DE GRUYTER OPEN
RIGA TECHNICAL UNIVERSITY
*Transport and Aerospace Engineering*
ISSN 2255-9876 (online)
ISSN 2255-968X (print)
December 2016, vol. 3, pp. 80–93
doi: 10.1515/tae-2016-0010
*https://www.degruyter.com/view/j/tae*

# Aviation Crew Recovery Experiences on Outstations

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***Abstract* – ACMI flight crews spend considerable time away from home on outstations. This study suggests that this long term stay carries its own considerations in regards to rest recovery with practical implications for Fatigue Risk Management as prescribed by ICAO. Four recovery experiences, Work Detachment, Control, Relaxation and Mastery, are identified and correlated with 28 crew behaviours on base. The results indicate improvement considerations for airline management organizing a long term contract with ACMI crews, in particular to increase schedule stability to improve the crew member's sense of Control.**

***Keywords* – Aviation crew, fatigue, job demands, job resources, recovery experiences.**

## I. INTRODUCTION

### ACMI Operators and the ICAO Regulatory Framework

All airlines must work in accordance with the agreed rule sets of the International Civil Aviation Organization (ICAO) published in 19 annexes. This is the framework by which all airlines operate, further enhanced by regional regulations (e.g. the European Aviation Safety Agency) and local authority requirements (e.g. the National Civil Aviation Agency).

There is, though, an underlying assumption to the ICAO rule sets, they implicitly assume that the airline operators operate on a fairly steady schedule from a fairly limited number of destinations. Most airlines have central hubs, airports from which they operate a number of flights to destination airports before returning back to the hub. There are variations of this setup but this is the way the industry has mainly operated since its inception in the 1920s. Like bus and train routes, flights were organized according to specific market requirements and available destinations.

Those airlines that did not operate according to this fairly rigid system sometimes found themselves at odds with regulations that did not account for a different business model. ACMI operators are airlines that provide other airlines with Aircraft, Crew, Maintenance and Insurance, hence the abbreviated name. These are business to business (B2B) operators, providing other airlines with aircraft capacity in times of shortage, e.g. if an airline has an offer to fly tourists from point A to point B but does not have any available aircraft. The airline then contacts the ACMI operator who operates the route under the name of the original airline. The aircraft may even be fully liveried in the customer colours so that the average passenger would never notice any difference.

These airlines, however, do not have the luxury of preplanning and establishing a permanent hub. The contracts are usually short term and only last a few months, maybe a few years on the outside. The crews are hired to be based on the operating base and have to spend the duration of the contract in airport hotels. Their life is not as exciting as it might sound. Turnover of crews is kept to a minimum to save costs so each crew member may have to make himself a make-shift home in the hotel.

**The Effects of Fatigue on Crew Performance**

It is hard to overstate how much of a safety risk fatigue poses to the aviation industry. Crew members suffering from fatigue exhibit a number of physical, mental and emotional symptoms, most or all of which are detrimental to the safety of the flight [1].

In order to combat this risk to aviation, ICAO has prescribed that airlines and other aviation related operators implement and rely on Fatigue Risk Management.

**Fatigue Risk Management**

ICAO's Fatigue Risk Management rules, located in ICAO Annex 6 [2], focus mainly on the responsibility of the airline to analyse their schedule so that hazardous working hours may be identified and mitigated.

However, in accordance with chapter 4.10 in ICAO Annex 6 [2], airlines are to implement a fatigue risk management system (FRMS) as prescribed by each state requirement which should be in accordance to ICAO document 9966, Fatigue Risk Management for Regulators [3]. The FRMS should be based on providing multiple redundant defences against fatigue related risks. One major component of FRMS is a focus on the production of flight crew duty schedules. They should not overly tax the crew member and unduly increase the level of fatigue [4].

The second major FRMS component is training and education for crews focusing on their own responsibility to maximise the amount of sleep obtained immediately prior to flights, identifying circumstances where the likelihood of fatigue is elevated, and managing the risks associated with fatigue related impairment [4].

If a flight duty schedule is analysed to be too taxing, it is therefore incumbent on the airline to find ways to ensure that high levels of fatigue do not take place and distribute the duties amongst more crews, thus lightening the load. As the FRMS pertains to an individual crew member, there is still the implicit assumption that the crew member gets to rest on his home base, at his home residence where he can fall back into his familiar rest routine. This does not, however, apply to ACMI crews which have to return to their airport hotel, socialize with their colleagues and be constantly surrounded with work reminders.

It can be said that the FRMS is a two-way street. While the airline is responsible to minimize the risk of fatigue in their scheduling, it is also the responsibility of the crew member to ensure that he maximizes his rest potential during his off hours. Every crew member is obligated to evaluate his fitness to fly and report himself unfit to fly if he is tired, sick or otherwise incapacitated. There is a risk though that while it is easy to identify sudden fatigue, which may appear due to emergency work hours, sudden insomnia or sickness; it may be more difficult for the crewmember to accurately assess his own fatigue if it has been slowly deteriorating over time [4].

**Accumulated Fatigue**

Most fatigue research has been conducted on the immediate fatigue, i.e. fatigue that takes place after a very taxing or prolonged duty, but there has been a shift of attention to the idea of accumulated fatigue, or fatigue that gradually builds during duty periods [1]. The intent of Fatigue Risk Management is to identify when there is a risk of accumulated fatigue, however crews on outstations face a vastly different rest environment than the one that is addressed in the ICAO rulebook.

Currently ICAO addresses accumulated fatigue by setting limits on the number of duty hours in a certain period of time, which is considered the bare minimum as a fatigue combating measure [4]. But ICAO does not make there a distinction between duty on crews on home bases and crews actually stationed long-term away from home.

ICAO also encourages fatigue reporting when a crewmember self-diagnoses himself as being too fatigued to operate. There are clear rules that no punitive actions should be taken by the airline to the crewmember, but in reality, there is a great hesitancy for crews to disrupt airline operations, which can be very costly, especially when other standby crews may not be available. Good intentions aside, there is the possibility that crews fear repercussions if they are not being supported

by strict regulatory requirements. It may be difficult to report accumulated fatigue when there are no direct and well defined scheduling causes visible in the system.

**Job Demands-Resources Model**

The job demands-resources (JD-R) model describes the interaction between job demands and job resources and how it influences the well-being of the employee [5]. The model is careful in describing that while every job is unique in the sources of employee well-being (or lack of), it is possible to classify them all in terms of struggle between job demands and job resources [5]. The medical profession, e.g. doctors and nurses, may experience a great deal of emotional demands, but other professions may experience that mental demands play a higher role in their work (e.g. air traffic controllers, computer programmers).

Job demands are described as those physical, psychological, social or organizational aspects of any job that require effort or any other psychological or physiological cost.

Job resources are more positive aspects of the job that refer to the physical, psychological, social or organizational aspects of the job that aid towards achieving work goals, reduce job demands and stimulate personal growth, learning and development. This is usually seen as adequate monetary compensation, work autonomy and sufficient support and feedback from management. Again it must be emphasized that each profession has its own unique sets of job demands and job resources.

These two factors interact via two different underlying psychological processes that have their effect on performance and well-being of the employee [5].

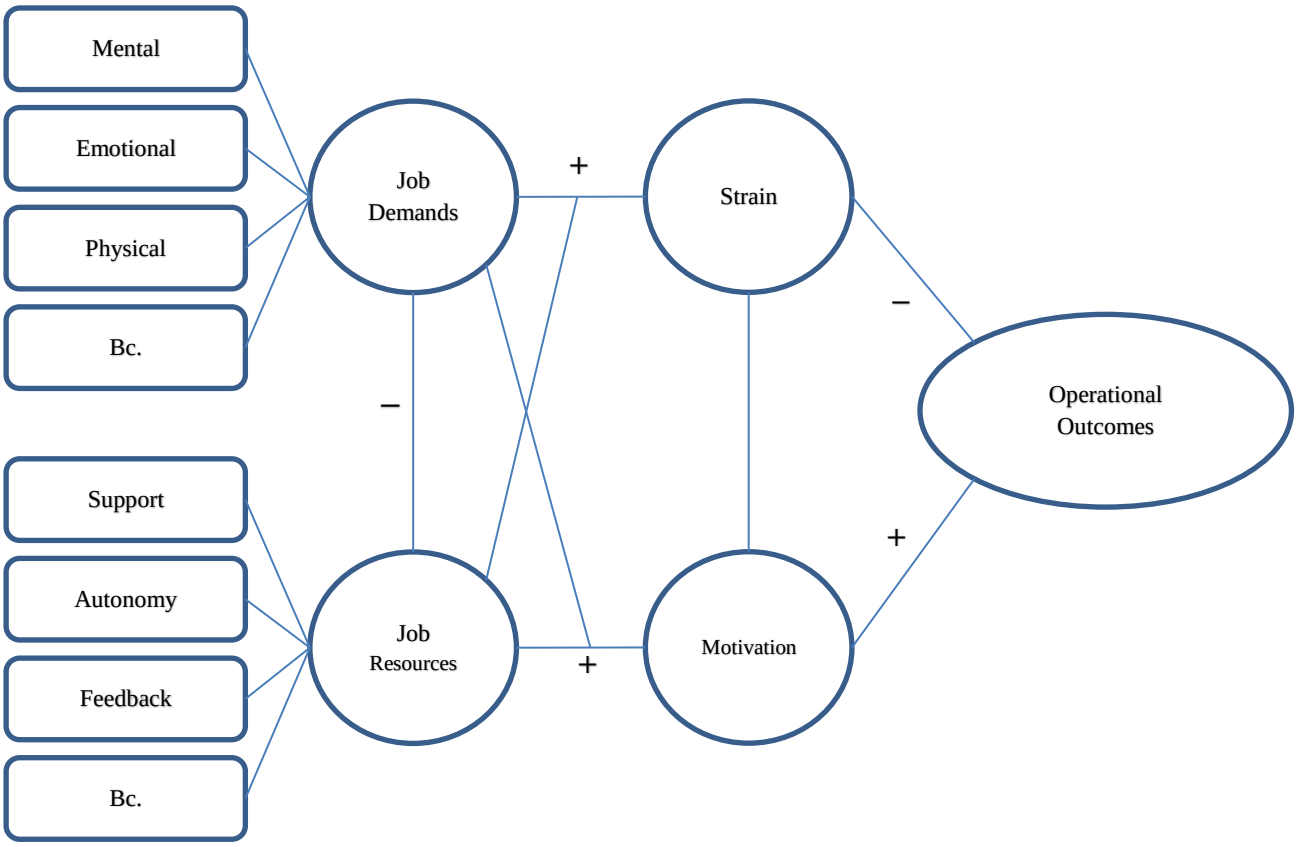


Fig. 1. Job demand/resources model.

The negative result of this interaction is called strain [5]. Strain is the process where the demands prove to be too high for the available employee resources and the cost of the task becomes so great that the employee starts performing in a degraded manner. This can be evident as compensatory costs (e.g. increased effort and constant activation), strategy adjustments (e.g. attention narrowing) and fatigue after-effects (e.g. bad decision making) [6]. If allowed to go unchecked, this can lead to an eventual breakdown for the employee [6].

The second process is motivational, stating that certain job aspects may foster employee growth and competence, i.e. autonomy at work, good managerial feedback, social support and learning opportunities [5]. If job resources remain high, after the interaction with job demands, this could lead to increased work motivation which would lead to better organizational outcomes.

Recovery refers to the process by which employees return to their normal non-work level and in which strain is reduced. It has also been defined as a process that allows individuals to replenish their resources [5].

Recovery is, though, not simply a respite from work. It is a rebuilding of resources via various factors [7]. In particular, this is important for sleep. Positive recovery experiences are expected to reduce the strain accumulated over the day and enhance sleep quality. Lack of these recovery experiences may, on the other hand, adversely affect sleep quality and sleep onset [7], something extremely important to Fatigue Management. If recovery is insufficient, this may lead to extra strain during work and lead to health issues [8]. Recovery thus acts as a buffer, either by reducing strain or by replenishing resources.

Some research has been conducted on the job demands-resources model as it relates to crew safety behaviour [9], [10]. It was found that when job demands were high, safety behaviour decreased, and if resources were perceived to be greater, safety behaviour increased [9]. Recovery plays an important role as it increases internal resources and aids them to cope with the job demands [7].

**Crew Recovery**

Benjamin Searle [11] raised the question whether airline crew members are perhaps unable to fully utilize their rest periods while staying in airport hotels, particularly if the stay is somewhat extensive. This would possibly lead to insufficient recovery and thus to fatigue in the long run. It has been shown that people that are highly immersed in their work while off duty, experience higher fatigue levels, even higher than those with great work demands [12]. Crews spending all their times at airport hotels are perhaps, by definition, always immersed in their work or work environment. This constant immersion may therefore be detrimental to the quality of their rest. This would apply double to the ACMI crews who do not return to their homes for months at a time.

The research of Sonnentag & Fritz [7] on recovery is quite relevant to this question. Sonnentag & Fritz [7] builds on the Effort-Recovery Model by Meijman & Mulder [8] and the Conservation of Resources Theory by Hobfoll [13]. Recovery would thus consist of two complementary processes:

1. to refrain from work demands and to avoid activities that call upon the same functional systems or internal resources as those required at work;
2. gaining new internal resources such as energy, self-efficacy or positive mood can help restore threatened resources.

Sonnentag & Fritz [7] have identified four mechanisms that influence recovery: detachment, mastery, relaxation and control. These mechanisms can be seen as personal mitigation strategies to restore or maintain resources and health.

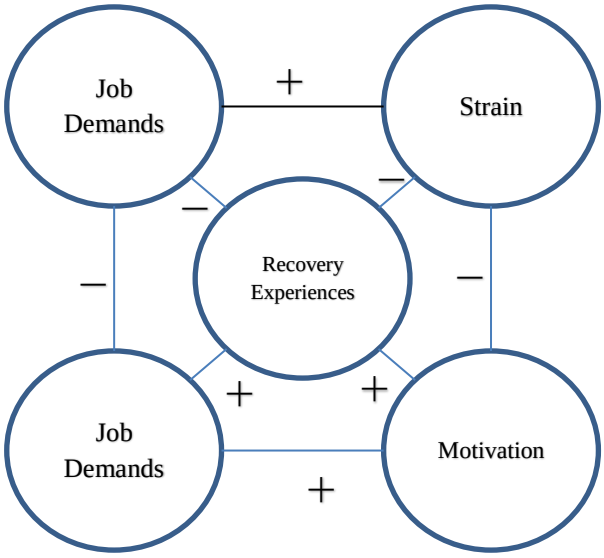


Fig. 2. Job demand/resources model with recovery experiences as mediators.

**Work Detachment** is the ability to distance yourself from the work environment, visual cues, reminders and associated thoughts. This includes phone calls, emails and any other job related activities. This goes beyond being simply removed from the work place – it means being able to switch off mentally and not to call on any resources for job related tasks. This would enable recovery to take place according to the Effort-Recovery Model [8]. If the individual keeps on thinking about his work issues, his functional systems are constantly in a state of activation and no recovery can take place. Sonnentag & Fritz [7] showed evidence that this detachment was negatively related to need for recovery, sleep problems, emotional exhaustion and health complaints.

There is also some empirical data that work detachment is related to recovery from stress, i.e. being able to not think about work reduces stress and increases the chances of rebuilding internal resources [14].

**Mastery** is the ability to engross oneself in the task of self-betterment, of mastering a task, skill or ability. It seems contradictory to talk about Mastery as a recovery aid as it can be challenging and taxing to the individual, thus there is a possibility of exhausting the existing resources. Mastery, however, enables feelings of competence and having increased resources [7]. Furthermore, Mastery has been negatively related to emotional exhaustion, need for recovery and depressive symptoms [7].

**Relaxation** is a state of low activity and increased positive affect. This is important as it signifies the ability to take a break from work demands. The inability to take relaxation has been linked to negative affect and health [7]. By raising the positive effect, job stress effects may be reduced [15].

**Control** is the extent to which the employee has influence on his leisure time, i.e. what activity to pursue, its timing and best ways of performing. Personal control has been shown to have a positive effect on individual well-being [16]. Sonnentag & Fritz [7] found that Control was negatively related to emotional exhaustion, depressive symptoms, need for recovery and sleep problems.

In the case of outstation crews, there may be little possibility for them to exert any control on the timing of their leisure time as the schedules are controlled by their managers. To add to the complication, crews are often required to be on standby for extended periods thus lessening their ability to control their own leisure time. Being on standby means that crew members are assigned a period to be available for immediate duty – if no duty is assigned, they receive a 12-hour mandatory rest. If, however, duty is assigned, they might go on extended flight, return 14 hours later to the base and then get a 14-hour rest. To add to the standby complication – sometimes an extended flight might take the crew member away from the base for days at a time – effectively nullifying the schedule for the remainder of the month as it has to be completely restructured. It can easily be seen

how a schedule with many standbys may be very disruptive to crews planning their personal life during off hours.

**Recovery and the Crew Member**

Crews can however try to seek detachment by minimizing socialization with work colleagues and avoid work related environment. In reality, the close proximity of all work members at the hotel accommodation means that every breakfast, every dinner, every gym visit will mean a potential work encounter with colleagues. In addition, crew members are informed daily about their schedule changes, timing changes and are required to check their emails and text messages on a regular basis. Those are all constant reminders of their work duties and the fact that they can be called back to duty at a minimum notice.

Sonnentag & Fritz [7] found moderate relationships between recovery experiences and well-being measurements. Psychological Work Detachment and Control had negative relationship with health complaints, emotional exhaustion, depressive symptoms, need for recovery and sleep problems. Relaxation had negative relationship with health problems, emotional exhaustion, need for recovery and sleep problems. Mastery was negatively related to depressive symptoms, emotional exhaustion and need for recovery. All four factors had positive relationship with life satisfaction.

Perhaps more relevantly, Kinnunen, Feldt, Siltaloppi & Sonnentag [17] directly tested the effects of these mechanisms on the JD-R model and found that Work Detachment had a negative relationship with work fatigue and Mastery had a positive relationship with work engagement. Relaxation and Control were not found to have any significant relationships with neither fatigue nor work engagement.

Furthermore, Sonnentag & Natter [19] did some research on cabin crew rest and found no significant detrimental effect of hotel stays, but the study only measured a few day's length of stay and did not investigate the effects of longer term stays. Staying in a hotel for a few days is a different experience from having to make it a temporary home for months.

To further Benjamin Searles [11] questions in regards to flight crews possible inability to fully recover while on outstations, this relationship can be elaborated on by investigating further the actual behaviour of flight crews on base, the connection between those behaviours to the four factors identified by Sonnentag & Fritz [7] and then seek confirmation on whether or not these factors significantly affect levels of fatigue.

This study aims to identify crew behaviour on outstation bases that have a significant relationship with recovery experiences in accordance with Sonnentag & Fritz [7] recovery model.

## II. METHOD

**Participants**

Participants were crew members ($N$ = 63) from a mid-size European airline. The response rate was 55 %. The majority of participants were male (62 %) and 38 % were women. The age distribution: 21–31 years (48 %) and another 30 % being between ages of 32–40. 83 % of participants had been less than 5 years in the company. Participants were flight crew and cabin crew from 10 bases across Europe. All participants volunteered to take the survey.

**Materials and Procedure**

These following surveys were used for the data collection: Recovery experience questionnaire [7], Identified crew behaviour on outstations [20] Fatigue scale [18] and demographic information questions.

Recovery Experience Questionnaire [7] which measures:

- (*W*) Work Detachment, (e.g. I distance myself from work);
- (*M*) Mastery, (e.g. I seek out intellectual challenges);
- (*C*) Control, (e.g. I determine for myself how I will spend my time);
- (*R*) Relaxation, (e.g. I take time for leisure).

This is a 16 question survey addressed to their experience during off work hours, e.g. “On base, during time after work: I don't think about work at all”. These are answered on a 5 point scale, from 1 (I do not agree at all) to 5 (I fully agree).

Fatigue was assessed using the fatigue scale [18]. Subjective Fatigue scale is a 7 point scale, from 1 (Fully alert / wide awake) to 9 (Completely exhausted, unable to function effectively).

Identified crew behaviour on outstations is an original questionnaire designed for this study (see Table I).

**Focus Group**

The second part of the questionnaire consisted of specific behavioural questions derived from a specialized focus group. The group consisted of eight experienced professionals in the aviation field who identified crew behaviours that may facilitate or impede the four factors identified by Sonnentag & Fritz [7]. The focus group consisted of three pilots, three senior cabin crew members and two station managers. Each focus group member had at least 6 years of work experience and had worked on outstation projects on at least 5 occasions.

The focus group members were briefed on the concepts of Work Detachment, Mastery, Relaxation and Control as described by Sonnentag & Fritz [7] and subsequently asked to identify what regular behaviour they have observed or performed themselves on outstations that might facilitate or hinder these four factors. The result of the focus group was compiled into a questionnaire along with Sonnentag & Fritz [7]. Recovery Experience questionnaire to measure those behaviours among actual crewmembers currently on outstations.

TABLE I

IDENTIFIED CREW BEHAVIOUR ON OUTSTATIONS

| **Behaviour** | **Connection to Recovery Factor** |
|---|---|
| Crew member schedules breakfast with other crew members. | *W* |
| Crew member finds a “secret” place away from hotel, only to enjoy for him/herself. | *W* |
| Crew member sets up a training regime in the hotel gym. | *M* |
| Crew member attends a crew party near every night when off duty. | *W* |
| Crew member stays in room and avoids contact with colleagues during off duty days. | *W* |
| Crew member actively explores the region in which he/she is based. | *C* |
| Crew member uses off time to further education or training. | *M* |
| Crew member joins other like-minded colleagues for activities away from hotel. | *W* |
| Crew member rents a car to travel more extensively while on off days. | *W* |
| Crew member attends dinners with colleagues most all nights. | *W* |
| Crew member attends the swimming pool (if available) nearly every day. | *R* |
| Crew member goes to the nearby beach (if available) on a regular basis. | *R* |
| Crew member goes out on the nightlife when on off duty nights. | *W* |
| Crew member goes sightseeing alone. | *W* |
| Crew member catches up on reading during off hours. | *M* |
| Crew member starts drinking more than usual during off hours. | *C* |
| Crew member regularly contacts family at home via telephone or video chat. | *W* |
| Crew member uses medication to regulate sleeping patterns. | *C* |

| Behaviour | Connection to Recovery Factor |
|---|---|
| Crew member swaps duties with other crew members in order to organize his off day activities. | *C* |
| Crew member does some shopping during off duty hours (retail therapy). | *C* |
| Crew member actively tries to meet new people away from work. | *W* |
| Crew member plays computer games in his/her hotel room during off duty hours. | *R* |
| Crew member watches TV-shows or movies in his/her hotel room during off duty hours. | *R* |
| Crew member is unable to schedule off time duty due to schedule instability. | *C* |
| Crew member experiences homesickness. | *W* |
| Crew member arranges for his family to join him/her on base for some extended period of time. | *W* |
| Crew member immerses him/herself in a hobby during off hours. | *M* |
| Crew member personalizes their hotel room (e.g. photographs on stands, moving/removing furniture). | *C* |

*W: Work Detachment, M: Mastery, C: Control, R: Relaxation.*

**Distribution**

The questionnaire was distributed in electronic format to crews on all operating bases. All participation was anonymous.

The bases available were: Pristina, Budapest, Brussels, Prague, London, Cardiff, Birmingham, Antalya, Istanbul and Madrid.

**Measures**

Regression analysis was performed on the four Recovery Factors: Work Detachment, Control, Relaxation and Mastery, in order to determine the predictive validity of the focus group identified behaviours to these factors, thus trying to obtain a better resolution on how the behaviour on base can predict the factor scores. The scores of the four factors are valuable in themselves, but the added detail of the identified behaviours will improve the overall picture of crew behaviour and its effect on crew recovery.

There are three fatigue self-reporting questions in the questionnaire which will serve as an indicator on a relationship between the factors and fatigue, and/or between certain behaviour patterns on fatigue.

## III. RESULTS

The four factors were established by the average of the factor question scores from 1 to 5. This group of participants showed lower score of Work Detachment than the general population as measured in Sonnentag & Fritz [7] but higher scores in Relaxation, Mastery and somewhat surprisingly, Control. This might indicate that the participants might indeed have a harder time detaching from their work than other workers but somewhat compensate with the other factors.

TABLE II

RECOVERY EXPERIENCES SCORES

| | **Work Detachment (*N* = 63)** | **Relaxation (*N* = 63)** | **Control (*N* = 63)** | **Mastery (*N* = 63)** |
|---|---|---|---|---|
| **Mean** | 2.76 | 4.04 | 3.88 | 3.90 |
| **Std. Deviation** | 0.95 | 0.71 | 0.63 | 0.75 |

**Identified Behaviour Questions**

In order to define the four factors with behavioural indicators, multiple regression analysis was performed on the factor scores with the identified behaviours from the focus group.

None of the identified behaviours had any significant relationship with the Relaxation, Control, Work Detachment.

The identified mastery behaviour shows some significant relationship with the Mastery factor (see Table III), in particular the fact that they report using their off-duty time to further their education or training. This should perhaps not come as a much of a surprise as the field of aviation professions is full of mandatory regulatory training, all of which have to be passed if crew members wish to continue on their chosen career. In any year, a crew member may have to attend and pass ten separate training courses. In addition, every operating flight is started with a pre-flight briefing which can resemble a training test. It is therefore understandable and perhaps necessary that the crew member may wish to spend much of his time gaining mastery of his profession.

The crew members also show a significant relationship between attending their chosen hobby and Mastery.

TABLE III

RECOVERY EXPERIENCE

| **Recovery Experience – Mastery Coefficients** | | | | | |
|---|---|---|---|---|---|
| **Model** | **Unstandardized Coefficients** | | **Standardized Coefficients** | ***t*** | **Sig.** |
| | ***B*** | **Std. Error** | **β** | | |
| (Constant) | 1.272 | 0.393 | | 3.240 | 0.002 |
| I try to immerse myself in a hobby during my off duty hours | 0.251 | 0.085 | 0.300 | 2.946 | 0.005 |
| I catch up on my reading | –0.103 | 0.081 | –0.131 | –1.268 | 0.210 |
| I use the off time to further my education or training | 0.543 | 0.082 | 0.648 | 6.590 | 0.000 |
| I set up a training regime in the hotel gym | –0.010 | 0.053 | –0.018 | –0.189 | 0.851 |
| a. Dependent Variable: Mastery | | | | | |

**Fatigue**

Fatigue was measured with the Samn-Perelli scale [18] which was designed for the use of monitoring air crew fatigue and is considered somewhat of an industry standard.

The overwhelming majority, or close to 80 %, reported that they did not consider themselves tired. 12.9 % reported themselves to be a little tired and only 2 % reported to be extremely tired.

TABLE IV

SUBJECTIVE FATIGUE SCORES – SAMN-PERELLI SCALE

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| **Valid** | Fully alert, wide awake | 22 | 21.6 | 21.8 | 21.8 |
| | Very lively, responsive, but not at peak | 18 | 17.6 | 17.8 | 39.6 |
| | Okay, somewhat fresh | 40 | 39.2 | 39.6 | 79.2 |
| | A little tired, less than fresh | 13 | 12.7 | 12.9 | 92.1 |
| | Moderately tired, let down | 6 | 5.9 | 5.9 | 98.0 |
| | Extremely tired, very difficult to concentrate | 2 | 2.0 | 2.0 | 100.0 |
| | Total | 101 | 99.0 | 100.0 | |
| **Missing** | System | 1 | 1.0 | | |
| **Total** | | 102 | 100.0 | | |

## IV. CONCLUSION AND DISCUSSION

This study aimed to find significant relationships between crew behaviours on base to the four recovery factors as identified in the Recovery Experience Questionnaire [7]. The goal of the study was to determine if it might be in the best interest of safety if airlines in the ACMI business try not only to focus on the duty distribution aspect of Fatigue Risk Management System, but also try to organize the setup of the outstations so that they encourage the facilitating recovery behaviours and discourage the hindering behaviours. This was especially relevant for Work Detachment and its direct connection to fatigue at work [17].

The results were also meant to aid station managers, who always are on location and intermingle with the crews, to identify when the behaviour of the crews may become negative to the efficacy of their rest. This can be added to the Fatigue Risk Management System of the airline that can implement actions to improve situation on base. The practical implications of this study were to assist airlines to facilitate certain behaviours that may increase the positive aspects of the recovery factors. Based on the research, airline management could therefore be influenced to change schedule patterns, hire different hotel accommodations or establish programs that could enable the positive experiences, e.g. giving free access to local educational courses, gym memberships, car rentals. This could minimize fatigue and prevent accumulated fatigue. Preventing fatigue increases safety – the common goal of the whole of the aviation industry.

This study found significant relationships between the identified behaviours and the Master and Control Recovery Experiences. It was unable to confirm any relationship neither between the identified behaviours and the Work Detachment Experience nor between the identified behaviours and the Relaxation Experience.

The significant relationships for Mastery focused mainly on the crew member behaviour of studying and improving their skills, something that is quite essential for the air crew who are more closely monitored and undergo more frequent training than most other professions. The significant relationship for Control was mainly about the inability to control or predict their own work schedule.

This research did not find any significant relationship between the work detachment behaviours to the corresponding factor and there may be several reasons for that result.

The identified behaviours as were suggested by the focus group may have been too broad in their application and failed to catch the specificity of the recovery experiences, e.g. asking if a crew member goes to the swimming pool may be indicative of many behavioural markers (social,

situational, financial) that are not directly connected to relaxation. The results of this survey may serve as a guidance tool for a future focus group to try to identify a more detailed and specific set of behaviours to monitor.

Furthermore, perhaps data gathering should be done via nuanced interviews. The nature of the work detachment experience may be such that participants do not fully realize how their behaviour differs from the ones who are more social in nature, e.g. those who report that they do not avoid their colleagues may not know that their other colleagues have much more contact between themselves.

As suggested by Sonnentag & Fritz [7], there may be a social dimension to the work detachment factor. Perhaps constant interaction between employees serves a positive function and prevents the negative effects of social isolation and possible loneliness that might follow. While not being able to detach from work is not good – social isolation in a strange place might be even worse.

Lastly, there is an issue of time spent on base. The majority of participants (72 %) had spent five weeks or less on base when the survey was administrated. Given the shortage of time at full time work, it is possible that this study falls in line with the results of Sonnentag & Natter [19] who also failed to find any negative effects of short-term hotel stay.

It may be that the work detachment only becomes important after the initial excitement of starting a new job in a new place has worn off. At least, this study can lend support to the idea that work detachment is not an issue for most employees staying five weeks or less on a new base – perhaps even longer. Meijman & Mulder [8] state that job demands are not always necessarily negative – they only become negative job stressors if recovery time has been insufficient for the employee. It can be argued that starting on a new base after a long time of unemployment, as was the case for these crews, gives the crew members a fairly large reservoir of job resources. This can also be seen in the lack of reported fatigue, which supports the notion that crews had not yet experienced enough work load for the four factors to act as mediators to recovery. This survey will be distributed anew to the same group of participants at the end of season, when crews have been flying for five months in a fairly heavy schedule, while living in their hotels, in order to determine if their responses have changed with the increase of fatigue.

Furthermore, it would be more beneficial, in order to coax out the interaction between these four recovery mechanisms with fatigue, to conduct the research on one base, thus controlling for the various fatigue causal factors that also impact fatigue, e.g. types of flights, timing of flights, frequency of flights, quality of hotel etc.

**Subjective Comments**

Even if this particular study failed to find many significant relationships between the identified behaviours and recovery experience there was a red thread throughout the open ended comments about control. As was apparent in the study, the Control factor had a strong relationship with the question about the instability of the schedule. This is strongly reflected in the crew member comments where there are basically no complaints about social activities or the inability to relax away from work, but there are some strong opinions on the crew's ability to control their own life when work is concluded. It may be that the inability of the crew to schedule their own life when not working simply overshadows the influence of the other three factors to recovery.

**Practical implications for Airline Management**

The field of aviation management is a constant struggle to balance safety vs. profitability. As the saying goes, the safest thing would be not to fly at all. Every airline manager is trained to follow the ALARP principle, to lower risk to As Low As Reasonably Practicable. "Reasonably" being the key word. The results of this study indicate that it can be possible to improve the crew members' sense of Control by stabilizing their schedule and ensure that crew members are able to plan their off hours in advance. This would entail some additional cost to the airline as schedule instability would then fall on the shoulders of standby crews, which would have to be hired for the purpose. The decision of the managers is to consider if this action would be reasonable within the framework of a temporary contract.

Mastery can be addressed by airline management by offering membership in distance learning and by rewarding additional training courses and good training performance.

This study does, however, indicate that recovery issues are not a factor in the first five weeks, a small comfort for budget conscious airline managers.

The other recovery scores did not indicate any particular area of neglect or discontent that could be addressed by airline management.

**Implications for future research**

The limitations of this study can be addressed as follows. Crews should participate in the survey after being subjected to a fairly long stay on base, giving all the Recovery Experiences time to establish themselves. The reality of life on base may be easy in the early weeks, but become intolerable after five months. This would be reflected in the survey results.

The identified behaviours may have to be more detailed in nature – currently some of them are quite coarse and nuanced interviews with cabin crew members on location may reveal more relevant and detailed behaviours that can be surveyed. Questions like "I go partying most nights" may not reveal the same results as the more nuanced "I feel pressured to attend crew parties". The behaviour might be the same but the underlying factor would be different. A new focus group with more detailed instructions and building on the data from this survey might lead to a better list of identified behaviours.

Given that the work life of the ACMI crew member differs substantially from the average scheduled airline crew members, it might be beneficial to conduct a separate job demands/resources analysis on their work. Bakker & Demerouti [5] have designed a questionnaire specific to that purpose. If applied to the ACMI crew operator, it might highlight the work areas that require adjustments in order to increase resources and lessen the demands. There may be more immediate buffers available to the airline than those proposed by Sonnentag & Fritz [7].

Ideally, it would be possible to obtain objective fatigue data. Self-reporting fatigue scales are not considered as reliable and valid as actual objective physiological data. Given the prevalence of new technological monitoring devices, it may be feasible for any airline to purchase a number of such monitoring devices and collect actual behavioural symptoms of fatigue, of course with the approval of the subjects and within the limits of personal data protection. These monitoring devices, along with in-flight cameras and blood tests, give a very good picture of crew internal state and have been used successfully in the last years [4]. Sleep patterns, quality of sleep and onset of sleep could thus be correlated with the recovery factors. Up until now, these devices have been the privilege of the larger airlines as they have entailed a large sum of cost for their use. However, as the monitoring devices advance technologically and become less costly, it may be possible for smaller airlines to easily collect data on other bodily markers, e.g. blood pressure and pulse, to give a more accurate picture of life on base, as well as in the air.

Lastly, the positive aspects of social relationships on base might be worthy addition to the next study. Sonnentag & Fritz [7] mentioned the possibility but warned that social activity might be a double edged sword, capable of causing both good and bad experiences. However, given the situation we are studying, i.e. crews away from home for a long period of time, perhaps social work interaction serves a greater positive role that undermines the Work Detachment factor. Future studies might want to investigate levels of social interactions on base, the perceived positivity of such interactions and correlate with well-being factors.

The goal of increasing crew well-being while on long term stay is quite relevant to aviation safety. This has risen in prominence during these last months as job-stress and mental health has become the key topic in the world of airline management. Reducing stress, increasing well-being and recovery is thus a worthy pursuit for any airline manager.

## REFERENCES

[1] K. Avers and W. B. Johnson, "A Review of Federal Aviation Administration Fatigue Research: Transitioning Scientific Results to the Aviation Industry," *Aviation Psychology and Applied Human Factors*, Hogrefe Publishing. vol. 1, no. 2, pp. 87–98, Dec. 2011. http://doi.org/10.1027/2192-0923/a000016

[2] ICAO PANS-ATM Doc.4444, ATM/501, *Procedures for Air Navigation Services – Air Traffic Management, Annex 6 – Operation of Aircraft*, 15th Ed. Canada, Montreal, Quebec: ICAO, 2010. [Online]. Available: http://code7700.com/pdfs/icao_annex_6_part_i.pdf [Accessed: June 5, 2016]

[3] ICAO PANS ATM Doc.9666, *Fatigue Risk Management for Regulators*, Canada, Montreal, Quebec: ICAO, 2012. [Online]. Available: http://www.icao.int/safety/fatiguemanagement/frms%20tools/doc%209966%20-%20frms%20manual%20for%20regulators.pdf [Accessed: June 7, 2016]

[4] P. Gander, L. Hartley, D. Powell, P. Cabon, E. Hitchcock, A. Mills and S. Popkin, "Fatigue Risk Management: Organizational factors at the regulatory and industry/company level," *Accident Analysis and Prevention*, vol. 3, iss. 2, pp. 573–590, Mar. 2011. http://doi.org/10.1016/j.aap.2009.11.007

[5] A. B. Bakker and E. Demerouti, "The job demands-resources model: State of the art," *Journal of managerial psychology*, vol. 22, no. 3, pp. 309–328, 2007. ISSN 0268-3946. http://doi.org/10.1108/02683940710733115

[6] G. R. J. Hockey, "Cognitive-energetical control mechanisms in the management of work demands and psychological health," in *Attention: Selection, Awareness, and Control*, Baddely, A. and Weiskrantz, L. Eds. Oxford: Clarendon Press, 1993, pp. 328–345.

[7] S. Sonnentag and C. Fritz, "The Recovery Experience Questionnaire: Development and validation of a measure for assessing recuperation and unwinding from work," *Journal of Occupational Health Psychology*, vol. 12, issue 3, pp. 204–221, 2007. http://doi.org/10.1037/1076-8998.12.3.204

[8] T. F. Meijman and G. Mulder, "Psychological aspects of workload," in *Handbook of work and organizational psychology*, P. J. D. Drenth and H. Thierry Eds. Hove, England: Psychology Press. 1998, vol. 2: Work psychology, pp. 5–33.

[9] C. Chen and S. Chen, "Investigating the effects of job demands and job resources on cabin crew safety behaviors," *Tourism Management*, vol. 41, pp. 45–52, Apr. 2014. http://doi.org/10.1016/j.tourman.2013.08.009

[10] L. H. Kao, M. Stewart and K. H. Lee, "Using structural equation modeling to predict cabin safety outcomes among Taiwanese airlines," *Transportation Research. Part E*, vol. 45, issue 2, pp. 357–365, 2009. http://doi.org/10.1016/j.tre.2008.09.007

[11] B. J. Searle, "Detachment From Work in Airport Hotels: Issues for Pilot Recovery," *Aviation Psychology and Applied Human Factors*, Hogrefe Publishing. vol. 2, issue 1, pp. 20–24, 2012. http://doi.org/10.1027/2192-0923/a000019

[12] T. Akerstedt, A. Knutsson, P. Westerholm, T. Theorell, L. Alfresson and G. Kecklund, "Mental fatigue, work and sleep," *Journal of Psychosomatic Research*, vol. 57, no. 5. pp. 427–433, Nov. 2004. http://doi.org/10.1016/j.jpsychores.2003.12.001

[13] S. E. Hobfoll, *Stress, culture, and community: The psychology and physiology of stress* (The Springer Series in Social Clinical Psychology). New York: Plenum Press, 1998.

[14] D. Etzion, D. Eden and Y. Lapidot, "Relief from job stressors and burnout: Reserve service as a respite," *Journal of Applied Psychology*, vol. 83, pp. 577–585, 1998. https://doi.org/10.1037/0021-9010.83.4.577

[15] J. J. L. Van der Klink, R. W. B. Blonk, A. H. Schene, F. J. H. Van Dijk, "The benefits of interventions for work-related stress," *American Journal of Public Health*, vol. 91, no. 2. pp. 270–276, 2001. https://doi.org/10.2105/AJPH.91.2.270

[16] A. Bandura, *Self-efficacy: The exercise of control*. New York: Freeman. Worth Publishers. 1997. ISBN 9780716728504.

[17] U. Kinnunen, T. Feldt, M. Siltaloppi and S. Sonnenberg, "Job demands-resources model in the context of recovery: Testing recovery experiences as mediators," *European Journal of Work and Organizational Psychology*, vol. 20, issue 6, pp. 805–832, 2011. https://doi.org/10.1080/1359432X.2010.524411

[18] S. W. Samn and L. P. Perelli, "Estimating Aircrew Fatigue: A Technique with Application to Airlift Operations," No. 82-21, ADA125319. Brooks AFB, TX: USAF School of Aerospace Medicine, 1982.

[19] S. Sonnentag and E. Natter, "Flight attendants' daily recovery from work: Is there no place like home?" *International Journal of Stress Management*, vol. 11, issue 4, pp. 366–391, Nov. 2004. http://doi.org/10.1037/1072-5245.11.4.366

[20] S. H. Gislason, "Aviation crew recovery experiences on outstations," Master thesis, 2015. Retrieved form the author.

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