing times to OJTI and student/trainee.
- **Review of OJT programme:** Regular review of OJT programmes to ensure adequacy and relevance.

# 8. INTERACTION BETWEEN THE 6 ISSUES

## 8.1 INTRODUCTION

When describing the ATC operational work situation in terms of different working/environmental modes, two dimensions appear:

- high-workload versus low-workload situations,
- normal versus degraded operating conditions.

Staffing during workload extremes and staffing in degraded systems operations, under either nominal (e.g. routine maintenance) or non-nominal (malfunction) conditions, can be considered as implicit in the two dimensions above, and thus serve as a framework to consider the remaining topics, i.e. SPO, night work, position handover, and OJT. Each of these four topics was explored in relation to how they are affected by high/low workload (e.g. sector complexity) in combination with normal/degraded working conditions.



## 8.2 RECOMMENDATIONS WHEN CONSIDERING NIGHT WORK, SPO, HANDOVER, AND OJT IN DIFFERENT OPERATING CONDITIONS

### NIGHT WORK

#### NORMAL OPERATING CONDITIONS + HIGH WORKLOAD

- Consider traffic flow management or other filtering techniques (e.g. re-routing to an adjacent sector).
- Consider calling in additional staff.

#### DEGRADED OPERATING CONDITIONS + HIGH WORKLOAD

- Supervisors should be on duty.
- Consider traffic flow management or other filtering techniques (e.g. re-routing to an adjacent sector).
- Consider calling in additional staff.

#### NORMAL OPERATING CONDITIONS + LOW WORKLOAD

- Consider collapsing positions where possible.
- Allowing breaks.
- Consider approving extra curricula activity
- Consider allowing napping.

#### DEGRADED OPERATING CONDITIONS + LOW WORKLOAD

- In planned degraded situations supervisors should be on duty e.g. to manage impact of work plans. If no supervisor is on available, procedures should exist in the contingency plans to support the controller.
- Consider calling in additional staff if required.
- Roster for planned degraded situations.

## SPO

### NORMAL OPERATING CONDITIONS + HIGH WORKLOAD

#### Common recommendations for SPO Position/Ops Room

- Consider traffic flow management or other filtering techniques (e.g. re-routing to an adjacent sector).
- Should workload increase unexpectedly and uncontrollably, backup staff should be available on call-in within reasonable time limits to ensure the safe continuation of service.

#### Additional recommendations for SPO Ops room

- In the case of an aircraft emergency or any other incident/accident it is unlikely that staff could be called in quickly enough to assist in the increased workload. Procedures subject to risk management approach. Staff should be trained on these procedures.

### DEGRADED OPERATING CONDITIONS + HIGH WORKLOAD

#### Common recommendations for SPO Position/Ops room

- Consider traffic flow management or other filtering techniques (e.g. re-routing to an adjacent sector).
- Guidance procedure on managing the most critical issues - such situations should be simulated during refresher/emergency situations.
- Crisis management plans and procedures should be developed and be put in place to support the single controller

#### Additional recommendations for SPO position

- Managed by staff management including re-assignment of duties (combining /de-combining positions, calling in additional staff). If unable to do either, supervisor may provide support services.

### NORMAL OPERATING CONDITIONS + LOW WORKLOAD

#### Common recommendations for SPO Position/Ops room

- Consider introducing support tools to improve vigilance.
- Consider approving extra curricula activity to manage the situation.

#### Additional recommendations for SPO position

- Consider bandboxing the position if operationally feasible

### DEGRADED OPERATING CONDITIONS + LOW WORKLOAD

#### Common recommendations for SPO Position/Ops Room

- Procedures should be in place to support the operational staff and this procedure should be subject to a risk management approach.
- Guidance procedure on managing the most critical issues - such situations should be simulated during refresher/emergency situations.

#### Additional recommendations for SPO position

- Supervisor should consider using this opportunity to provide mentoring support.



## HANDOVER

### NORMAL OPERATING CONDITIONS + HIGH WORKLOAD

- All handovers/takeovers should be conducted at a time when doing so will not compromise the information transfer (i.e. during demand troughs).
- Consider monitoring the handover/takeover.
- The length of the handover/takeover will also vary and should take the time required (not necessarily the rostered time).
- Consider requiring the handing-over controller to remain to answer any queries and verify handover.
- Train handover situations

### DEGRADED OPERATING CONDITIONS + HIGH WORKLOAD

- Consider requiring the handing-over controller to remain to answer any queries and verify handover.
- Handover/takeover should not be done during an emergency or degraded situation (may wish to make a controller swap because of performance management issues). In the case of critical incidents - CISM procedures maybe recommended.
- All handovers/takeovers should be conducted at a time when doing so will not compromise the information transfer (i.e. during demand troughs).
- Consider monitoring the handover/takeover.
- The handover/takeover should take the time required.

### NORMAL OPERATING CONDITIONS + LOW WORKLOAD

- Where possible minimise the number of handovers.
- Avoid unnecessary handovers, e.g. smoking breaks.

### DEGRADED OPERATING CONDITIONS + LOW WORKLOAD

- Handover/takeover of a position should not be done during an emergency or degraded situation until the emergency or degraded situation is stabilised. However, the supervisor may wish to make a controller swap because of performance management issues. In the case of critical incidents - CISM procedures may be recommended.



## OJT

### NORMAL OPERATING CONDITIONS + HIGH WORKLOAD

- The OJTI's assessment of the trainee and his/her own capability should determine whether or not to allow the trainee to continue in the service delivery role under the supervision of the OJTI.
- A supervisor may remove a trainee from active control in deference to the circumstance. At no time should a supervisor insist that the trainee needs to stay in position under supervision (this is only at the decision of the OJTI).
- Use simulator to get trainee to a minimum standard prior to training commencing in the operational environment, and use simulator to provide trainee with workload that approaches (or exceeds) the live environment.
- Build up student's capability in the operational environment by following a unit training plan.

### DEGRADED OPERATING CONDITIONS + HIGH WORKLOAD

- The OJTI's assessment of the trainee and his/her own capability should determine whether or not to allow the trainee to continue in the service delivery role under the supervision of the OJTI.
- A supervisor may remove a trainee from active control in deference to the circumstance. At no time should a supervisor insist that the trainee needs to stay in position under supervision (this is only at the decision of the OJTI).
- Use simulator to get trainee to a minimum standard prior to training commencing in the operational environment, and use simulator to provide trainee with workload that approaches (or exceeds) the live environment.
- Run a contingency training session for all students and OJTI in simulators.

### NORMAL OPERATING CONDITIONS + LOW WORKLOAD

- It is not always possible to combine positions because the trainee is not receiving training in all positions at once. This may lead to additional staffing requirements during low-workload situations.
- Low workload provides opportunities for the OJTI to use the time in the position for teaching purposes, which helps maintain arousal for both participants.
- Positions combined wherever possible to ensure that the trainee is properly challenged and maintains concentration.

### DEGRADED OPERATING CONDITIONS + LOW WORKLOAD

- Whether or not trainee is permitted to continue working under supervision will depend on the competence achieved to date and the degree of abnormality. This assessment is usually made by the OJTI but may include advice from the supervisor if one is present.

# 9. CONCLUSIONS

## 9.1 CONCLUSIONS

The purpose of this report was to highlight a range of hazards and prevention and mitigation strategies relevant to the selected six topics for staffing an ATC Operations. The study served to identify information to derive practical material, for instance:

- checklists,
- training and awareness material for controllers,
- safety risk assessment material.

The information provided is not exhaustive or prescriptive. The information in the report can be used, where appropriate, as a checklist for supervisors, and safety managers in ANSPs, and adapted to the context of the local environment.

ANSPs are invited to:

- assess their own practices related to the findings of the report and update these where appropriate.
- share their best practices in the framework of Safety Improvement Sub-Group (SISG). This will serve to improve further enhancements of cumulative sharing knowledge at EUROCONTROL organisation level. This exchange of information should be reflected in work of SISG and developed products and processes
- use the content of the report in training for supervisors, controllers and safety personnel. It is considered that the work produced in this report is valuable to supervisors, safety assessors, and roster designers. Therefore, the contents of the report may be adapted locally and generated into suitable communication and awareness material.

# ABBREVIATIONS AND ACRONYMS

<b>ANS:</b>	Air Navigation Services
<b>ANSP:</b>	Air Navigation Service Provider
<b>ATC:</b>	Air Traffic Control
<b>ATM:</b>	Air Traffic Management
<b>ATMO:</b>	Air Traffic Management Organisation
<b>ATS:</b>	Air Traffic Services
<b>CAA:</b>	Civil Aviation Authority/Administration
<b>CISM:</b>	Critical Incident Stress Management
<b>DAP/SSH:</b>	Directorate ATM Programmes, Safety, Security and Human Factors Division (EUROCONTROL Headquarters, formerly split in two divisions: DAP/SAF and DAS/HUM)
<b>EATM:</b>	European Air Traffic Management
<b>EUROCONTROL:</b>	European Organisation for the Safety of Air Navigation
<b>ESARR:</b>	EUROCONTROL Safety Regulatory Requirement (SRC)
<b>IANAS:</b>	Institute of Air Navigation Services (EUROCONTROL, Luxembourg)
<b>ICAO:</b>	International Civil Aviation Organisation
<b>IFATCA:</b>	International Federation of Air Traffic Controllers' Associations
<b>LFV:</b>	Luffartsverket (Swedish CAA)
<b>LoA:</b>	Letter of Agreement
<b>OJT:</b>	On-the-Job Training
<b>OJTI:</b>	On-the-Job Training Instructor
<b>Ops room:</b>	Operations room
<b>SISG:</b>	Safety Improvement Sub-Group
<b>SPO:</b>	Single Person Operations
<b>SMS:</b>	Safety Management System
<b>SRC:</b>	Safety Regulation Commission (EUROCONTROL)
<b>SSAP:</b>	(European) Strategic Safety Action Plan
<b>TCU:</b>	Terminal Control Unit







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