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Collaborative and Harmonised ATCO Manpower Planning (CHAMP) Process

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Abstract

This deliverable describes a practical process called 'CHAMP' (Collaborative and Harmonised Air Traffic Controller Manpower Planning). The CHAMP process promotes a process to bring people together to understand the long-term impact of Air Traffic Controller (ATCO) Manpower Planning (MP) decisions using the LAMPS (Long-term ATCO MP Simulation) tool. The LAMPS tool models and simulates over a fifteen-year timeframe the variables influencing the number of ATCOs available and required. The key benefit of introducing the LAMPS/CHAMP approach in an Air Navigation Service Provider (ANSP) is that it provides a framework to recognise signs of changes and to evaluate their impacts for ATCO MP. In the longer term this should lead to improved decision-making on ATCO MP issues, and should alleviate experiencing peaks and dips in the number of ATCOs available and required. The main users of this document should be manpower planners, Human Resources (HR) managers, training managers and Operations (OPS) managers/experts, in short, any person involved in the ATCO MP process. This includes managers and experts involved in strategic and operational ATCO MP issues.

Keywords

Collaborative	Decision-making	Manpower Planning	Strategies
Scenarios	Future Challenges	Simulation	Process Owner
Facilitation	Modelling		

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CONTENTS

EXECUTIVE SUMMARY

This deliverable describes a practical process called 'CHAMP' ('Collaborative and Harmonised Air Traffic Controller Manpower Planning'). The CHAMP process promotes a process to bring people together to understand the long-term impact of Air Traffic Controller (ATCO) Manpower Planning (MP) decisions using the LAMPS (Long-term ATCO MP Simulation) tool. The LAMPS tool models and simulates over a fifteen-year timeframe the variables influencing the number of ATCOs available and required.

This document acts as a guide to demonstrate how a collaborative long-term planning process can be put in place to discuss ATCO MP issues. The key benefits of introducing the LAMPS/CHAMP approach in an Air Navigation Service Provider (ANSP) are that it provides a framework to recognise signs of changes and to evaluate their impacts for ATCO MP. In the longer term this should lead to improved decision-making on ATCO MP issues, and should alleviate experiencing peaks and dips in the number of ATCOs available and required.

Section 1, 'Introduction', describes the purpose, scope and overview to the document.

Section 2, 'Context', highlights the factors which makes ATCO MP complex, the main drawbacks of a traditional approach to ATCO MP in meeting future challenges and outlines the characteristics of this fresh perspective to long-term ATCO MP.

Section 3, 'The Concept', describes the background to the CHAMP concept, the key design features and contributors in the CHAMP process, the critical success factors and the benefits.

Section 4, 'The CHAMP Process', describes the six stages of the CHAMP process, outlining the objective, process steps, output and time required for each stage of the process.

Section 5, 'Conclusion', provides a summary of the key principles and benefits of the LAMPS/CHAMP approach.

An Annex, 'Case Study', provides worked examples for the six stages of the CHAMP process for a fictitious ANSP called Skycontrol.

References and Further Reading, A Glossary, the Abbreviations and Acronyms used in this report, and a list of the Contributors to this document are provided.

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1. INTRODUCTION

This document is the third deliverable in the frame of the Work Package 'Advanced Manpower Planning (MP) Methods' of the Manpower Sub-Programme (MSP-003). The Manpower Sub-Programme (MSP) forms part of the Human Resources Programme (HRS) under the European Air Traffic Management Programme (EATMP).

1.1 Purpose and Scope

LAMPS (Long-term ATCO Manpower Planning Simulation) is a simulation tool which models the variables influencing the inflow, throughflow and outflow of ATCOs over a fifteen-year timeframe. The LAMPS tool also models the factors influencing the relationship between traffic demand and ATCOs required. The tool with its key features of simulation and gaming provide a platform to bring people together to understand the long-term impact of ATCO MP decisions (see EATMP, 2001).

CHAMP (Collaborative and Harmonised ATCO Manpower Planning) promotes a collaborative process for the application of the LAMPS tool within an Air Navigation Service Provider (ANSP). This document describes the CHAMP concept and process.

The main users of this document should be manpower planners, Human Resources (HR) managers, training managers and Operations (OPS) managers/experts, in short, any person involved in the ATCO MP process. This includes managers and experts involved in strategic and operational ATCO MP issues.

For the purpose of this document the term ATCO should be interpreted as any controller function in the operations environment (e.g. radar, planner, tower and approach), and includes also functions outside the Operations room (OPSroom) demanding an ATCO background.

1.2 Benefits

The main benefits of this document on the CHAMP process are that it provides:

- transparency on the stages and steps involved in setting up and managing the CHAMP process;
- guidelines for developing collaboration among the various persons involved and influencing ATCO MP;
- a framework for the development of scenarios to understand future challenges facing an ANSP and their impacts for ATCO MP;
- a structure and framework for using the LAMPS tool within an ANSP.

1.3 Background

This document builds on previous research and publications relating to ATCO MP and in particular the following:

- EATMP (2000) provides detailed guidelines on ATCO MP that includes strategic MP, MP methodology and management. In particular, this document emphasised the importance of a strategic and systems perspective for ATCO MP.
- The workshop on the ATCO shortage in European Civil Aviation Conference (ECAC) States held in September 2001 emphasised the need to increase the profile/quality of MP and Human Resource Management (HRM) in ANSPs, and recognise that MP is a dynamic process that needs close collaboration of all parties involved.
- EATMP (2001) provides a simulation software package and user guide for the LAMPS tool.

1.4 Document Overview

To facilitate understanding and to ensure easy reading, this document is composed of the following three components (as shown in Figure 1):

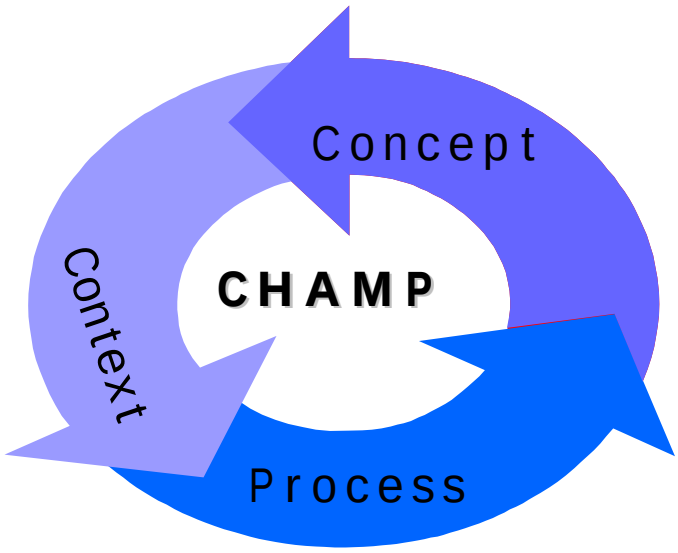

Figure 1: Document overview

- **Context:** This section describes the challenges facing ANSPs, the drawbacks of traditional approaches to ATCO MP in this context, the characteristics of a fresh perspective to ATCO MP.

- **Concept:** This section outlines the key features of the LAMPS / CHAMP approach, the key contributors, integrating CHAMP within the corporate planning lifecycle, critical success factors and benefits.

- **Process:** This section describes the objective, process steps, expected output and time required for each of the six stages of the CHAMP process.

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2. CONTEXT

2.1 ATCO MP – A Key Process to Meeting Business Requirements

Today, ANSPs are facing many challenges where change is becoming the norm rather than the exception. When it comes to ATCO MP, ANSPs are not only faced with the decision to recruit and train more ATCOs. The factors involved have grown more complex. For example, the challenges now include how to attract young people to a career in Air Traffic Control (ATC), the challenge of an older ATCO population adapting to new technology, an increase in workload to meet capacity demand - to name but a few. As an ANSP faces each of these challenges, they confront a deeper dilemma. How to strike a balance between prediction (believing that they can see past these uncertainties) and paralysis (letting the uncertainties freeze them into inactivity).

The ATCO MP process has a pivotal role to play to ensure that ANSPs attain the strategic objective of MP. This objective consists of 'providing the right number of staff, with the right qualification, at the right time and in the right place to meet business requirements'. It is difficult to reach this objective in practice. Consequently, an ATCO MP method and process needs to add value and support the uncertain, complex and dynamic nature of the ATM environment.

The LAMPS tool and the CHAMP process are two products available to assist ANSPs in understanding and managing uncertainty, complexity and the dynamic nature of the challenges impacting ATCO MP. The following paragraphs outline:

- why ATCO MP is complex;
- why the traditional approach to ATCO MP does not work;
- what is needed – a fresh approach.

2.2 Complexity of ATCO MP

EATMP (2001) highlighted that ATCO MP is complex because:

- it requires *balancing* the size of the pool of ATCOs available with the actual number of ATCOs required (dependent on how the operational requirement changes over time);

- as *time horizons widen* what will be needed in terms of HR (i.e. Manpower) and what will be available is less easy to answer;

- it depends on a *multiple of interconnected and interdependent variables* (as shown in Figure 2), which means that several things have to happen that cause multiple effects in different parts of the system;

- *decision-making involves many participants* in the MP process and their current understanding of the causes and effects of their actions;

- decisions are required on the number of ATCOs required five years from now rather than the number needed now, influenced by a number of *factors which are difficult to determine and shorten*; for example, the number of *ab initios* who will be selected and who will in potential successfully complete the training stage, etc.;

- it is dynamic in that the cause and effect are distant in time and changes occur at many timescales.

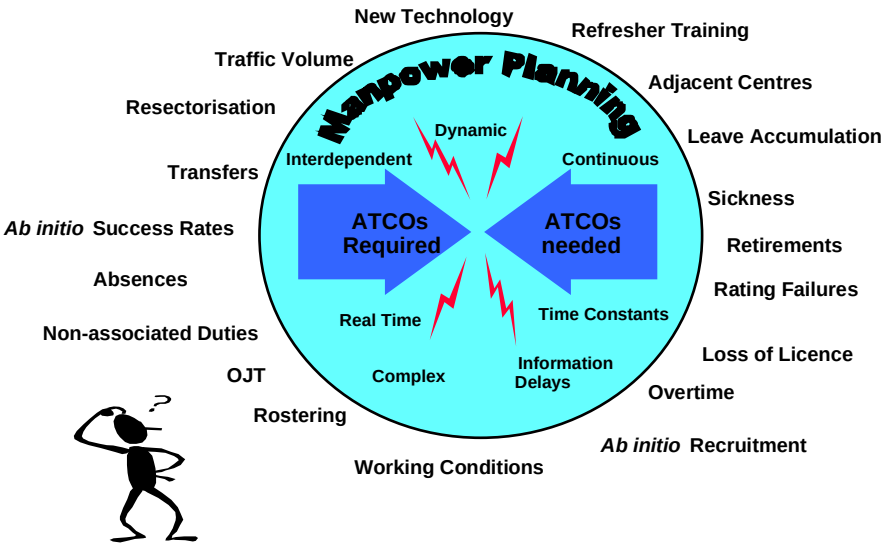

Figure 2: Examples of the many variables involved in ATCO MP

It is evident that ATCO MP is complex and improved management of MP requires gaining an understanding of how the various variables involved in ATCO MP interact overtime. Furthermore, in this climate of uncertainty where ANSPs are becoming more performance driven and cost focus, ANSPs are under increasing pressure to alleviate experiencing peaks and dips in ATCO availability and requirement in the longer term.

2.3 Traditional Approaches

The traditional approaches to ATCO MP manifest the following characteristics as illustrated in Figure 3:

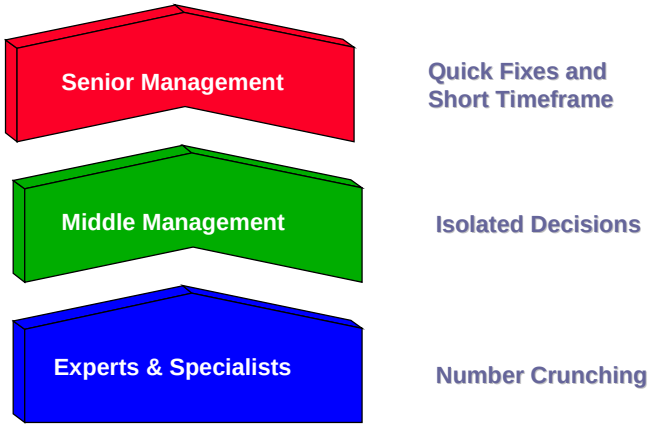

Figure 3: Traditional approach to ATCO MP

2.3.1 Number crunching and link to budgetary process

The present way to calculate the number of ATCOs needed at a given time, related to traffic demand, is quite straightforward. It is based on personnel data and operational data on opening times of sectors to cover air traffic demand. This data is adjusted taking into account several views on how this data may change over time. The main problem with this planning approach is that requirements, data and availability of ATCOs are viewed as separate factors in a static context, resulting in the snapshot establishment of the budgetary number of ATCOs needed. It does not take into account the interdependencies of the various factors and their effect on the number of ATCOs actually needed over time and the consequences for recruitment, training and development of ATCOs. Furthermore, the link to the strategic context of the ANSP is reactive.

2.3.2 Quick fixes and short timeframe

Senior management tend to look for quick fixes and results. Quick wins are good but not if they have a negative impact in the long-term. Whatever decisions are made on ATCO MP, it takes years to learn whether decisions made were wise or not. Take for example, the current ATCO shortage in Europe. Many ANSPs are now suffering the impact of a ‘stop and go’ approach to recruiting and training ATCOs in the eighties. In addition, the planning timeframe is usually a five-year window. Five years is too short to see the impact of decisions when it can take up to four years to recruit and train an ATCO.

2.3.3 Predict and control frame of mind

Looking for quick wins and short-term time horizons implies that uncertainty is either ignored or it is dealt with it on the basis of probability. There is a limit to using statistical predictions for determining future trends for the longer term. Many MP challenges tend to be unique to their point in time and have not been seen before under these conditions. The paralysis that can result from facing uncertainty with a predict and control frame of mind can lead to panic reactions and resulting in less optimal outcomes.

2.3.4 Isolated decisions

Management and staff at the functional level – HR, training, OPS – put their respective plans together to meet the demand for future ATCOs. However, these plans do **not** communicate in operational terms how the various functions of the ANSP work either in isolation or together. Without a shared understanding of how the MP processes work, the output from groups sharing information collectively is limited. This results in opportunities for synergy going untapped (see also 2.3.1). In addition, in dealing with uncertainty no one person can have the level of skill and understanding to take advantage of the complexity involved. Thus, the absence of a truly interactive process makes it too easy to achieve consensus on a fantasy.

2.4 A Fresh Approach

To deal with uncertainty proactively requires a different approach to ATCO MP. An approach that shifts the emphasis from short-term and isolated decisions to long-term thinking about the future and integrated decisions as illustrated in Figure 4.

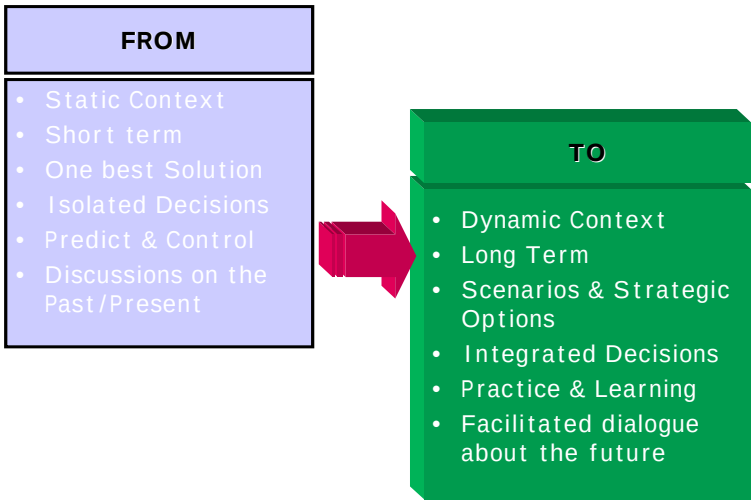

Figure 4: From the traditional perspective to a fresh approach

This fresh perspective requires that the ATCO MP process needs to be viewed as a:

2.4.1 Learning process

Learning should be an integral part to ATCO MP. Learning involves exploring, discovering and experimenting. Learning depends on being able to acknowledge specific uncertainties and unsettled questions for which answers may never be known. This implies ATCO MP is no longer primarily a MP function for coming up with the proper answer which managers use for further analysis and decisions but a process where management teams exchange their shared mental models of the ANSP internal and external environment.

2.4.2 Ongoing and flexible process

Developing an ATCO MP plan should not be seen as a one-time decision but as an ongoing and flexible process. This is the logical consequence of introducing uncertainty, which invalidates the idea of a single best strategy. Thus, decisions on ATCO MP are not made once and for all but must be constantly revisited, tested and modified. There is no best strategy and there is no simple definitive set of decisions - “what may seem best today may be far from optimum tomorrow”.

2.4.3 Practice field

People are expected to learn and predict the number of ATCOs required and available when there is no opportunity to replay an important decision to better understand the consequences of actions. In ATCO MP, the various players involved need to be able to play out and see the impact of their decisions in the longer term. The LAMPS tool provides this practice field for ATCO MP.

2.4.4 Development of scenarios

Scenarios are narratives that describe alternative paths towards the future. They do not predict what is going to happen but they do help to generate better understanding, starting from today what may happen tomorrow. Scenario development derives from the observation that, given the impossibility of knowing precisely how the future will play out, a good decision or strategy to adopt is one that plays out well across several possible futures. The aim is to find a robust strategy. Thus, scenarios are created in plural such that each scenario diverges markedly from the others.

2.4.5 Understanding the driving forces

Scenarios are built upon the distinction between two types of driving forces – predictable and uncertain forces. Predetermined forces are reasonably predictable e.g. how many twenty years old will exist in any country nineteen

years from now. But the vast majority of forces at play are uncertain. You can't know the answer but you can become far more aware of the reasons why such forces might move in one direction or another and the implications of their movements on ATCO MP. Developing scenarios provides a framework to capture the key uncertainties.

2.4.6 Stimulating discussion about the future

To improve decision-making on ATCO MP requires that discussion be stimulated about the future. This requires facilitating conversations about what is taking place and what might take place in the ANSPs internal and external environment. The focus is on the future not on the past or present where most debates have concentrated their attention usually leading to recriminations and accusations rather than to constructive quest for alternatives. The discussion is not intended to generate compromises or binding commitments but is centred on "What do we do if…." and then "What does this mean for what we do now…. ".

2.4.7 Facilitating dialogue

The endpoint of ATCO MP should not only be the delivery of an ATCO manpower plan but the process that people engage in to develop the ATCO manpower plan must be equally valued. This implies ATCO MP needs to be a social process where individuals work together to combine and generate the spontaneous as yet unconnected insights into coherent structures. The process is conversational. However, experience has shown that these desirable results do not necessarily emerge spontaneously from people sitting around a table wishing to engage in such a conversation. Useful results come from a suitable process involving a facilitator familiar with group dynamics.

2.5 Summary

ANSPs are facing many uncertainties and challenges where change is now the norm rather than the exception. Long-term ATCO MP work completed before there is any dialogue between the various players or functional units involved is ineffective. ATCO MP should not be a one step exercise but an ongoing and flexible process. It needs to be a conversational process involving a high degree of human interaction taking a long-term perspective where scenarios about the future are constructed and investigated.

The LAMPS and CHAMP approach provides a long-term perspective (as illustrated in Figure 5) for the planning of ATCOs which include:

- a method to try out and test alternative scenarios (LAMPS);
- a process to help build mutual awareness amongst the many players involved on ATCO MP issues and to enable the development of integrated solutions (CHAMP process).

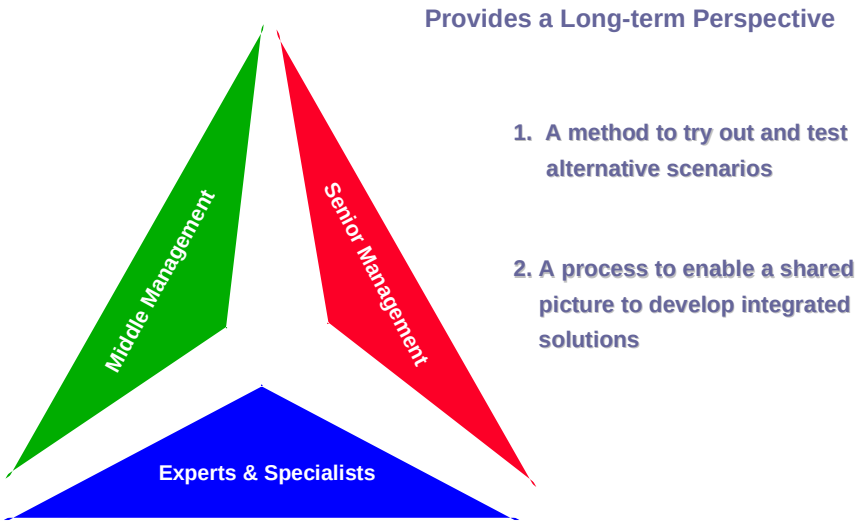

Figure 5: The LAMPS/CHAMP approach

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3. THE CONCEPT

3.1 LAMPS – Modelling and Simulation for Learning

LAMPS is a simulation tool which models the variables influencing the inflow, throughflow and outflow of ATCOs over time. The LAMPS tool also models the factors influencing the relationship between traffic demand and ATCOs required. LAMPS can simulate these variables over a fifteen-year timeframe. LAMPS also has a PC-based gaming interface (allowing variables to be changed during the fifteen-year timeframe) and uses graphs and tables to show the results. The LAMPS tool is based on system dynamics concepts, which runs under VENSIM (VENtana SIMulator) software.

The challenge of matching air traffic demand and having adequate ATCOs available is quite complex (see 2.2). LAMPS aims to simplify this process. LAMPS provides a platform to examine how the various factors influencing ATCO MP interact over time and to understand how the factors behave in response to changing circumstances. This approach is different from the normal view of modelling for forecasting, prediction and optimisation designed to provide 'the right answer' for decision-makers. This tool enables 'modelling and simulating for learning'.

To implement the LAMPS tool in an ANSP and to realise the maximum benefits of providing a 'modelling and simulation for learning' platform, the LAMPS tool needs to be embedded within a collaborative process. This should lead to improvements in how ATCO MP issues are discussed and avoid a situation where isolated solutions are taken. To create this collaborative environment, skills and processes are needed to enable OPS managers/experts, HR managers, training managers, manpower planners, etc., to work together to visualise and rehearse ATCO MP scenarios, construct and test strategies to arrive at the most viable solution. An environment where all the players in the ATCO MP process work together to find the optimum solutions.

3.2 CHAMP – A Collaborative Learning Process

CHAMP offers a process to bring all the players together to think creatively yet systematically about possible future environments and to develop scenarios and devise alternative strategies for ATCO MP. This collaborative planning process involves six stages as illustrated in Figure 6 overleaf:

1. Review the Current Situation.
2. Assess Future Challenges.
3. Identify the Long-term Impact.
4. Devise Alternative Strategies.
5. Evaluate Strategies.
6. Decide on Actions Needed.

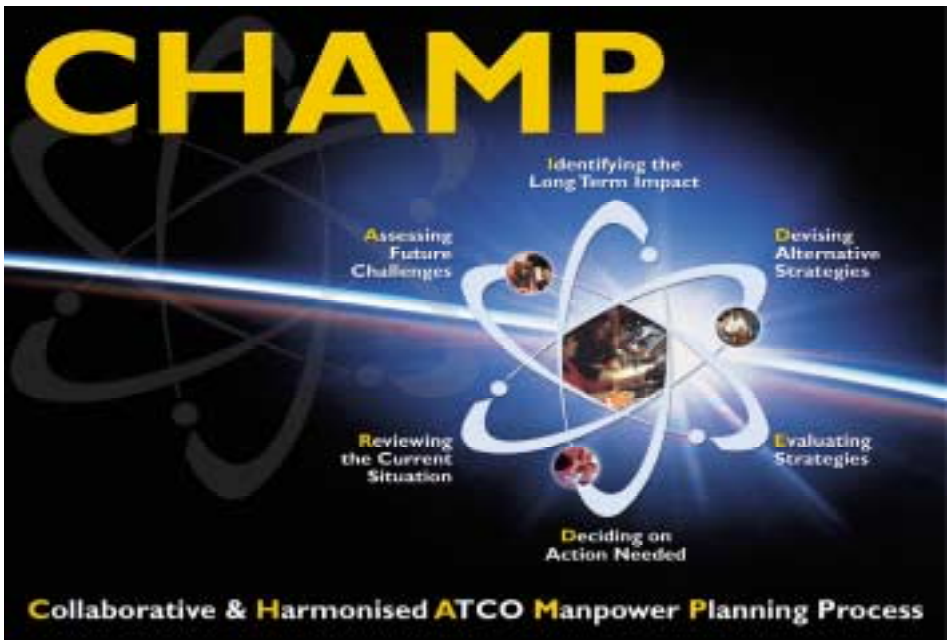

Figure 6: The CHAMP process

The key design features of CHAMP are highlighted in Table 1 below. The added value of the CHAMP process is that it provides a long-term perspective and integrated decisions on ATCO MP issues.

Table 1: Key features of the CHAMP process

Design features	Collaborative ATCO manpower planning process
Value creation focus	• Long-term perspective • Integrated decisions
Performance measure	• ATCO margin • Reduced delays due to adequate staffing
Planning techniques	• LAMPS tool – simulation and gaming
Organisational process	• Series of six stages
Attendance	• Key managers/experts from the functional areas, i.e. training, HR, OPS
Role of manpower planner	• Process owner, analyst, facilitator

3.3 Contributors

The CHAMP process requires a cross-functional approach with representatives from OPS, training, HR and OPS support as illustrated in Figure 7. This implies managing and reviewing ATCO MP as a system of interrelated processes to improve the ANSP business and process performance.

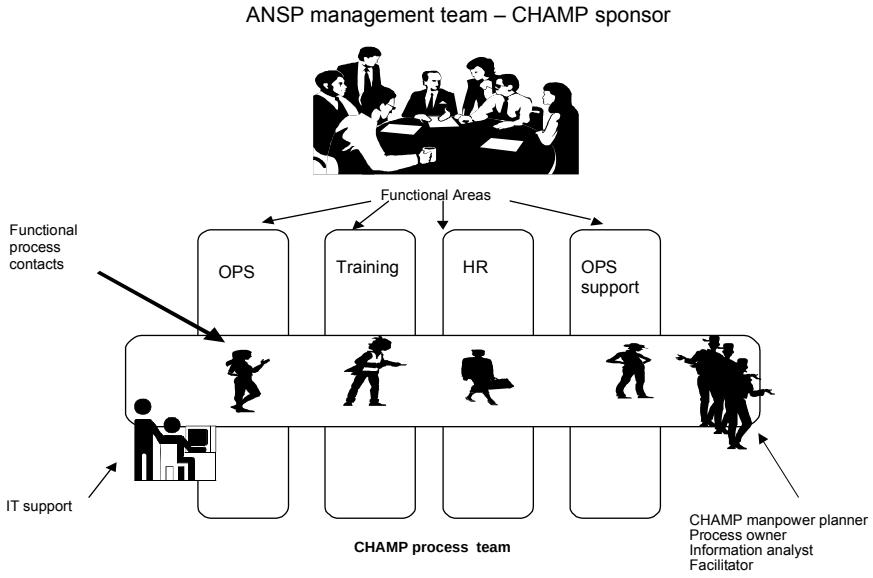

Figure 7: CHAMP contributors

The roles of the key contributors in the CHAMP process are as follows:

- **CHAMP sponsor:** The CHAMP sponsor is the ANSP management team. Management needs to be committed to implementing process improvements and regards process objectives as important as functional objectives. Management sees MP as a system of related processes that are integrated and aligned to achieve the ANSPs strategic goals i.e. the provision of safe Air Traffic Service (ATS).

- **CHAMP functional process contacts:** The functional process contacts are managers/experts from the respective functional areas and the key players actively participating in the six stages of the CHAMP process.

- **CHAMP manpower planner:** To manage the CHAMP process effectively requires additional elements to the role of the manpower planner. In addition to information analysis, it requires process ownership and

facilitation (as illustrated in Figure 8). Depending on the size of the ANSP these roles should be shared between two or more persons.

- **Process owner:** The process owner is responsible for managing, measuring and improving the CHAMP process and representing the process in the ANSP.

- **Information analyst:** This role requires gathering the relevant data to configure in LAMPS, configuring data in LAMPS, simulating, analysing and interpreting the results from LAMPS.

- **Facilitator:** The role of the facilitator is to support the CHAMP process team members when working together in a group by managing the meeting process to enable participants to share insights. As facilitator, the manpower planner achieves this by encouraging full participation, promoting mutual understanding and fostering inclusive solutions.

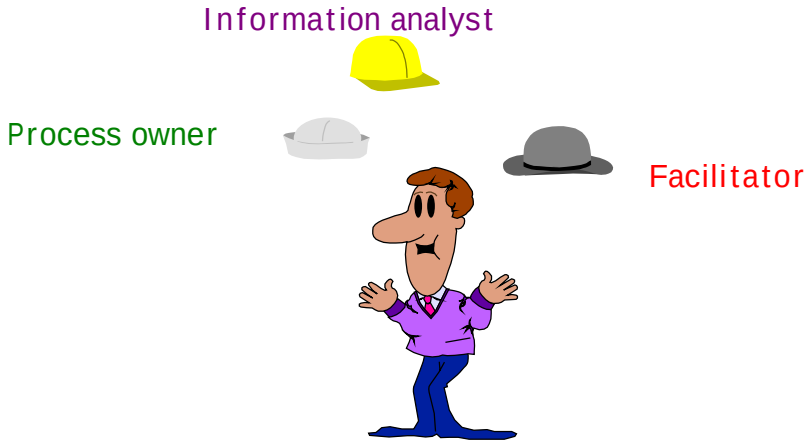

Figure 8: Roles of the manpower planner

- **IT support**: Implementing the LAMPS tool will require making interfaces with relevant databases to retrieve statistics on ATCO data required for configuring data in LAMPS. Consequently, IT support will be needed to contribute technical expertise when required.

The functional process contacts and the manpower planner(s) make up to CHAMP process team.

3.4 Integrating CHAMP in the Corporate Planning Cycle

An ANSP's planning cycle (illustrated in Figure 9) involves the development of:

- strategy,
- master planning (involving the translation of strategy into a description of the cross functional overall business plan);
- project planning (involving the translation of the strategy into business projects and action steps);
- budget planning (involving the overall quantification and the setting of targets) and
- appraisal (looking at actual performance in the light of what was intended in the plans).

The CHAMP process needs to be integrated into the ANSP's formal process of strategy development by making it part of the ANSP's corporate planning cycle.

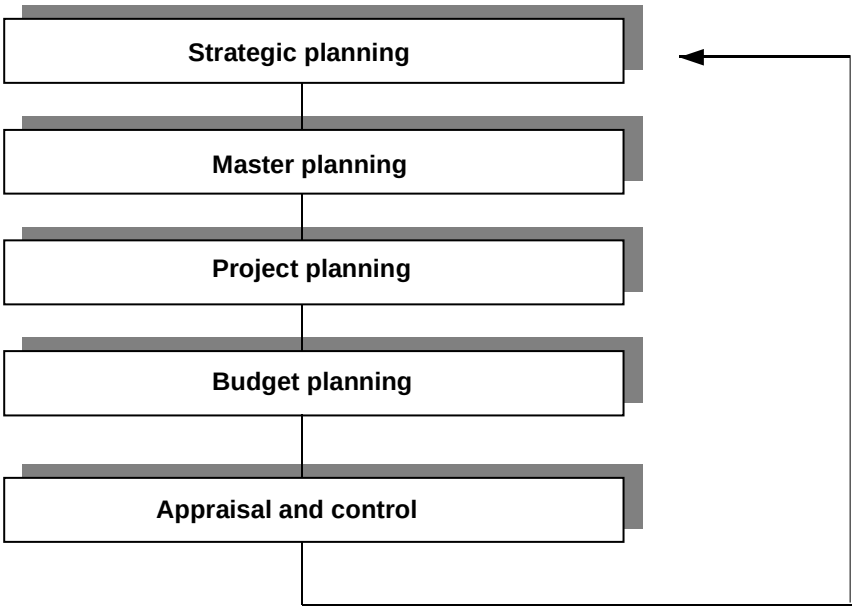

Figure 9: An example of an ANSP's corporate planning cycle

3.5 Critical Success Factors

To manage the CHAMP process and achieve true collaboration the following are critical success factors:

- **Management commitment:** Management needs to see ATCO MP as a system of related processes that are integrated and aligned to achieve its strategic goals, i.e. the provision of safe ATS.
- **Clear ownership:** Everyone involved in the process needs to understand their roles and responsibilities according to their position in the process.
- **Education and training:** Education and training needs should be identified and provided at all levels as appropriate to manage and run the CHAMP process.
- **Planning and review:** The process should be reviewed routinely using key process measurement.
- **Communication:** A systematic and effective communication mechanism at all levels should be established for two way communication at all stages of the CHAMP process.

3.6 Benefits

The added value of the CHAMP process is that it:

- provides a structure and framework for using the LAMPS tool within an ANSP;
- builds mutual awareness amongst the many players involved in ATCO MP and leads to the development of integrated solutions on ATCO MP issues;
- avoids situations in which events can take people by surprise;
- calls into question conventional predictions about the future;
- provides a framework to recognise signs of change and establish standards for evaluating the different ATCO MP strategies under different circumstances.

In the longer term an ANSP should experience improved decision-making on ATCO MP and should alleviate experiencing peaks and dips in the number of ATCOs available and required.

4. THE CHAMP PROCESS

4.1 Introduction

The CHAMP process involves six stages as shown in Figure 10 below. This section describes each stage of the CHAMP process outlining the objective, process steps, output and the estimated time required for each stage of the process. In addition, explanations are provided on using LAMPS during the CHAMP process. To aid understanding of the CHAMP process and to visualise the output from each stage, an Annex provides a case study for a fictitious ANSP, called Skycontrol, where worked examples are provided for each stage of the CHAMP process.

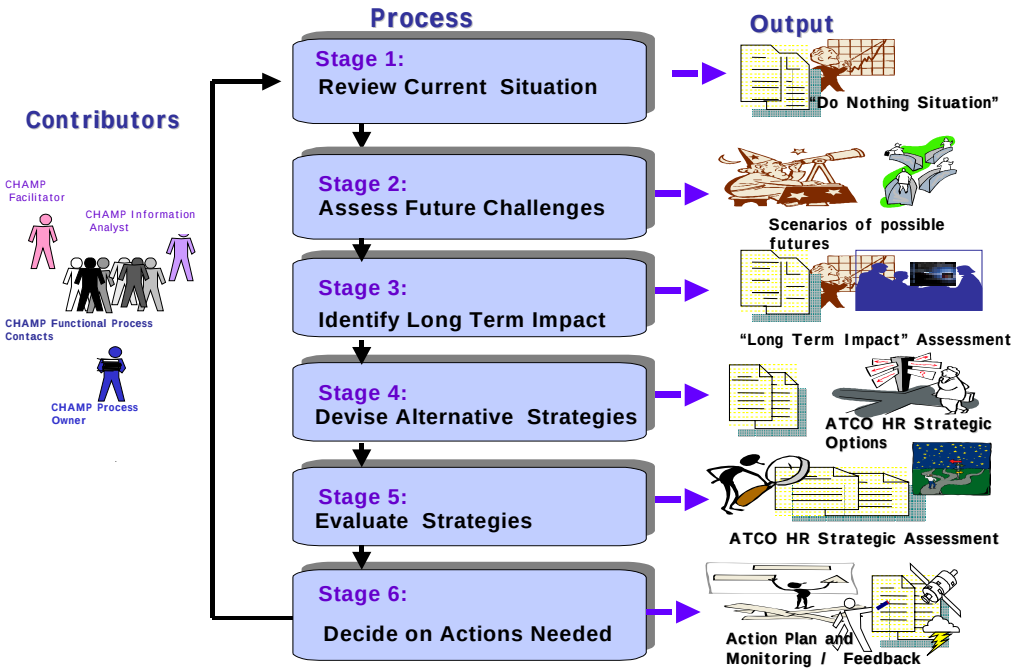

Figure 10: CHAMP process overview

4.2 Preparation

The following are some key preparation tasks that are required before embarking on the CHAMP process:

- **Communication and buy in**: Support of the ANSP's senior management team is required, and sponsorship.

- **Set up CHAMP process team**: This requires securing representatives from the relevant functional areas, i.e. OPS, training, HR, OPS support.

- **LAMPS familiarisation**: An introduction to the functionality of the LAMPS tool to the CHAMP process team members.

- **Establish a project plan:** A timetable for each stage of the CHAMP process.

- **Establish a communication plan**: The communication of key milestones in the CHAMP process and decide when and who will communicate this.

4.3 Framework

In describing the six stages of the CHAMP process the following framework is used as outlined in Figure 11:

- The columns represent various current and future worlds. The rows represent respectively context, levers and outcomes.

- The context box represents the specific context in which the ANSP operates. The emphasis is on the external environment features in which the ANSP operates, i.e. the political context, nature of the industry, social factors (e.g. demographics) and technical factors such as technological trends affecting the ANSP.

- Levers and lever settings represent the fundamental policies affecting the ATCO MP. Examples of levers are:
  - the ATCOs available lever determines how many ATCOs are employed;
  - the training lever determines the way in which training is undertaken and how training capacity is utilised;
  - the working condition lever determines the roster, working hours and leave and absences policies in place;
  - lever settings are the actual value that this lever is set during a simulation run.

- Outcomes represent the results such as ATCO margin, training utilisation. Many levers may influence outcomes. The levers that are in place operate on the outcomes only indirectly through cause and effect relationships that are complex and involve time delays.

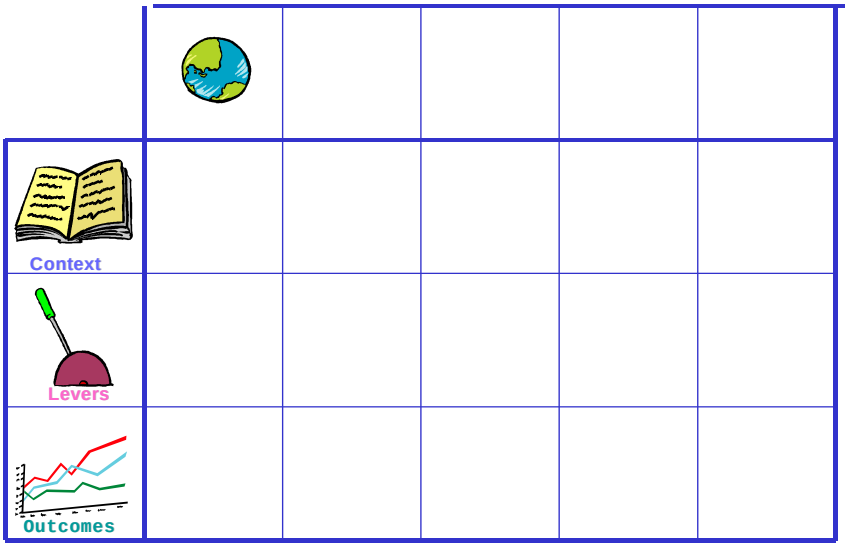

Figure 11: CHAMP process framework

4.4 Stage 1: Review the Current Situation

4.4.1 Objective

To establish a baseline on ATCO MP current policies over a fifteen-year timeframe review and agree the baseline results with the ATCO MP players.

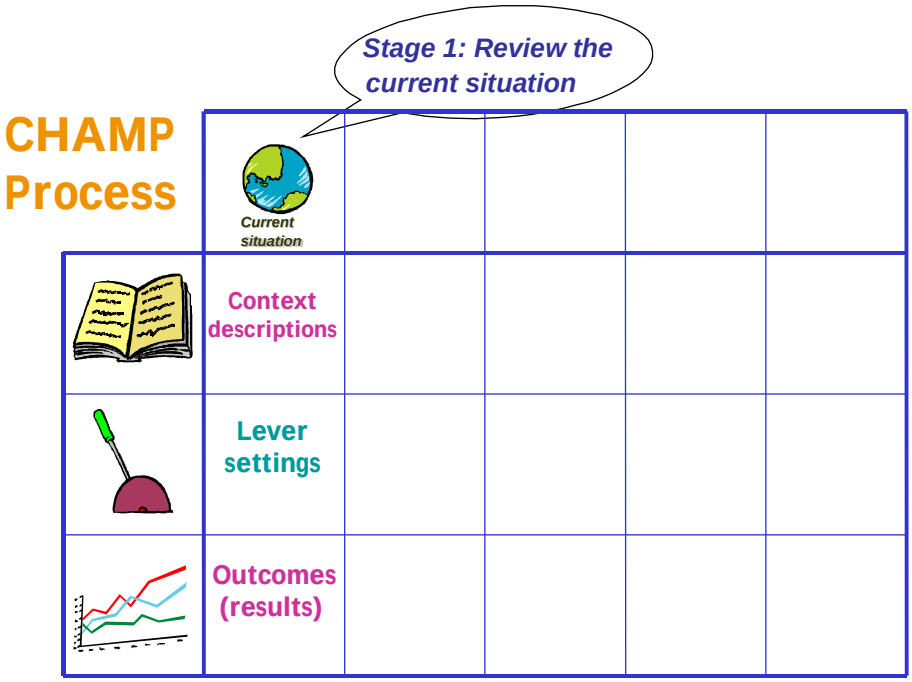

Figure 12: Stage 1: Review the current situation

4.4.2 Process steps

The steps are as follows:

1) Prepare LAMPS.
2) Brief participants.
3) Review meeting.

1) Prepare LAMPS

Gather and configure data in LAMPS relevant to ATCO MP. It is necessary to decide the date (i.e. month and year) that the baseline will start from. During this step, it is useful to document what data (lever settings) have been taken into account and why. Appendix 1a provides a template to record the data configured in LAMPS together with comments relevant to the case study. The next step is to simulate the data in LAMPS

and analyse the results for key variables, e.g. ATCO margin, institutional, OJT and pre-OJT training places, costs, etc. Following this, a report is prepared on the key findings. This report should include a list of bullet points on the context that the ANSP is operating in, the key levers (policies) in place and the outcomes expected over the fifteen years. Appendix 1b provides an outline on the format this report could take in relation to the case study.

2) Brief participants

This step involves briefing participants and preparing them for a meeting to review and agree on the baseline results. The baseline results shows the results of key variables if no changes are implemented within the fifteen-year timeframe. The key aspects to highlight during the briefing with participants are as follows:

- explain the LAMPS tool and CHAMP process;
- data configured to develop the baseline (Appendix 1a);
- analysis of baseline situation (Appendix 1b);
- preparation for meeting to discuss baseline, i.e.:
  - study the baseline assumptions,
  - changes to suggest for the baseline assumptions,
  - questions and comments on the baseline.

3) Review meeting

The objective of this meeting is to present the results of the baseline situation to the ATCO MP players and to agree the assumptions used to derive the baseline results. The key topics to cover during this meeting are as follows:

- overview of LAMPS tool and CHAMP process,
- data configured in LAMPS,
- baseline results.

The following questions may arise during the discussion:

- How does the results shown in LAMPS differ from our existing plans?
- How is LAMPS different from our existing planning tools?
- How can we trust the results?

It is important that the manpower planner at this meeting has anticipated that such questions may arise and has prepared possible replies. This is a crucial stage in building confidence in both the LAMPS tool and the CHAMP process. During this stage the goal is to achieve agreement on the baseline. During the discussion participants may want to make changes to the baseline assumptions. It is useful during the briefings with individual participants to have picked up on this and that the manpower

planner has experimented with changing variables in LAMPS to see how sensitive the results are to changes in the baseline assumptions. It is important to be able to explain why there is low or high sensitivity to variable changes to the baseline assumptions.

The risk during this meeting is that participants would want to look at changes to the baseline assumptions. If this is the case, a suggested way to handle this is to collect all possible changes to the baseline assumptions, i.e. what variables to change and the rate of change. It is wise not to make changes to the LAMPS variables during the meeting. This is time consuming and can distract participants. It is better to take a break and make changes offline and resume the meeting later when the results can be presented.

This review meeting may take two parts especially when running the CHAMP process for the first time:

- to agree the initial data,
- to agree the baseline results.

4.4.3 Output

Agreed baseline on the current ATCO MP situation and shared understanding of the impact over the next fifteen years.

4.4.4 Associated appendices

Appendix 1a - LAMPS Data Preparation Template

Appendix 1b - Report on Baseline Results – 'Current Situation'

4.4.5 Time required

Manpower planner: Preparation of LAMPS data and results, briefing participants and facilitating the review meeting requires an estimated six to ten days.

Managers/experts: Preparation and attendance at the review meeting will require an estimated one to three days.

4.5 Stage 2: Assess Future Challenges

4.5.1 Objective

To identify the future challenges facing an ANSP that may impact ATCO MP. This involves getting a shared understanding of the driving forces facing the ANSP and developing various scenarios about the future.

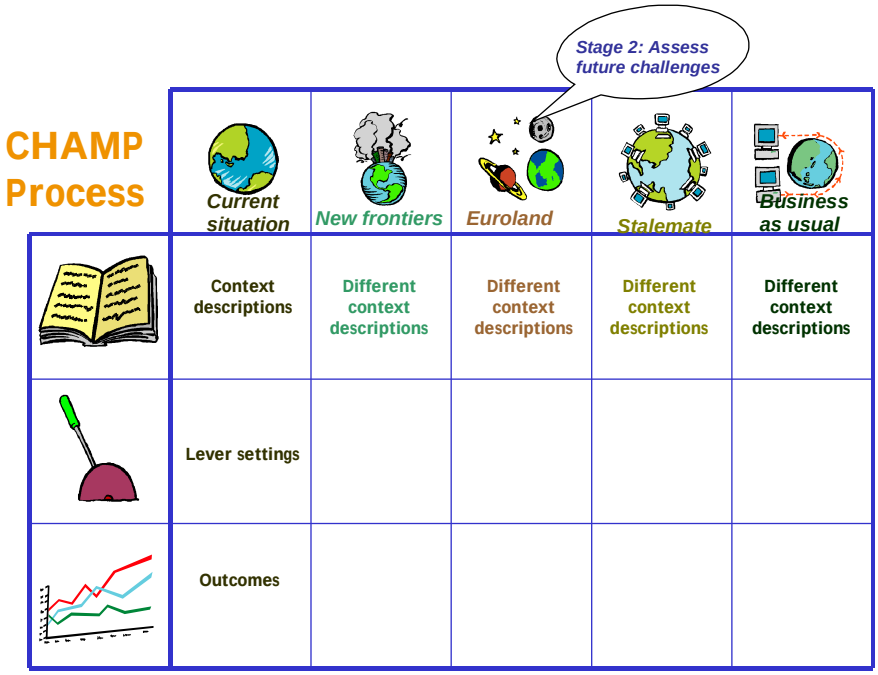

Figure 13: Stage 2: Assess future challenges

4.5.2 Process steps

This stage involves a two-day workshop where participants identify the driving forces (predetermined and uncertain forces) and define scenarios for the future which may impact ATCO MP. There are five steps involved in this process, i.e.:

1) Setting the scene.
2) Agenda setting.
3) Business idea.
4) Identification of driving forces (predetermined and uncertain).
5) Scenario generation and design.

1) Setting the scene

The objective of setting the scene is to trigger free flowing conversation about the future. Participants are asked a series of trigger questions to elicit a list of the main uncertainties facing an ANSP and its environment. These questions help to trigger ideas of what could be important factors to look at to help discover the underlying driving forces. For example, questions like:

- **Oracle:** If you had the opportunity to talk to an oracle (fortune teller) about the future, what questions would you ask him/her?
- **Good world:** Imagine that the future is a good one, rolling out as you would like it to be, how would you describe it?
- **Bad world:** Imagine that the future develops in an undesirable direction, what would it be like?
- **Culture:** What elements of the culture would step in the way of introducing new things?
- **Inheritances from the past:** What pivotal events can you identify in the past, good or bad, that should remain in peoples memories as important lessons for the future?
- **Important decisions ahead:** What major decisions with long-term implications is the organisation facing at the moment, decisions that need to be tackled in the short term.
- **Constraints in the system:** What major constraints are being experienced inside and outside of the ANSP that limit the ANSP in what it can achieve?

Appendix 2a provides some examples of possible responses to the first four questions.

2) Agenda setting

The objective of agenda setting is to identify four or five broad themes or areas of interest in the ANSP's environment where it is clear that ATCO MP has the potential of impacting. These are areas of major uncertainty that management is significantly concerned about. For example, some agenda setting themes could be:

- ATCO/management relation – transparency and understanding,
- meeting air traffic demand,
- timely implementation of new technology,
- sustainability of ANSP in European context,
- flexible workforce.

3) The business idea

The business idea is the organisation's mental model of the forces behind its current and future success. An articulated business idea is a rational explanation of why the ANSP has been successful in the past, and how it will be successful in the future. The business idea incorporates the following elements as illustrated in Figure 14:

- **Societal/customer value created:** What need in society is the ANSP fulfilling, i.e. the reason why the ANSP exists which generates investment?
- **Investment:** How do stakeholders invest in the ANSP, e.g. route charges.
- **Distinctive competencies:** Distinctive competencies are the factors which are unique to an ANSP which cannot be easily copied, e.g. service, tacit knowledge, specific locations, reputation and trust, patents, legal protection. What are the unique factors that allow the ANSP to be successful and are difficult for others to emulate?

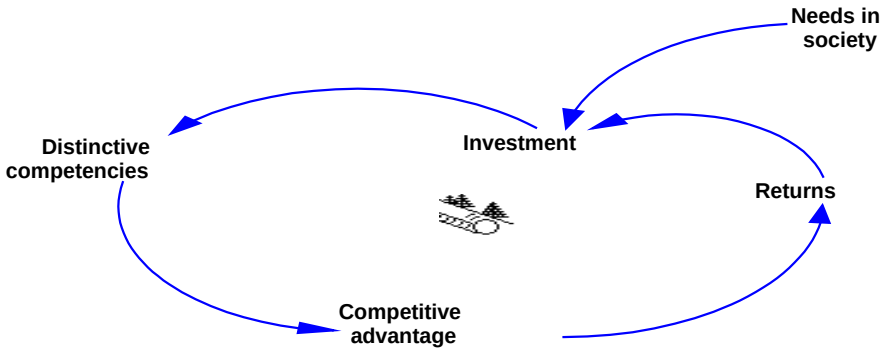

Figure 14: The elements of the business idea

- **Competitive advantage:** What is the nature of the competitive advantage exploited, e.g. quality image, service quality, service or product differentiation, low cost? The basis of an ANSP's competitive advantage can be derived by identifying how one would explain to potential customers why they should prefer this organisation as supplier / business partner over another organisation.
- **Return:** What is the benefit that stakeholders get?

A business idea contains a positive feedback loop which creates a reinforcing system as illustrated in Figure 14. In such a system increasing competitive advantage leads to increasing returns which cause increasing resources to be available for investment in enhancing distinctive

competencies which in turn leads to increased competitive advantage. However, distinctive competencies depreciate over time so an organisation needs to spend resources in maintaining and renewing its business idea. In addition, a positive feedback loop can also create collapse (less surplus leading to fewer resources, leading to weaker competencies, leading to less surplus, etc.). The primary concern of an ANSP is to keep the loop working in the upward direction.

Appendix 2b provides an example of a draft business idea for the case study.

4) Identification of driving forces (predetermined and uncertain)

Generating scenarios involves addressing the driving forces in the surrounding world of the ANSP, i.e. the contextual environment. Contextual environmental factors relate to societal, environmental, economic, political and technological developments as highlighted in Figure 15. In addition, it requires analysis of the structure of the industry and market that an ANSP operates in. The transactional environment (see Figure 15) is related to the stakeholders in the organisation environment where the ANSP has some control on how it interacts with these components.

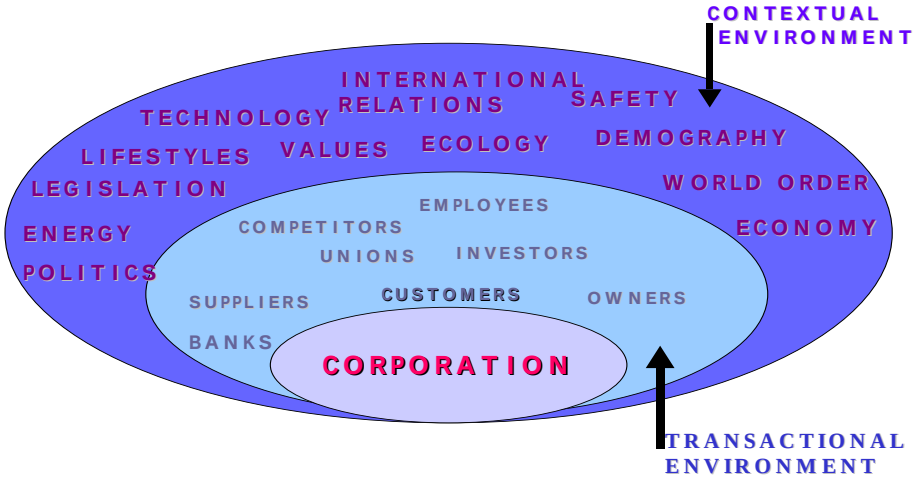

Figure 15: The organisation's environment

The objective is to build scenarios related to the contextual environment. This is a process of looking '**outside in'** by identifying the key driving forces which include a number of key uncertainties and the predetermined elements. In this way multiple futures are generated depending on different possible conclusions reached on the cause and effect of the key uncertainties identified. It is essential that external issues are expressed and developed in scenarios separately from internal issues. The steps involved to generate scenarios are as follows:

- **Identify the predetermined forces facing the organisation:** This requires listing the predetermined forces, i.e. the known events that will come into play over the fifteen-year timeframe - known investments by the ANSP, e.g. plans to move to a new OPSroom, technology improvements, changes in traffic growth, as illustrated in Table 2. At this stage it is only necessary to specify the change or event and the expected date of effect. The implications for ATCO MP and what variables need to change in LAMPS will be discussed in Stage 3 (Identify the Long-term Impact). Appendix 2c provides an example of predetermined forces for the case study.

Table 2: Example of identification of predetermined forces

Change	Date of effect	Variable to be changed in LAMPS
Move to new OPSroom – increase in number of working positions	Jan 2003	(for Stage 3 of the CHAMP process)

- **Identify the uncertain forces:** List the uncertain forces over the fifteen-year timeframe. One approach that can help in this identification is the iceberg analysis as shown in Figure 16. This is a method for understanding underlying structure of the situation by inferring patterns and trends in the events that are expected to happen. This analysis involves:
  - specifying important events – things that one can see happening,
  - identifying possible trends over time impacting an ANSP,
  - identifying structural impacts, i.e. for ATCO MP.

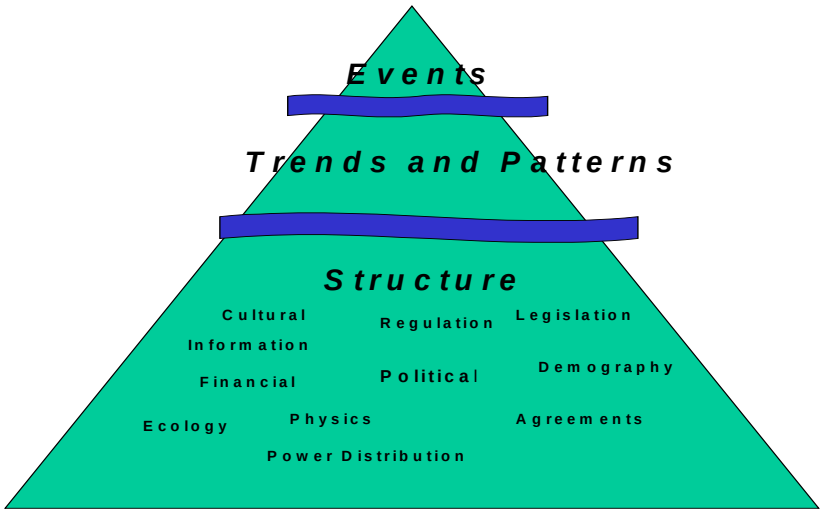

Figure 16: Iceberg analysis

The steps involved are as follows:

- Summarise each insight gained in a few words on cards or post it notes using the iceberg analysis.
- Cluster the cards into mutual independent groups until every insight has found a natural place in the context of all other notes/cards.
- Identify for each cluster mutually independent dimensions at event, trend and structural level. Appendix 2d provides an example of possible uncertain forces for the case study.
- Rank the clustered groups. The ranking should be on the basis of the level of predictability (high/low) and impact on the business idea (high/low), as illustrated in Figure 17 for the case study.

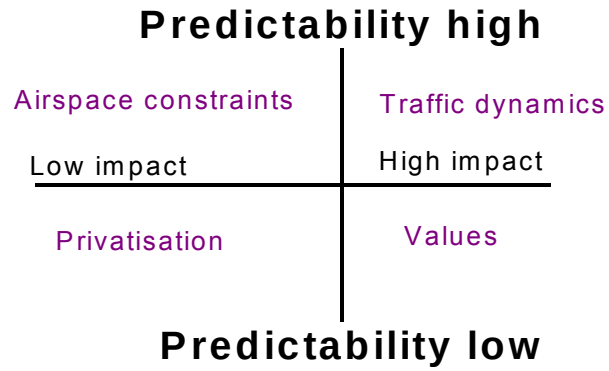

Figure 17: Example of ranking of clusters

5) Scenario generation and design

The next step is to create a limited number of scenarios in which the driving forces (predetermined and uncertain forces) can be reflected. Scenarios as stories about the future provide an efficient medium through which ideas across many disciplines can be linked in context. It should be noted that predetermined events need to end up in all scenarios while uncertain events are included in only one. Key elements to take into account in generating and designing scenarios are:

- At least two scenarios are needed to reflect uncertainty; more than four has proven organisationally impractical.
- Each of the scenarios must be plausible. They must grow logically in a cause and effect way from the present to the future.
- They must be internally consistent. That means that events within a scenario must be related through cause/effect lines of arguments.
- They must be relevant to the issues of concern. They must provide useful, comprehensive and challenging idea generators and test

conditions against which future business ideas, strategies and direction can be evaluated.

- Each scenario must produce a new and original perspective.

The steps involved to generate and design scenarios are:

- **Develop a scenario matrix**: Select the most important clustered groupings or the most dominant trends as the structuring dimensions for the matrix. Another option is to identify two or three key structural variables or driving forces on the basis of which the scenarios will be distinguished from each other. Expressing each of these driving forces variables in terms of two opposite ways in which they could play out in the future will then create a 2 x 2 matrix indicating four scenario end states as candidates for the scenario sets. Distinguishing driving forces need to be recognised as having the most impact and least predictable.

- **Name each scenario**: This involves giving a clear distinctive name to each scenario generated.

- **Generate story lines**: A story for each scenario needs to be developed which describes how the end state is reached from the current state of affairs, through a series of events with one leading to another over time. A story line needs to be based on a cause and effect logic. An effective framework for developing story lines is to state:

  - starting conditions,
  - drivers (pressures to move in a certain direction),
  - implications,
  - the end state.

  The purpose is to create a number of internally consistent story lines. Appendix 2e provides the story line for each of the scenarios shown in Figure 18.

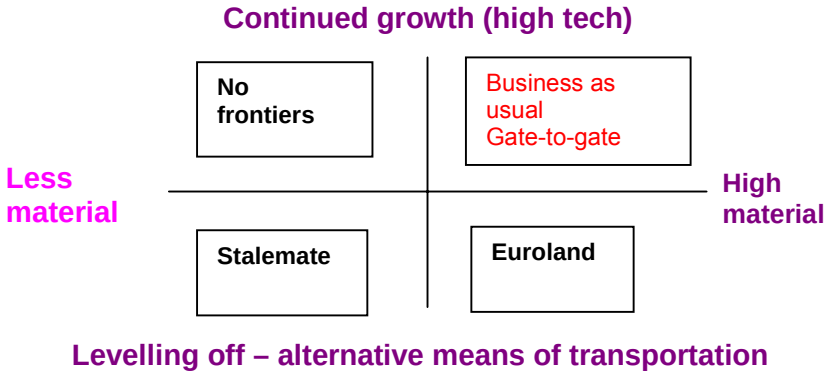

Figure 18: Scenario matrix

4.5.3 Output

A number of scenarios and their story lines about how the future may unfold over the fifteen-year timeframe which encompass the predetermined and uncertain forces facing the ANSP.

4.5.4 Associated appendices

Appendix 2a - Example of Setting the Scene – Response to questions

Appendix 2b – Example of Business Idea for Skycontrol

Appendix 2c – Assessment of Impact for ATCO Manpower Planning of future Challenges - Predetermined Forces

Appendix 2d - Uncertain Forces

Appendix 2e - Scenario Description

4.5.5 Time required

Manpower planner: Preparation and running the workshop requires an estimated three days.

Managers/experts: Preparation and attendance at future challenges workshop requires an estimated two to three days.

4.6 Stage 3: Identify the Long-term Impact

4.6.1 Objective

To identify the implications for ATCO MP of the scenarios generated in Stage 2 and gain a common understanding of the long-term impact for ATCO MP.

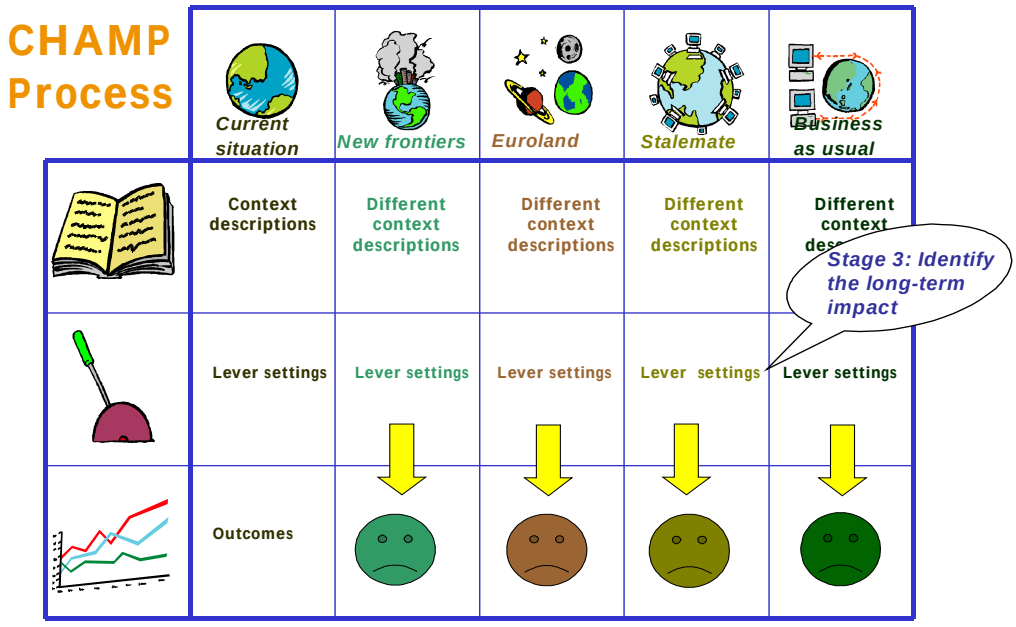

Figure 19: Stage 3: Identify the long-term impact

4.6.2 Process steps

This stage examines each of the scenarios and identifies using the LAMPS tool how each of the scenarios will impact ATCO MP. The key question to address at this stage for each of the scenarios is 'If this is what the world looks like, then what would the impact/implications be for ATCO MP?' The steps involved in this stage are as follows:

1) Assess the implications.
2) Prepare LAMPS.
3) Analyse results.
4) Draft report.
5) Brief participants.
6) Review meeting.

1) Assess the implications

This step involves defining the implications for ATCO MP. For each of the scenarios, if the levers (policies) remain at the actual settings as the 'current situation' will the outcome be good or bad. The implications need to be defined for the predetermined forces identified in Stage 2 which includes what variables will need to change in LAMPS, the level change and the date of effect (see Appendix 2c). Similarly, for the uncertain forces it is necessary to assess for each scenario generated in Stage 2 the implications for ATCO MP by identifying the variables changes for LAMPS, the level of the variable change and date of effect. Appendix 3a provides an example.

2) Prepare LAMPS

Preparing LAMPS involves making the relevant variable changes and creating new datasets for the predetermined forces and the scenarios generated in Stage 2. It involves changing the baseline dataset generated in Stage 2 and using the gaming functionality in LAMPS to make the variable changes which are relevant for each scenario at the relevant point in time over the fifteen-year timeframe.

3) Analyse results

Once the data is simulated in LAMPS, the next step is to analyse the results for key outcome (result) variables (e.g. ATCO margin and training utilisation, etc.) to assess the impact.

4) Draft report

Once the results are prepared for all the datasets, the next step is to draft a report explaining the outcomes (results). Appendix 3b provides an outline of the key elements for this report in relation to the case study. It is important to include in the report a comparison with the baseline of the 'current situation' agreed in Stage 1 of the CHAMP process.

5) Brief participants

Once the report is drafted, it is necessary to brief the participants and explain the following:

- recap on finding from Stage 2;
- explain the structure of the datasets representing the future challenges;
- explain the key findings for each of the datasets;
- explain difference to the baseline agreed at Stage 1;
- ask for initial impressions;
- preparation for review meeting.

6) Review meeting

The purpose of the review meeting is to review the impact of future challenges for ATCO MP and to arrive at a common understanding of the implications for ATCO MP for the predetermined forces and each of the scenarios generated. Key elements to discuss at this meeting are:

- the predetermined forces incorporation in LAMPS and their impact,
- changes made to LAMPS for each of the scenarios,
- outcomes and insights for each scenario.

4.6.3 Output

An assessment for ATCO MP of the impact of possible future challenges facing an ANSP.

4.6.4 Associated appendices

Appendix 3a - Implications of Uncertain Forces (Scenarios)

Appendix 3b - Report on the Long-term Impact for ATCO MP

4.6.5 Time required

Manpower planner: Preparation and running the review meeting requires an estimated five days.

Managers/experts: Preparation and attendance at the review meeting requires an estimated one day.

4.7 Stage 4: Devise Alternative Strategies

4.7.1 Objective

To identify ATCO MP strategic options for each of the scenarios generated and to investigate what policies need to be introduced to optimise the ATCO MP situation over the fifteen-year timeframe.

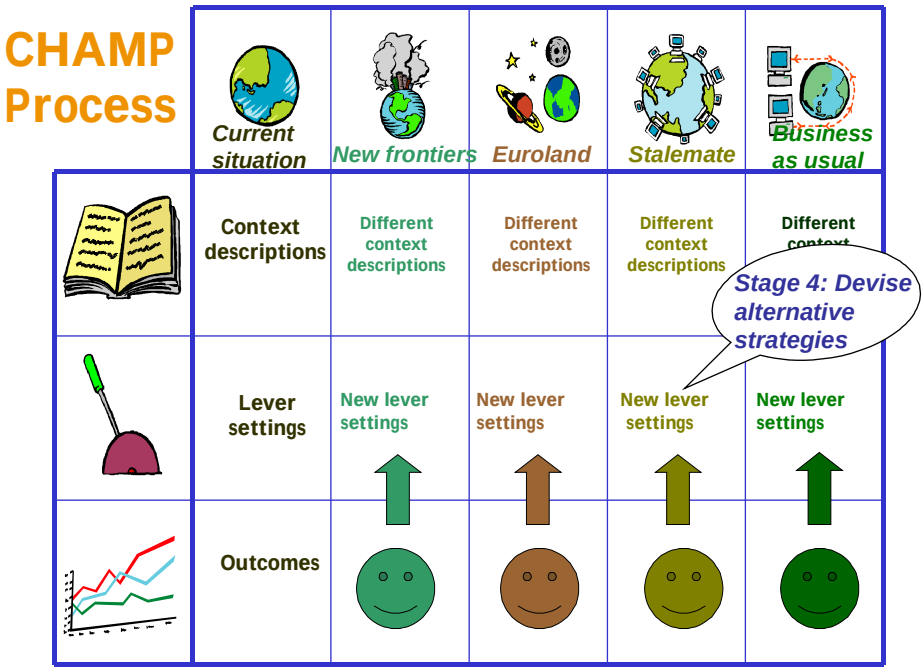

Figure 20: Stage 4: Devise alternative strategies

4.7.2 Process steps

The output for Stage 3 may have shown a positive or negative outcome for the ATCO Margin for the scenarios. The focus of this stage is on devising alternative ATCO MP strategies for each of the scenarios to achieve a smooth ATCO MP. In the context of the CHAMP process strategy is defined in terms of the target setting of all levers. Strategy is all about resetting levers.

In the case where the outcomes (i.e. ATCO margin) for a scenario with the levers set as the 'current situation' context are bad (i.e. a large ATCO shortage or surplus), the LAMPS tool can be used to 'reverse engineer' the lever settings (i.e. the policies). The task is to try and discover what the lever settings need to be to give a positive outcome. This may require setting the levers at very different levels to the current situation levels or indeed invoke totally new levers.

The steps involved are as follows:

1) Business idea comparison.
2) Assess implications for ATCO capability.
3) Assess implications for HR practices.
4) Experiment with LAMPS to optimise the ATCO margin.
5) Devise HR strategic options for scenarios.
6) Draft report.
7) Brief participants.
8) Review meeting.

1) Business idea comparison

To examine the effect that each scenario would have on the business idea generated in Stage 2 to see if the business idea will stand up across a range of future worlds. This comparison involves addressing three key questions:

- To what extent does the business idea continue to create value?
- Are there any threats to providing quality service and staff?
- What are the major challenges to the business idea?

From this analysis a conclusion will emerge on the resilience of the business idea against these uncertain futures (scenarios). Appendix 4a indicates for each scenario, the challenge to the business idea for the case study.

2) Assess implications for ATCO capability

The main issue to address here for each scenario is what are the ATCO capability and requirement to meet the challenges to the business idea. Appendix 4a indicates for each scenario, the ATCO capability for the case study.

3) Assess implications for HR practices

The next question to address is how can the HR practices be levered to create, reinforce and sustain ATCO capability and optimise the ATCO Margin. As shown in Figure 21 the impact for the HR practices can be assessed by considering the inflow, throughflow and outflow processes. Appendix 4a provides an example for the case study.

As well as identifying the numbers to be recruited and rated, it is also necessary to consider the skills mix of ATCOs, quality of staff and working conditions to consider how these elements will change over time.

4) Experiment with LAMPS to optimise the ATCO margin

Considering the output from Stage 3 on the long-term impact and the implications for the HR practices for each scenario, it is necessary to

address how could the outcomes (ATCO margin and training utilisation, etc.) be optimised. The ANSP will need to address the following:

- What response needs to be put in place to minimise peaks and dips in the ATCO Margin over the fifteen years?
- What constraints or improvements are needed for training capacity?
- What policy changes are required to working conditions, training utilisation, etc.?

This step involves experimenting with LAMPS to try and discover what the lever settings need to be to give a positive outcome. This may require setting the levers at very different levels to the 'current situation' levels or indeed invoke new levers totally.

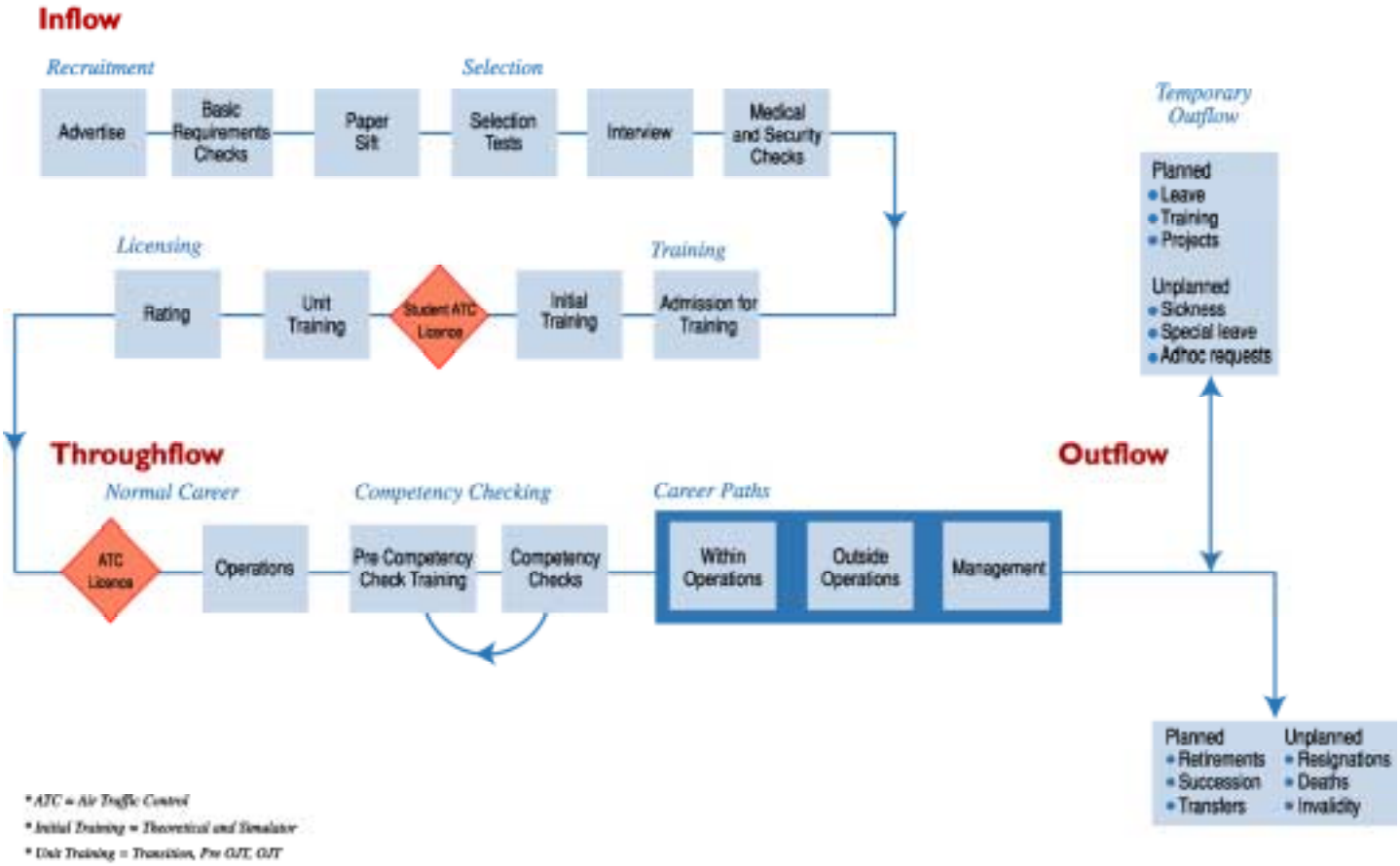

Figure 21: Inflow, throughflow, outflow – HR practices

5) Devise HR strategic options for scenarios

The results from experimenting with LAMPS to optimise the ATCO margin and the implications for the HR practices and lever settings will lead to the identification of HR strategic options for scenarios. The strategic options provide the direction for each of the HR practices. For example, how the ATCO job should be marketed, the number and type of people to be recruited, the success rate for training, duration, etc. Appendix 4b illustrates the HR strategic options for each of the scenarios generated for the case study.

6) Draft report

The next step is to prepare a report on the possible options to be reviewed and discussed by the CHAMP process team. The key elements of the report would include the following points for each of the scenarios:

- **operational requirement development:** Traffic volume, number of positions, traffic handling capability.
- **recruitment and selection:** Numbers to be recruited, marketing the ATCO job, improvements to the process in terms of quality and lead times.
- **institutional, OJT and simulator training:** Numbers in training, internal or external conversions, improvements to the process in terms of quality and lead times.
- **working conditions:** Part-time work, rostering and shift work, retirement policies, overtime utilisation.
- **licensing and competency checks:** Performance improvements, improvements to the process in terms of quality and lead times.
- **refresher training and leave and absences:** Leave and absences distribution and requirements for refresher training and changes to the skills mix.
- **salary costs and allowances:** The salary costs and allowances are expected to increase or decrease over time.

7) Brief participants

Brief participants on the content of the report. Participants should investigate for their areas of responsibility the implications.

8) Review meeting

The focus of this meeting is to gather feedback on the ATCO HR strategic options report. It is also necessary to discuss and include any fresh information brought forward by participants and to arrive at a common understanding for the ATCO HR strategic options for the scenarios.

4.7.2 Output

Strategic options for ATCO MP related to the scenarios generated and a common understanding on each strategic option.

4.7.3 Associated appendices

Appendix 4a – Assessment of Scenario Implications for ATCO MP

Appendix 4b – ATCO HR Strategic Options for Scenarios

4.7.4 Time required

Manpower planner: Preparation and running the strategic option workshop/meeting requires an estimated five to ten days.

Managers/experts: Preparation and attendance at review meeting requires an estimated two days.

4.8 Stage 5: Evaluate Strategies

4.8.1 Objective

To assess ATCO HR strategic options devised for each scenario in Stage 4 and identify the ATCO HR strategic direction which best fits the ANSP for the longer term.

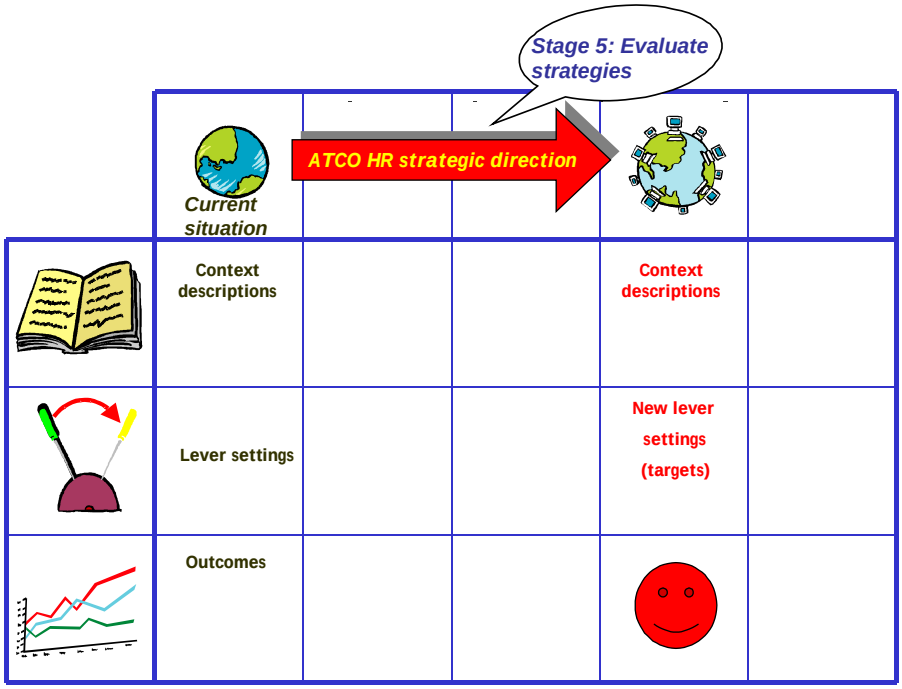

Figure 22: Stage 5: Evaluate strategies

4.8.2 Process steps

Having identified the HR strategic options for ATCO MP in Stage 4, the next step is to assess and identify the ATCO HR strategic direction for the longer term. The focus at this stage is that all strategic options need to be assessed for all scenarios before a judgement of relative value can be made. The temptation is to develop preferences for specific scenarios. This should be avoided. The steps involved are:

1) Identify evaluation criteria.
2) Evaluate strategic options.
3) Identify ATCO HR strategic direction.
4) Prepare report.
5) Brief participants.
6) Review meeting.

1) Identify evaluation criteria

It is necessary to identify what criteria to assess the ATCO HR strategic options and its impact for the ANSP in providing an efficient and safe ATS. For example the evaluation criteria could include:

- Cost and financial performance.
- Risk.
- Strategic fit: How does the option fit with ANSP business strategy and exploiting existing distinctive competencies, e.g. training utilisation? Unrealistic expectations in this area have a significantly lower potential for success.
- Cultural fit: A strategic option aiming to make significant changes in the area of organisation culture faces major obstacles as the corporate culture is one of the most stable characteristics of an organisation.

2) Evaluate strategic options

The objective of this step is not primarily to decide between acceptance and rejection but to work on each strategic option and change its component mix until the choices across the decision criteria become clear. This may also include building increased flexibility into the strategic option to reduce the risk factor.

It involves an ongoing search for options that are most robust across the scenarios. This involves identifying to identify what group of lever settings that are the same or closely so across all scenarios. This implies that if the levers are set to those values the future might evolve in a wide variety of different ways but the ANSP is still relatively secure.

3) Identify ATCO HR strategic direction

Taking into account the whole portfolio of ATCO HR strategic options will help to build the list of options gradually into an overall strategic direction. The process needs to continue until a small number of fundamentally different strategic directions are left to choose from in terms of:

- robust: performs well over a range of scenarios;
- flexible: keep options open for as long as possible;
- multiple coverage: pursue multiple strategies simultaneously until the future becomes clear.

4) Prepare report

This report should indicate the following:

- assessment of the scenario/HR strategic options evaluation;

- recommendation for ATCO HR strategic direction.

Appendix 5 outlines the key elements for the ATCO HR strategic options report.

5) Brief participants

Brief participants on the content of the report and to prepare for the meeting by reviewing the report and reflecting on any ideas which may need to be brought forward at the review meeting.

6) Review meeting

The focus of this meeting is to gather feedback on the ATCO HR strategic options evaluation report.

4.8.3 Output

Agreed evaluation of the ATCO strategic options for each of the scenarios and identification of an ATCO HR strategic direction.

4.8.4 Associated appendix

Appendix 5 - Key Elements of ATCO HR Strategic Options Evaluation Report

4.8.5 Time required

Manpower planner: Preparation and running the review meeting requires an estimated five days.

Managers/experts: Preparation and attendance at review meeting requires an estimated two days.

4.9 Stage 6: Decide on Actions Needed

4.9.1 Objective

To decide what actions are needed for ATCO MP for the short, medium and long-term and when/how this process needs to be repeated, evaluated and monitored.

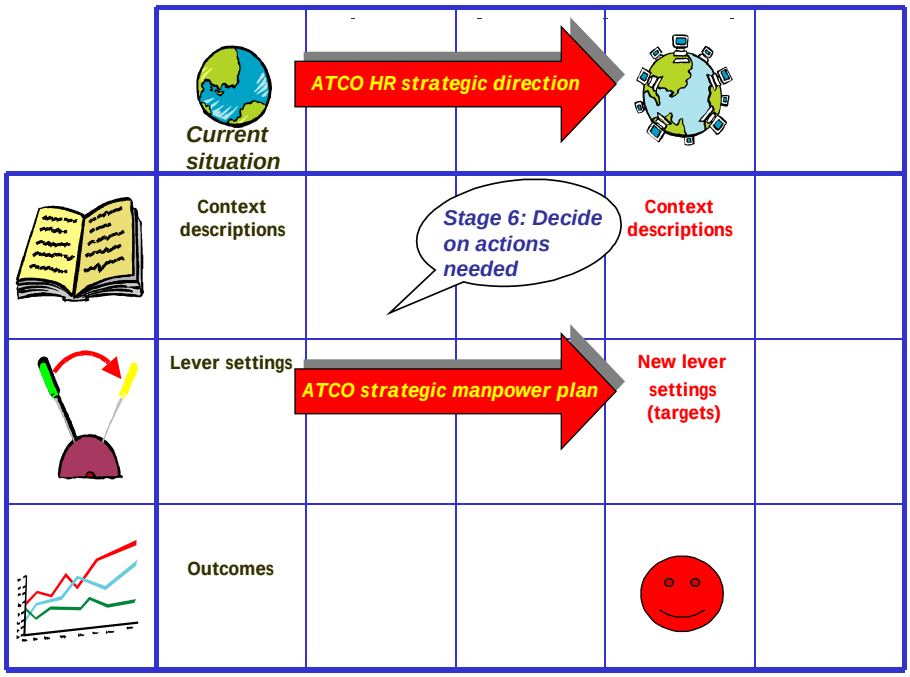

Figure 23: Stage 6: Decide on actions needed

4.9.2 Process steps

Deciding on actions needed involves devising an ATCO strategic (long-term) manpower plan. This plan provides the framework of activities or tasks for the accomplishment of the ATCO HR strategic direction identified in Stage 5. The steps involved are:

1) Draw up action plan(s) and tasks.
2) Identify the risks.
3) Identify the controls for the plan(s).
4) Monitoring and feedback.

1) Draw up action plan(s) and tasks

- **Name the plan(s):** Identify the high-level tasks for which you are writing the plan and who has total accountability, e.g. ATCO marketing and awareness plan, recruitment and selection plan, training plan, etc.

- **Establish the expected outcome or objectives for the plan(s):** Identify the results that you wish to achieve in taking this action. What are the different results we are trying to achieve with this action?

- **List the tasks:** Identify all the tasks or activities associated with the plan. These can be brainstormed then reworked until they reflect the entire project activity.

- **Sequence the tasks:** Next, set the activities in draft order of occurrence. Some tasks will be sequential, i.e. they happen one after the other. Others will be concurrent, i.e. they happen at the same time.

2) Identify the risks

Identify any potential problems or risks associated with any of the activities.

- **Assess the risk:** The potential problems/risks will not be of equal importance. Using a high/medium/low scale, assess each risk in terms of its probability of occurrence and its seriousness if it were to occur.

- **Identify likely causes:** For those risks with the most significant probability and seriousness, identify the most likely reason for the existence of the risk.

- **Set preventive actions:** For each cause, determine actions that would prevent the problem for occurring. Build all the action back into your sequence of activities.

- **Set contingent actions:** For each cause, set an action that will minimise the effects of the problem should preventive action fail.

- **Set triggers for contingent actions:** Identify an indicator that will clearly tell you when to engage the contingent action(s).

3) Identify the controls for the plan(s)

Controls are those benchmarks by which progress in the action plan(s) can be measured. They typically identify who is accountable for each action as well as the deadlines (the latest possible date of

accomplishment) and milestones (the check-in dates, etc.). Costs should also be identified.

4) Monitoring and feedback

The CHAMP process has provided insight as to the external conditions which will impact ATCO MP. As the future evolves for real, an ANSP needs to track what is happening in the external environment to ensure that the ANSP gets as early a warning as possible as to whether the conditions are evolving favourably or not. If things are not favourable then maybe the ATCO strategic manpower plan has to be reconsidered. Progress should be appraised on a continuous basis and control action should be exercised if unexpected deviations occur. There are two aspects to monitoring which include:

- **The actions plan(s):** to ensure that it is/they iare on track and being accomplished within budget and timeframe.

- **The early external indicators:** these are the factors in the outside world that need to be watched carefully to see if they have an impact on the scenarios. These early indicators could include:
  - airline concentration,
  - cheap airlines,
  - young people and their behaviour,
  - social trends: women working, people retiring, shift working,
  - demand for traffic,
  - attitude to air travel by public,
  - political mindset to aviation,
  - investments in environmental technology,
  - developments in alternative transportation,
  - economic growth and cost of living factors.

4.9.3 Output

An integrated ATCO HR strategic manpower plan.

4.9.4 Associated appendix

Appendix 6: Action HR Strategic Manpower Plan Template

4.9.5 Time required

Manpower planner: Preparation and running the action planning workshop requires an estimated five days.

Managers/experts: Preparation and attendance action planning workshop requires an estimated two days.

5. CONCLUSION

The LAMPS tool provides a platform to examine how the various factors influencing ATCO MP interact over time and to understand how the factors behave in response to changing circumstances. This tool enables 'modelling and simulating for learning'. The aim of the CHAMP process is to provide a framework to aid the application of the LAMPS tool in an ANSP to realise the maximum benefits of the LAMPS tool providing a 'modelling and simulation for learning' platform. This involves the development of an environment where all the players in the ATCO MP process work together to find the optimum solutions and avoid isolated solutions been taken.

This description of the CHAMP process should be seen as a guide to aid the application of the LAMPS tool in an ANSP. Depending how mature and sophisticated an ANSP's long-term planning process is, an ANSP may decide to select a number of stages to integrate into an existing process and revamp various stages to reflect their own organisational requirements. In addition, this deliverable provides the basis for the advanced training on the LAMPS tool (i.e. CHAMP2).

Perhaps, first impressions are that the CHAMP process is quite elaborate and extensive. Indeed, setting up a CHAMP process team and running the CHAMP process for the first time will require time and effort in working through the six stages using the LAMPS tool. However, once the CHAMP process is in place, the time and effort required should be considerably reduced as some stages may be merged (as appropriate) and only revisited as need be.

The key benefits of introducing the LAMPS/CHAMP approach in an ANSP is that it provides a framework to recognise signs of changes and evaluate their impacts for ATCO MP. This in the longer term should lead to improved decision-making on ATCO MP issues and which should alleviate experiencing peaks and dips in the number of ATCOs available and required.

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ANNEX: CASE STUDY

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Appendix 1a

LAMPS Data Preparation Template

Skycontrol is a fictitious ANSP in Northern Europe. It operates an air traffic control centre, an international airport and one regional airport. The data provided is for the period beginning January 2002.

Model Configuration Screen 1: Sector and Manpower Initialisation

Variable Name	Units	Data for LAMPS	Comments
Annual Traffic Growth	%	S1 = 7 S2 = 7 S3 = 5 S4 = 5	
Traffic Handling Capability	Aircraft per hour per sector group	S1 = 89.42 S2 = 86.66 S3 = 58.33 S4 = 30	
Traffic in Sector Group	% of traffic per sector	S1 = 50 S2 = 45 S3 = 31 S4 = 10	
Operational Daily Hours	Number of hours sector is open during a 24-hour period	S1 = 154.5 S2 = 164 S3 = 166 S4 = 34	S1-3 provide 24-hour service S4 is open from 7.00 to 13.00
Seasonality Table	% increase/decrease in traffic per month over a year	Jan = .88; Feb = .84; Mar = .96; Apr = .97 May = 1.06; June = 1.07; July = 1.10; Aug = 1.10; Sept = 1.08; Oct = 1.08 Nov = .95; Dec = .91	
Number of Sector Groups in Use	Number	4	S1 = upper S2 = Lower S3 = TMA International S4 = TMA Regional
Initial Monthly traffic all Sectors	Number of flights per month for centre	84000	
Starting Month	Month	January	
Starting Year	Year	2002	
Number of ATCOs	Number of male and female ATCOs per age category	S1 Male 20s = 9; 30s = 20; 40s = 10; 50s = 7 S1 Female 20s = 5 ; 30s = 4	

Variable Name	Units	Data for LAMPS	Comments
		S2 Male 20s = 7; 30s = 20; 40s = 2; 50s = 14 S2 Female 20s = 12; 30s = 7 S3 Male 20s = 10; 30s = 10; 40s = 4 S3 Female 20s = 5; 30s = 5; 40s = 4; 50s = 6 S4 Male 20s = 3; 30s = 3; 40s = 3;50s = 2 S4 Female 20s = 2; 30s = 2	
Manning Threshold	Weight greater than 1	S1 = 3 S2 = 2 S3 = 3 S4 = 4	
Average Retirement Age	Years	55	
Average Qualification Age	Years	25	
Percentage of New Male ATCOs	% per year	70	
Monthly Outflow Estimate	% per month	.05	

Model Configuration Screen 2: Rostering / Leave and Absences

Variable Name	Units	Data For LAMPS	Comments
Roster Cycle Length	Number of days per roster cycle	8	
Days Worked	Days per roster cycle	5	
Working Hours	Hours per week	35	
Time Leakage	% per month	10	
Break Time	% per day	22	
Supervisor Hours	Hours per 24-hour period	20	
New Working Hours	Hours per week	0	
Time New Working Hours	Number of months	0	
Overtime Limit	% per week	20	
Average Holidays	Days per year	46	
Average Training Days	Days per year	6	
Average Project Days	Days per year	7	

Variable Name	Units	Data For LAMPS	Comments
Average Sickness Days	Days per year	4	
Sickness Factor	% time per age category per year	20s = .80 30s = .90 40s = 1.00 50s = 1.40	

Model Configuration Screen 3: Leave / Absence / Maternity/Paternity Leave

Variable Name	Units	Data for LAMPS	Comments
Holidays	Weighting factor per month over 12 months	Jan = 5; Feb = 2; Mar = 5; Apr = 5; May = 10; Jun = 10; Jul = 10; Aug = 10; Sep = 10; Oct = 10; Nov = 2; Dec = 5	
Training	Weighting factor per month over 12 months	Jan = 5; Feb = 10; Mar = 5; Apr = 5; May = 0; Jun = 0; Jul = 0; Au = 0; Sep = 0; Oct = 5; Nov = 10; Dec = 5	
Sickness	Weighting factor per month over 12 months	Jan = 15; Feb = 15; Mar = 10; Apr = 5; May = 5; Jun = 5; Jul = 5; Aug = 5; Sep = 5; Oct = 5; Nov = 10; Dec = 15	
Maternity Leave Duration	Number of months	5	
Paternity Leave Duration	Number of months	0	
ATCOs on Maternity Leave	Number of female ATCOs	S1 = 3 = 30s	
ATCOs on Paternity Leave	Number of male ATCOs	0	
Births in Age Range	% of births expected by ATCOs for different age categories	M ale Female 20s .20 0 30s .60 1.0 40s .30 .20 50s .20 0	
Resignation after Maternity Leave	%	2	
Resignation after Paternity Leave	%	0	
ATCOs working Part Time	%	13%	Females in their 30s
Part-time Hours	% of week	50	

Model Configuration Screen 4: Institutional Training and OJT

Variable Name	Units	Data for LAMPS	Comments
Ab Initios in Training	Number in each phase	P1 = 10 P2 = 8	2 phases
Training Phase Completion	Number of months	P1 = 2 P2 = 2	
Training Duration	Number of months	P1 = 3 P2 = 6	
Training Success Rate	%	P1 = 85 P2 = 80	
Months between Intakes	Number of months	5	
Number of Training Places	Maximum number of places	10	
Ab Initios in OJT	Number	S1 = 2 S2 = 2 S3 = 1 S4 = 1	
OJT Positions	Maximum number	S1 = 4 S2 = 4 S3 = 3 S4 = 1	
OJT Duration	Number of months	18	
OJT Success Rate	%	85	
Ab Initios Awaiting OJT	Number	0	
Time Left in OJT	Number of months	8	

Model Configuration Screen 5: Pre-OJT and Conversion

Variable Name	Units	Data in LAMPS	Comments
Ab Initios in Pre-OJT	Number per sector group	S1 = 2 S2 = 2 S3 = 1 S4 = 1	
Pre-OJT Duration	Months	3	
Pre-OJT Success Rate	%	80	
Simulator Positions	Positions	10	
Time Left in Pre-OJT	Months	2	
Awaiting Pre-OJT	Number of *ab initios*	0	
Conversion Training	Number of ATCOs	0	
Pre-OJCT Duration	Months	N/A	

Model Configuration Screen 6: Costs

Variable Name	Units	Data in LAMPS	Comments
Employment Cost per ATCO	Month per age category	20s = 4000 30s = 5000 40s = 6000 50s = 7000	EUR is the currency
Annual Salary Increase	% of annual salary	2	
Overtime Premium	Per hour	30	
Employment Cost in Training Phase	Salary per month	P1 = 2000 P2 = 2500	
Allowances in Training Phase	Per phase	500	
OJT Employment Cost	Salary per month	3500	
OJT Allowances	Month	250	
Fixed Cost of application	Month	20000	
Variable Cost of Application	Month	100	
Success Rate of Application	%	10	
Fixed Cost of Selection	Month	40000	
Variable Cost of Selection	Month	300	
Success Rate of Selection	%	5	
Value of a Flight	Cost of cancelling a flight	1570	
Delay Cost	Cost per minute of delay by airline	21.2	

Model Configuration Screen 7: Delay and Unaccommodated Demand – Not Completed

Variable Name	Units	Data in LAMPS	Comments
Delay per movement	Table – demand capacity ratio		
Unaccommodated Demand	Demand capacity ration and % of flights that are unaccommodated		
XLS to VDF Conversion	- Retirement - Transfers - Traffic growth		

Switches

Switch Name	LAMPS	Comments
Recruitment Switch		
Manning Switch	On – operational hours	
Traffic Seasonality Switch		
Intake Switch	On	

Dataset Reference : _Skycontrol
Dataset Saved : _____
Date of Data Configuration : __January 2002

Appendix 1b

Report on Baseline Results – 'Current Situation'

Introduction

Data related to ATCO manpower planning for Skycontrol has been configured in the LAMPS tool and has been simulated over a fifteen-year timeframe starting from January 2002. The simulation starts at the 1st January 2002 and runs for 180 months (fifteen years), i.e. until 31 December 2016. The results show information related to a baseline which represents the 'current situation' over the fifteen years based on the following key assumptions:

- annual traffic growth of 5% for Sector Groups 3 and 4 and 7% for Sector Groups 1 and 2;
- traffic handling capability of:
  - 89,42 movements/hour for Sector Group 1,
  - 86,66 movements/hour for Sector Group 2,
  - 58,33 movements/hour for Sector Group 3,
  - 30 movements/hour for Sector Group 4;
- average retirement age of 55 years;
- average qualification of 25 years;
- a roster cycle of eight days with five days on and three days off;
- statutory working hours per week – 35 hours;
- ten places are available for each intake of academy training;
- period between intakes is five months;
- it is possible for twelve people to receive simulator training per month;
- four Sector Groups are in use and four people can receive OJT in Sector Group 1, four in Sector Group 2, three in Sector Group 3, four in Sector Group 4;
- monthly traffic is 84000 flights per the four Sector Groups.

Baseline results

The results are shown for the following key outcome variables for Skycontrol:

- ATCO margin – whether there is a shortage or surplus of ATCOs over the fifteen-year period;
- the utilisation of institutional training places;
- the utilisation of simulator possibilities;
- the utilisation of OJT possibilities.

These results provide long-term indicators if no improvements and changes occur for Skycontrol over this timeframe.

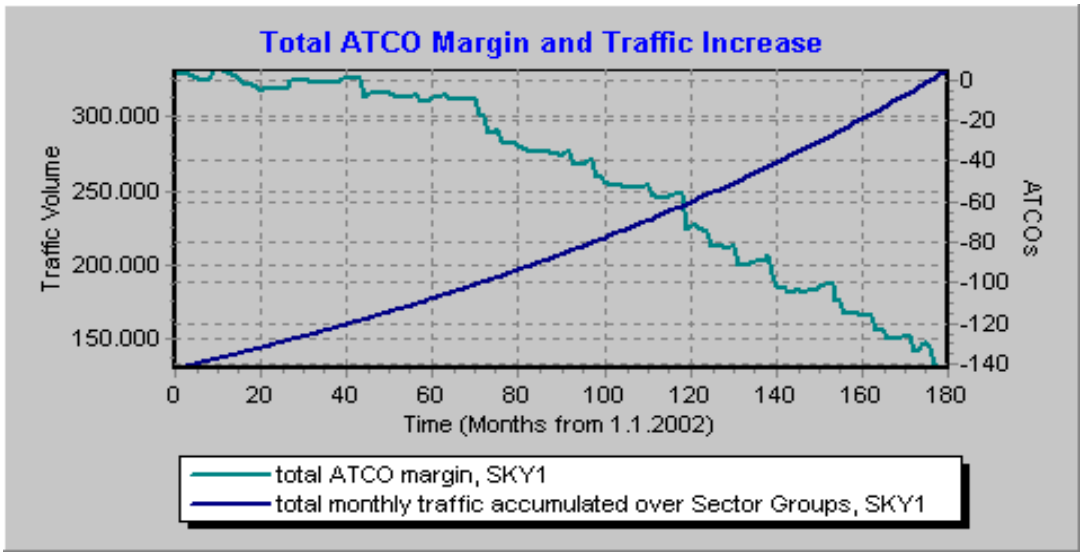
Note on changes to the Operational Requirement (OR)

By definition a shortage situation will be shown over time, as the OR in terms of sector group opening hours is adjusted during simulation to cope with increased traffic demand, as shown by the 'sudden' drop in the ATCO margin. The variable 'extra manning requirement[Sector Group]' indicates when adjustments to the OR have to be done. The data input to be changed is related to the variable titled 'traffic handling capability'.

For the purpose of this stage of the exercise no change has been made to the variable 'traffic handling capability'. At Stage 3 of the CHAMP process changes in relation to this variable are incorporated.

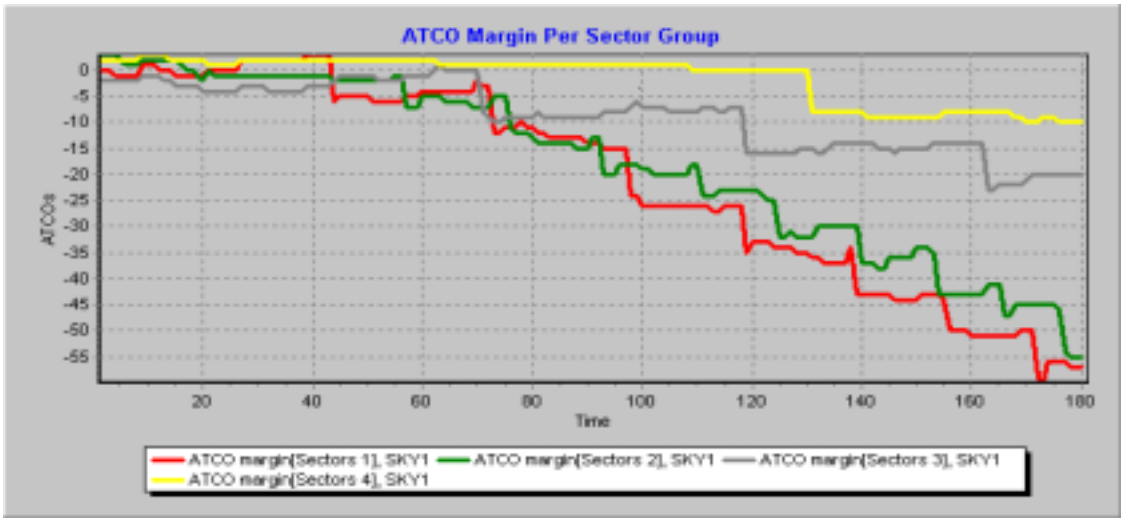
ATCO margin

The following graphs show how the ATCO Margin changes over the fifteen years. The margin is the difference between the number of ATCOs employed and the number of ATCOs required to handle the traffic volume. It becomes negative when there is a shortage. The ATCO Margin has been aggregated across the four sector groups. The results show that the number of ATCOs employed meets the requirement for the first forty months of the simulation (until April 2005) and that a shortage develops which increases as the traffic volume grows.



ATCO margin per sector group

The following graph shows the results of the ATCO margin per sector group. It is interesting to see if a shortage exists in all sector groups over the fifteen-year timeframe. Depending on Skycontrol policy of internal conversion training, it may be possible to transfer ATCOs from one sector to another to alleviate the shortage.



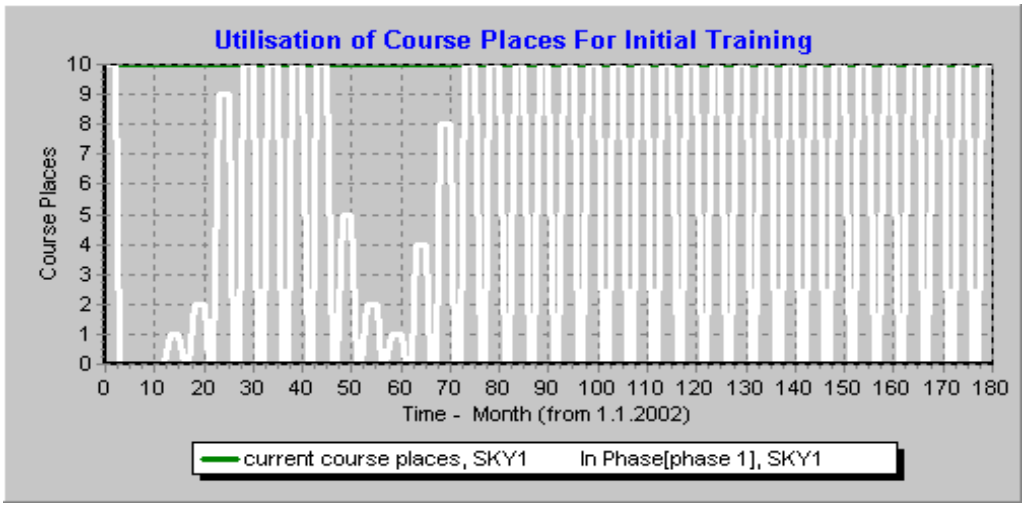
The results show that:

- Sector Group 1 currently experiences a shortage which improves in month 30 (trainees qualifying); however, the ATCO margin dips into a growing shortage from month 45 onwards;
- Sector Group 2 starts off with a slight surplus and then as of month 60 (2007) runs into a growing shortage situation;
- Sector Group 3 is currently in a shortage situation, recovering in month 60 for a couple of months and then dips into a shortage situation of ten to fifteen ATCOs;
- for Sector Group 4 the number of ATCOs employed meets the number of ATCOs required up until month 120 and then dips into a shortage of around ten ATCOs until month 150.

It is apparent that Skycontrol's long-term shortage cannot be solved by internal conversions. As traffic grows, the ATCO shortage may arise because of the number of *ab initios* entering academy training is restricted by the number of training places available or because of insufficient simulator possibilities and OJT places are limited. Next it is necessary to look at training utilisation for the academy, simulator and OJT over the fifteen years.

Institutional course places utilisation

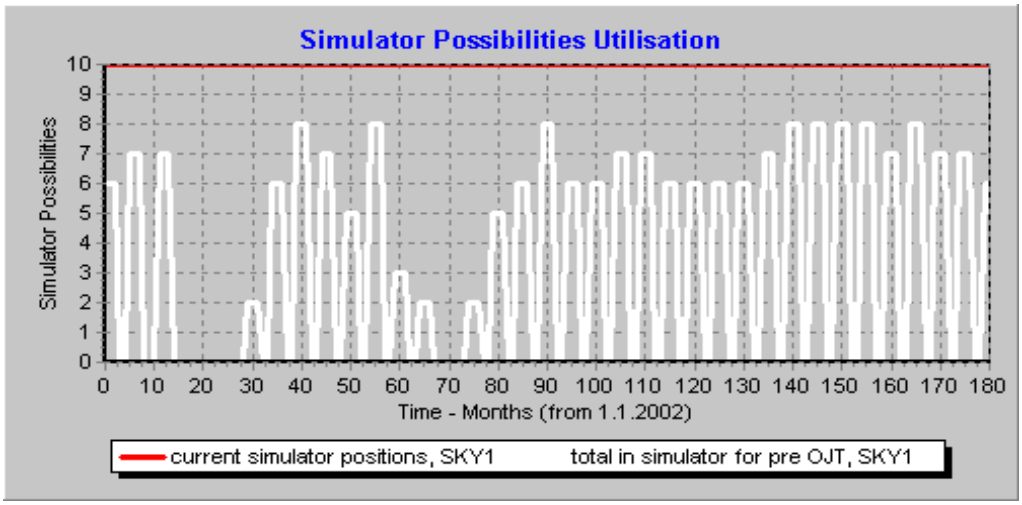
The next graph shows the number of places offered in initial training that are filled. There are ten places available for initial training. Considering that there is a five-month gap between intakes, the graph shows that there are possibilities between months 10 and 30 and between months 50 and 70 to increase intake. The initial training success rates are 85% and 80%, respectively in Phases 1 and 2. Skycontrol may also need to consider measures to improve the training success rates.



Simulator utilisation

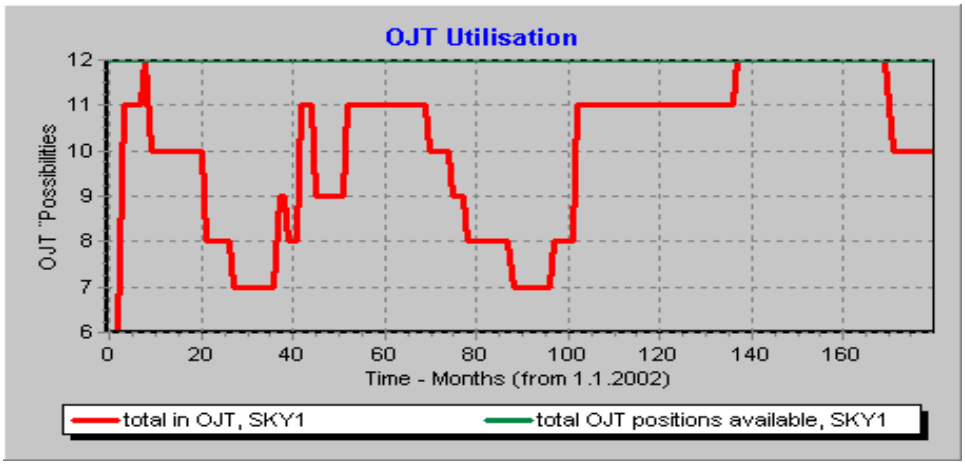
Even if improvements are made in initial training or more intakes take place, the future ATCO shortage may still exist and may occur later in the simulation time period. The following graph shows how simulator possibilities are utilised over the fifteen-year period.

There are ten simulator possibilities and the result shows that they have not been fully utilised over the fifteen years. It would be interesting to see what the impact would be if the success rates in initial training would be improved.



OJT utilisation

The following graph shows how OJT possibilities are utilised. The graph shows that twelve OJT possibilities exist. This number of OJT possibilities seems to be adequate as they are not fully utilised until month 140. Opportunities may exist here also for improvement.



Conclusion

The baseline results of Skycontrol show at present that the number of ATCOs employed meets the number of ATCOs required until month 40 (2005). If the policy settings (lever settings) stay the same over the fifteen-year timeframe, from month 40 there is growing shortage in line with increased traffic until the end of the simulation. From looking at the outcomes for initial training, OJT and simulator possibilities, improvement measures could be derived, e.g. to improve the success rates as a measure to maximise utilisation of OJT and simulator possibilities.

As well as looking at measures to improve the internal training process, it is also necessary to identify the future challenges facing Skycontrol both predetermined, i.e. technological improvements, traffic growth, working conditions changes, etc., to see what their impacts on the ATCO margin and training utilisation. This is covered in Stage 2 of the CHAMP process.

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Appendix 2a

Example of Setting the Scene - Response to questions

Oracle

- What will the job of the ATCO be?
- What will air traffic look like (size, type of aircraft, frequency)?
- What influence will technology have on the ATCO job?
- Will ATC be managed by one organisation or regionally?
- What societal changes will there be - working hours, etc.?

Culture

- Management and controllers (them and us)
- ATCO attitude
- Bureaucracy – everything takes too long – inflexible
- Action orientated
- Risk avoiding
- Management cost driven versus safety

Good World

- No delays caused by ATC
- No shortage of ATCOs
- Cope with traffic demanded
- More production – more income
- Job is attractive
- State of the art technology / working environment
- Air travel is safe (perception)

Bad World

- Increase in accidents – unsafe, declining air traffic
- Systems failure – technology
- Mobility is declining
- Unions and management relations escalates
- Job is unattractive
- Legal consequences

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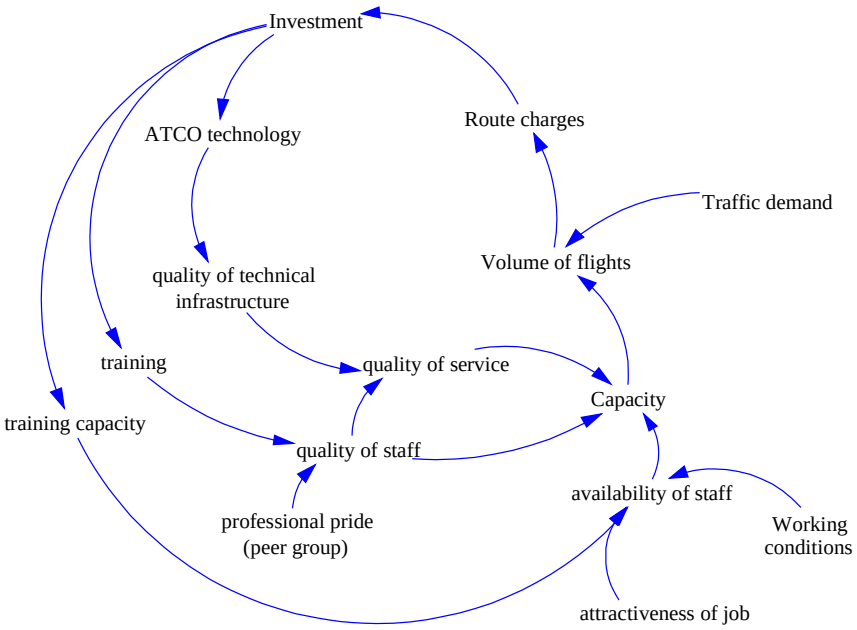
Appendix 2b

Example of Business Idea for Skycontrol



The societal/customer value created

The need to travel by air, and to get to destinations safely and on time or minimum delay.

The nature of the competitive advantage exploited

The purpose of the Air Navigation Service Provider (ANSP) is to offer a safe and reliable air traffic service by maximising the number of flights that can be handled, and thus increasing capacity.

The distinctive competencies

- Training delivery and capacity
- Quality staff
- Quality service
- Quality of technical infrastructure

Positive feedback loop driving growth

Increased air traffic demand means more flights to be handled, which leads to more route charges. An increase in the amount of money received through route charges leads to increased investment in technology improvements, training processes and training capacity. This in turn leads to quality service and staff to meet capacity demands. Increased training capacity also means more people available to do the job. The availability of staff depends on the working conditions and the attractiveness of the job.

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Appendix 2c

Assessment of Impact for ATCO Manpower Planning of Future Challenges

Predetermined Forces

Predetermined force Change expected	Description	When it is expected to take effect (different options could be considered here)	What and how is it going to impact ATCO MP?	What variables will it impact in LAMPS?	What is the level of the variable change to be implemented in LAMPS (different options could be considered here)
RVSM	RVSM Expected to be implemented on 24 Jan 2002	24 Jan 2002	Traffic handling capability of controllers, i.e. controllers will be able to handle more traffic for Sectors 1 & 2	Traffic handling capability	Month 1 – Increase traffic handling capability by 10% for S1 & S2 S1 = 98.36 & S2 = 95.26
Move to new OPSroom	The move to new OPSroom for en- route control, i.e. Sectors 1 & 2 will lead to 4 new working positions	Jan 2003	Traffic handling capability OJT possibilities		Month 13 – Increase traffic handling capability by 10% for S1 & S2 S1 = 108.20 & S2 = 104.79 OJT possibilities – Increase by 2 for S1 & S2 S1 = 6 & S2 = 6

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Appendix 2d

Uncertain Forces

Traffic dynamics (traffic volume and technology)

- Fuel supply
- Environmental constraints
- Alternative means of transport

Airspace constraints (European or regional)

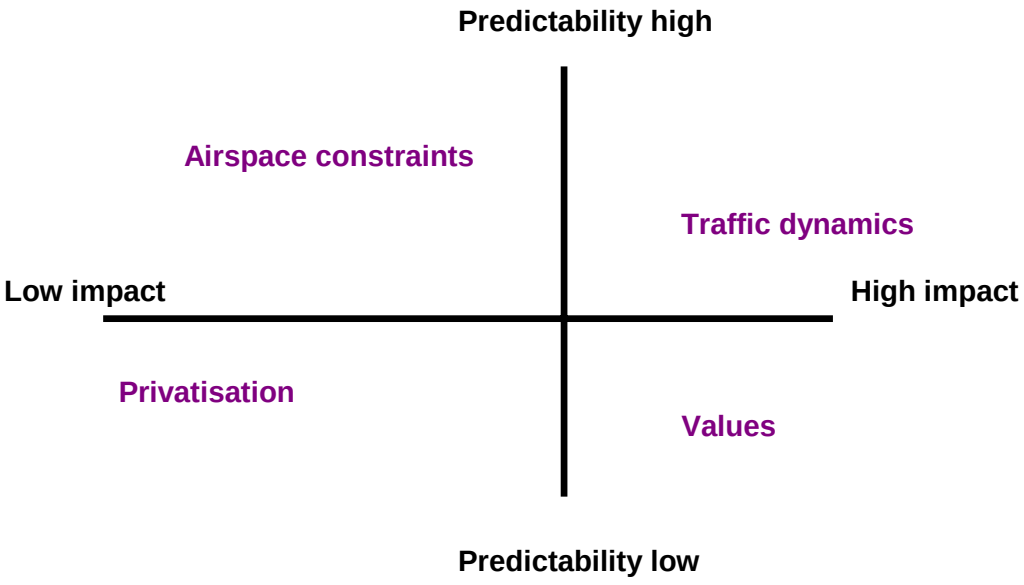
- Reduction of military airspace
- Liberation of airspace

Privatisation (complete privatisation or corporisation)

- Privatisation of ATC
- Relationship with Regulator

Values (down shifting or individual money machine 24/7)

- Less material values



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Appendix 2e

Scenario Description

2002 _____2017

Starting Conditions	Drivers	Implications	End State

Scenario 'No Frontiers'

Technology and operational procedure improvements

The current state is that there is continuous development in improving technology and operational procedures to safely increase capacity. A driver is the increased demand by airlines and the travelling public to travel by air. However, the speed of implementation of technology and operational procedure improvements is inherently slow because of the conservative nature of users (ATCOs), the testing required for safety/quality reasons and the consensus that needs to be reached with States to implement new technology. The end state is that currently planned technology and operational procedure improvements (i.e. 2002 to 2006) are attained by 2017. Traffic demand doubles (from the 2002 traffic volume) by 2015. The result is that these planned technology and operational procedure improvements will increase capacity to meet this demand.

Investment in technology for environment and fuel efficiency

Growing concern from the public about the environmental consequences related to air traffic, leads to severe constraints on expansion. An increase in the investment in technology to reduce aeroplane noise, increase fuel efficiency of aircraft and reduce carbon dioxide levels. As governments want to ensure continued economic growth and attractiveness to their countries they will subside either directly or indirectly this investment in the future.

Liberation

Currently we are in a fragmented situation with most States having autonomy over their individual airspace. There is growing political pressure with the 'single sky' to move to reduce the number of ACCs and to move towards a regionalised framework. For example, by 2017 the CEATS UAC would be in operation and possibly a Scandinavian UAC. Also military use of airspace would be on a need to use basis. In combination with the planned technology and operational procedure improvements, liberation will increase capacity to meet this demand.

Values in society

Currently individuals in society are struggling to balance working life, material values, family life, and free time. Money is a key driver to satisfy individual needs and wants. The number of working people in society will spend money on travel to achieve this balance is still growing. In addition, the number of people retiring is increasing, and these have money to

spend on travel and leisure. The implications are that money continues to be a key driver to satisfy the need for a balanced and quality life for pleasure, family needs and to alleviate the growing stress in this society.

Economic costs – route charges/airfares

- Investment costs will be high.
- High income from route charges because of increased demand/capacity which helps to fund the investment in the technology improvements for ACC and airport capacity improvements.
- The route charges themselves will probably increase in line with inflation.
- Airfares will follow the normal pattern, increased passengers may lead to lower or maintaining airfare levels.
- Economy of scales through consolidation of airline industry and the increase of 'no frill' airlines.

2002 _____2017

Starting Conditions	Drivers	Implications	End State

Scenario 'Stalemate'

Technology and operational procedure improvements

Currently there is a continuous development in improving technology and operational procedures to safely increase capacity. We can expect demand by airlines to level off because the travelling public is making greater use of alternative means of transport, e.g. fast trains, and the airline industry is increasingly sensitive to dramatic events and is seen as a polluter of the environment. Air travel becomes an expensive means of transport as governments put environmental taxes on fuel. People only fly if it is a necessity. This results in reduced investment in technology and operational improvements for ACC and in airport infrastructure. Investment is mainly for safety and maintenance improvements but not towards measures to increase capacity. The end state is a levelling off of traffic growth from 2009. Thus currently planned and decided on technology and operational procedure improvements geared towards safety measures (i.e. 2002/2004) are attained by 2017. Demand levels off from 2009 to 2015, which may result in underutilisation of capacity, which improves safety.

Investment in technology for environment and fuel efficiency

Currently, there is a growing concern from the public about the environmental consequences related to air traffic. Increased investment in technology to reduce aeroplane noise and increase fuel efficiency in aircraft and reduce carbon dioxide levels. As governments want to ensure continued economic growth and attractiveness to their countries, they consider investment in alternative transportation as being a more environmentally friendly. They tax heavily air transport and provide subsidies to companies investing in environmentally friendly air travel.

Liberation

Currently we are in a fragmented situation with most States having autonomy over their individual airspace. There is political pressure with the 'single sky' to move to reduce the number of ACCs and to go towards a regionalised framework. For example, by 2017 the CEATS UAC would be in operation and possibly a Scandinavian UAC. Also military use of airspace would be on a need to use basis. This pressure will be at a reduced pace.

Values in society

Currently individuals in society are struggling to balance working life, material values, family life, and free time. Money is a key driver to satisfy individual needs and wants. The number of working people in society who will spend money more selectively on alternative travel to achieve this balance or on other alternatives then travelling is growing. In addition, the number of people retiring is increasing, and these have money to spend on travel and

leisure. The implications are that money continues to be a key driver to satisfy the need for a balanced and quality life for pleasure and family needs and to alleviate the growing stress in this society.

Economic costs – route charges/airfares

- Investment costs will level off or decrease.
- Levelling off or decrease of income from route charges because of decrease demand/capacity levels.
- The route charges themselves will probably increase progressively.
- Airfares will increase progressively due to increased route charges and environmental measures.
- Force consolidation of airlines and reduce the number of no frill airlines and reduces the requirement for regionalised airports.

2002 _____2017

Starting Conditions	Drivers	Implications	End State

Scenario 'Euroland'

Technology and operational procedure improvements

Currently there is continuous development in improving technology and operational procedures to safely increase capacity. Demand by airlines is levelling off because the travelling public is making greater use of alternative means of transport, e.g. fast trains, and the airline is sensitive to dramatic events and seen as a polluter of the environment. Air travel becomes an expensive means of transport. Governments put environmental taxes on fuel. People only fly if it is a necessity. This results in reduced investment in technology and operational improvements for ACC and in airport infrastructure. Any investment is for safety and maintenance improvements but not towards measures to increase capacity. The end state is a levelling off traffic growth from 2009. Thus currently planned and decided on technology and operational procedure improvements geared towards safety measures (i.e. 2002/2004) will be reviewed and possibly be put on hold or implemented at a later stage beyond 2017 in order not to have underutilisation of capacity.

Investment in technology for environment and fuel efficiency

Growing concern from the public about the environmental consequences related to air traffic. Continued lip service to tackling these issues seriously by governments will not restrict people from flying but will also make them more attracted to alternative means of transport. As governments want to ensure continued economic growth and attractiveness to their countries so they consider investment in alternative transportation as an option and limited investment in technology for environment and fuel efficiency.

Liberation

Currently we are in a fragmented situation with most States still having autonomy over their individual airspace. There is growing political pressure with the 'single sky' to move to reduce the number of ACCs and to go towards a regionalised framework. For example, by 2017 the CEATS UAC would be in operation and possibly a Scandinavian UAC. Military use of airspace is not an issue. Pressure for liberation will be at a reduced pace.

Values in society

Currently individuals in society are struggling to balance working life, material values, family life, and free time. Money is a key driver to satisfy individual needs and wants. The number of working people in society need to work longer to keep their economic status and will have less time to spend on travelling on holidays. In addition, the number of people retiring is increasing but are less inclined to spend their time travelling by air for leisure. The implications are that money continues to be a key driver to satisfy people's individual economic wealth and wellbeing for old age.

Economic costs – route charges/airfares

- Investment costs will level off or decrease.
- Levelling off or decrease of income from route charges because of decrease demand/capacity levels.
- The route charges themselves will probably increase progressively.
- Airfares will increase progressively due to increased route charges and environmental measures.
- Force consolidation of airlines.
- Reduces the number of no frill airlines and this reduces the requirement for regionalised airports.

2002 _____2017

Starting Conditions	Drivers	Implications	End State

Scenario 'Gate to Gate' (Business As Usual)

Technology and operational procedure improvement

Currently there is a continuous development in improving technology and operational procedures to safely increase capacity. A driver is the increased demand by airlines and the travelling public to travel by air. However, the speed of implementation of technology and operational procedure improvements is inherently slow because of the conservatism of users (ATCOs), the testing, etc., required for safety/quality and the consensus to be reached with States to implement new technology. The end state is that currently planned technology and operational procedure improvements (i.e. 2002 to 2006) are attained by 2017. Demand doubles from 2002 traffic volume by 2015, so with this planned technology and operational procedure improvements will increase capacity to meet this demand. Investment goes also to alternative means of transport to alleviate the pressure.

Investment in technology for environment and fuel efficiency

Growing concern from public about the environmental consequences related to air traffic, which restricts expansion. Increased investment in technology to reduce aeroplane noise, increase fuel efficiency in aircraft's and reduce carbon dioxide levels. Entrepreneurial spirit and open markets will dominate to ensure continued economic growth and investment in technology improvements for environment and fuel efficiency.

Liberation

Currently we are in a fragmented situation with most States having autonomy over their individual airspace. There is growing political pressure with the 'single sky' to move to reduce the number of ACCs and to go towards a regionalised framework. For example, by 2017 the CEATS UAC would be in operation and possibly a Scandinavian UAC. Also military use of airspace would be on a need to use basis. In combination with the planned technology and operational procedure improvements, liberation will increase capacity to meet this demand. Increased number of privatised air traffic service providers who are growth driven and cost focus.

Values in society

Currently individuals in society are struggling to balance working life, material values, family life, and free time. Money is a key driver to satisfy individual needs and wants. The number of working people in society need to work longer to keep their economic status and will have less time to spend on travelling on holidays. In addition, the number of people retiring is increasing but are less inclined to spend their time travelling by air for leisure. Implications are that money continues to be a key driver to satisfy people's individual economic wealth and wellbeing for old age.

Economic costs – route charges/airfares

- Investment costs will be high.
- High income from route charges because of increased demand/capacity which helps to fund the investment in the technology improvements for ACC and airport capacity improvements.
- The route charges themselves will probably increase in line with inflation.
- Airfares will follow the normal pattern, increased passengers may lead to lower or maintaining airfare levels.
- Economy of scales through consolidation of airline industry and the increase of 'no frill' airlines.
- Consolidation of air traffic service providers and competition.

Appendix 3a

Implications of Uncertain Forces (Scenarios)

Scenarios	Impact	What variables will it impact in LAMPS?
No Frontiers	▪ Volume of flights increases ▪ Route charges are increasing ▪ More money from route charges ▪ More money to invest in new technology ▪ Increases the quality of technical infrastructure but at slow rate – delay before realising investment ▪ Due to a need for more free time would result in a change in working conditions (quality of life) for say rostering, less working hours, part-time work – to relief stress/high workload situation on a constant level.	Month 61 – Traffic growth increase 12% S1/S2. Increase traffic handling capability by 5% S1 = 113.61 & S2 = 110.02. Decrease statutory working hours per week to 32. Month 121 – Increase traffic handling capability by 5% S1 = 119.29 & S2 = 115.52. Month 157 - Increase traffic handling capability by 5% S1 = 125.25 & S2 = 121.29.
Stalemate	▪ Volume of flights level off ▪ Decrease in the amount of route charge – charges themselves would increase ▪ Investment in technology would be at a slower rate ▪ Underutilisation of capacity – gradual reduction in staff numbers ▪ Decrease in utilisation of capacity and the amount of new intakes levels off ▪ Job less challenging, less attractive, more people leaving the job ▪ Working conditions remain stable and less options for flexibility and choices ▪ Pressure on the job status - defensiveness in relation to professional pride	Month 2 – Decrease traffic growth to 3% all sectors. Month 37 – Increase in traffic handling capability by 3% S1 = 111.44 & S2 = 107.95. Month 49 – Decrease traffic growth to 1% all sectors.
Gate to Gate	▪ Volume of flights increases ▪ Route charges are increasing ▪ More money from route charges ▪ More money to invest in new technology ▪ Increases the quality of technical infrastructure but at slow rate – delay before realising investment ▪ In the short-term training capacity could be increased to deliver more ATCOs within three and half to four years. However, in the long-term implementation of new technology might result in a need for less ATCOs. ▪ High attractiveness of the job ▪ Increase in professional pride and demanding increase in salary and allowances ▪ Need to improve working conditions to relief stress/high workload situation on a constant level in the longer term – less working hours perhaps	Month 109 – Increase traffic handling capability by 3% S1 = 113.61 & S2 = 110.02. Month 157 - Increase traffic handling capability by 3% S1 = 119.29 & S2 = 115.52.

Scenarios	Impact	What variables will it impact in LAMPS?
Euroland	▪ Volume of flights level off ▪ Decrease in the amount of route charges ▪ Investment in technology would be at a slower rate ▪ Underutilisation of capacity – gradual reduction in staff numbers ▪ Decrease in utilisation of capacity and the amount of new intakes levels off ▪ Intensive training to improve the quality of staff to meet capacity requirements ▪ Job less challenging, less attractive, more people leaving the job ▪ Working conditions remain stable and less options for flexibility and choices ▪ Pressure on the job status - defensiveness in relation to professional pride ▪ More demand from ATCOs on improving working conditions, i.e. salary and allowances ▪ Salary would not increase very much due to traffic decrease	Month 2 – Decrease traffic growth to 3% all sectors. Month 37 – Increase in traffic handling capability by 3% S1 = 111.44 & S2 = 107.95.

Appendix 3b

Report on the Long-Term Impact for ATCO MP

Introduction

This reports provides an overview from the LAMPS tool on the impact of the four scenarios – 'No Frontiers', 'Stalemate', 'Euroland' and 'Gate to Gate' generated during Stage 2 of the CHAMP process over the fifteen-year timeframe 2002-2016.

For each scenario, results are provided on the ATCO margin, initial training, simulator and OJT utilisation.

Scenario 'No Frontiers'

This scenario takes the view that the volume of flights will continue to increase. This will lead to an increase in route charges and thus leading to more income from route charges. More revenue will lead to increased investment in technology improvements to aid the ATCOs job. However, there will be an increase in the quality of technical infrastructure but at slow rate as there is a delay before realising investment. However, in the long-term implementation of new technology might result in a need for less ATCOs. The need for more free time could result in a change in working conditions (quality of life) for say the roster, less working hours, part time work – to relieve stress / high workload situation at a constant level. The ATCO job is considered an attractive career option.

Changes to LAMPS

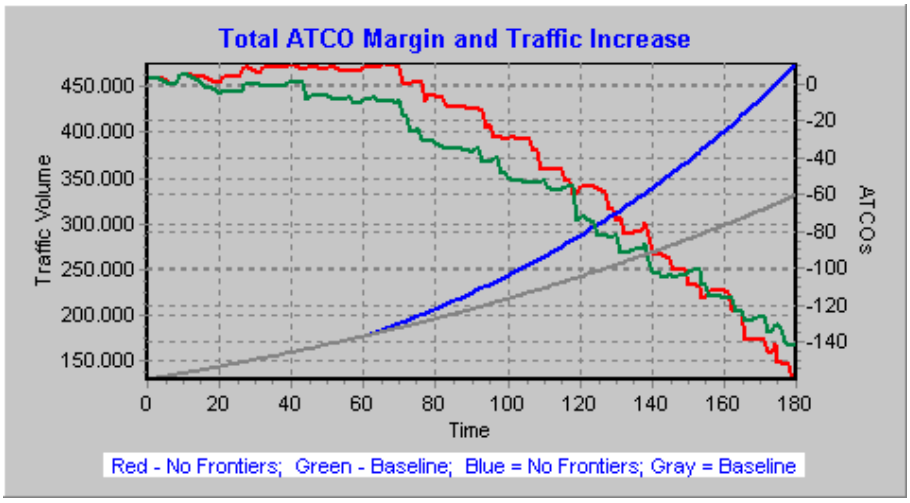
The following variables were changed in LAMPS using the gaming function:

- **January 2002 (Month 1)**: Traffic handling capability increased by 10% due to the introduction of RVSM for Sector Groups 1 and 2 to 98.36 for Sector Group 1 and 95,26 for Sector Group 2. Also, there are two extra OJT possibilities, which increases the number of OJT possibilities for Sector Groups 1 and 2 to 6.
- **January 2003 (Month 13)**: Due to the move to the new OPSroom and increased number of positions, traffic handling capability increased by 10% to 108.20 for Sector Group 1 and 104,79 for Sector Group 2.
- **January 2007 (Month 61)**: Traffic volume increase for all sector groups to 12%. In addition, new technology improvements to the ATCO job results in increase in traffic handling capability of 5% to 113.61 for Sector Group 1 and 110.02 for Sector Groups 2. Also, working hours are reduced to 32 hours a week. Thus, the variable 'statutory working hours' is changed to 32 hours.
- **January 2010 (Month 121)**: New technology improvements to the ATCO job results in an increase in traffic handling capability of 5% to 119.25 for Sector Group 1 and 115.52 for Sector Group 2.
- **January 2014 (Month 157)**: New technology improvements to the ATCO job results in an increase in traffic handling capability of 5% to 125.25 for Sector Group 1 and 121.29 for Sector Group 2.

Results

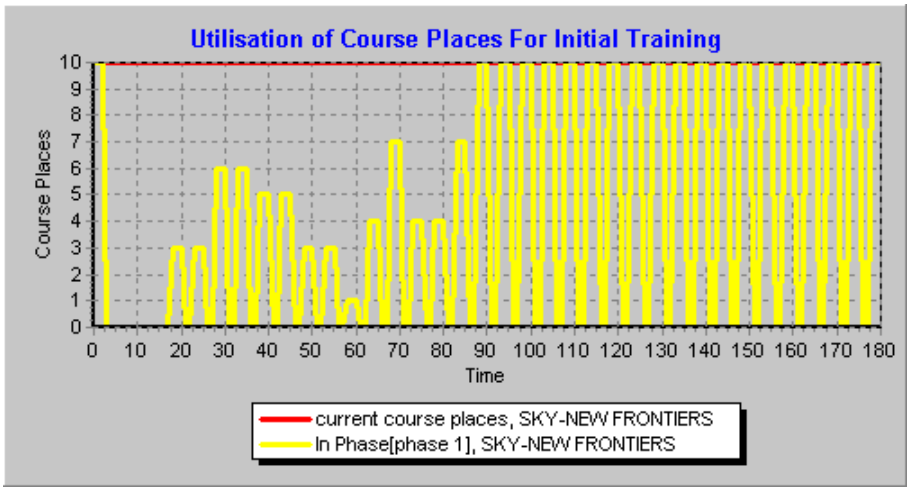
ATCO margin

The results on ATCO margin as indicated in the graph below show that there is a slight surplus from month 30 (2003/2004) to month 75 (2007/2008) and then sliding into a shortage until month 180 (2015). One explanation for this is the increase in traffic volume from 7% to 12% and the decrease in working hours from 2007. However, constraints in the training process may also exist.



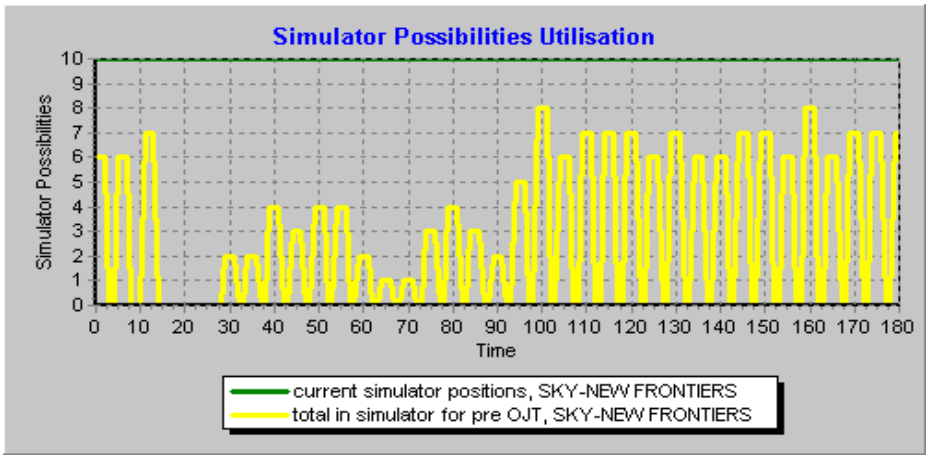
Initial training

The graph below shows how initial training capacity is being utilised over the fifteen-year timeframe. The results show that from month 5 (2002) to month 90 (2009) initial training capacity is being underutilised. However, from month 90 onwards there is maximum utilisation of training capacity.



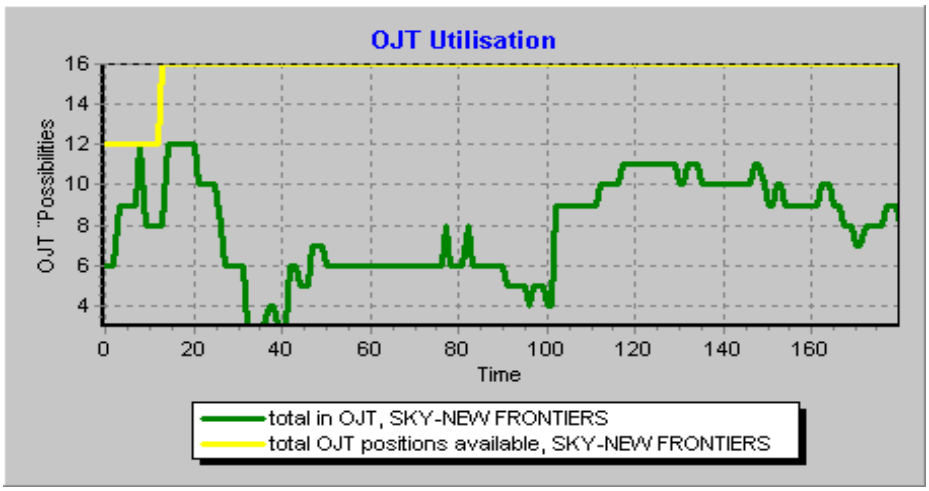
Simulator possibilities

The graph below shows how the simulator possibilities are being utilised over the fifteen-year timeframe. It is evident from the results that the ten places are adequate but are being constantly underutilised over the fifteen-year period. Measures to improve the success rate for initial training could be considered.



OJT possibilities

The graph below shows how OJT possibilities are being utilised over the fifteen years. In month 10 (2003) the number of OJT places increased by 4 (two for Sector Group 1 and two for Sector Group 2). However, the results show that from month 10 (2003) onwards OJT possibilities are not being used fully. Again, measures to improve the simulator and OJT success rates could be considered.



Summary and conclusion

In a ‘No Frontiers’ world, it is evident that in the long-term Skycontrol would experience a shortage. The intake, initial training, simulator and OJT processes and utilisation need investigation to improve the success rate during each of these training stages in order to optimise Skycontrol’s position in this world.

Scenario 'Stalemate'

This scenario takes the view that the volume of flights will level off. This will lead to a decrease in the amount of route charges and possibly to an increase in route charges. Investment in technology improvements to aid the ATCOs job would be at a slow rate. There would also be a gradual reduction in staff numbers resulting in a decreased utilisation of capacity and the amount of new intakes will level off. The ATCO job is seen as less challenging, less attractive and more people would leave the job. Working conditions would remain stable and less options for flexibility and choice would emerge. There would also be growing pressure on the ATCO job status leading to defensiveness by the ATCO profession.

Changes to LAMPS

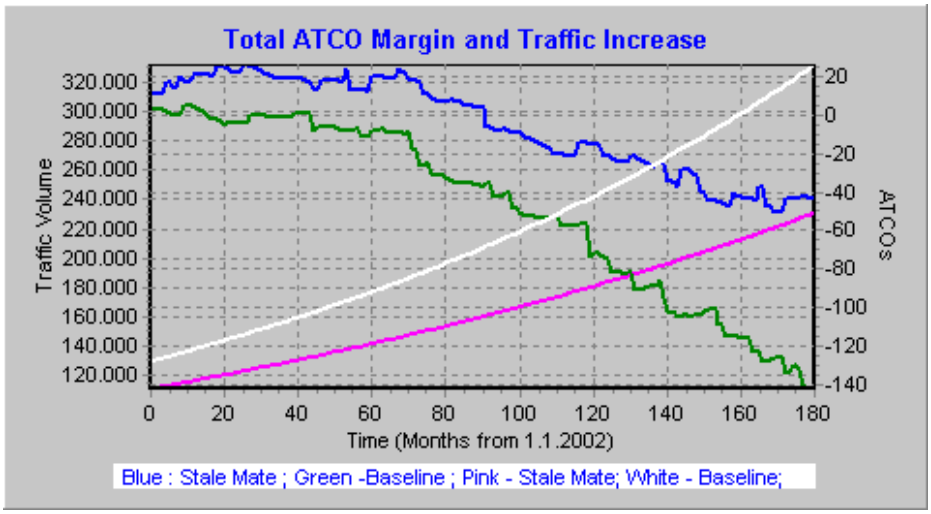
The following variables were changed in LAMPS using the gaming function:

- **January 2002 (Month 1)**: Traffic handling capability increased by 10% due to the introduction of RVSM for Sector Groups 1 and 2 to 98.36 for Sector Group 1 and 95,26 for Sector Group 2. There are also two extra OJT possibilities increasing the number of OJT possibilities for Sector Groups 1 and 2 to 6.
- **February 2002 (Month 2)**: Traffic volume decreases in all sectors to 3%.
- **January 2003 (Month 13)**: Due to the move to the new OPSroom and increased number of positions, traffic handling capability increased by 10% to 108.20 for Sector Group 1 and 104,79 for Sector Group 2. Also, working hours are reduced to 32 hours a week. Thus, the variable 'statutory working hours' is changed to 32 hours.
- **January 2005 (Month 37)**: Implementation of new technology improvements to the ATCO job results in increase in traffic handling capability of 3 to 111.44 for Sector Group 1 and 107.95 for Sector Group 2.
- **January 2006 (Month 49)**: Traffic levels off with a traffic growth of 1%. Traffic growth is decreased for all sector groups to 1%.

Results

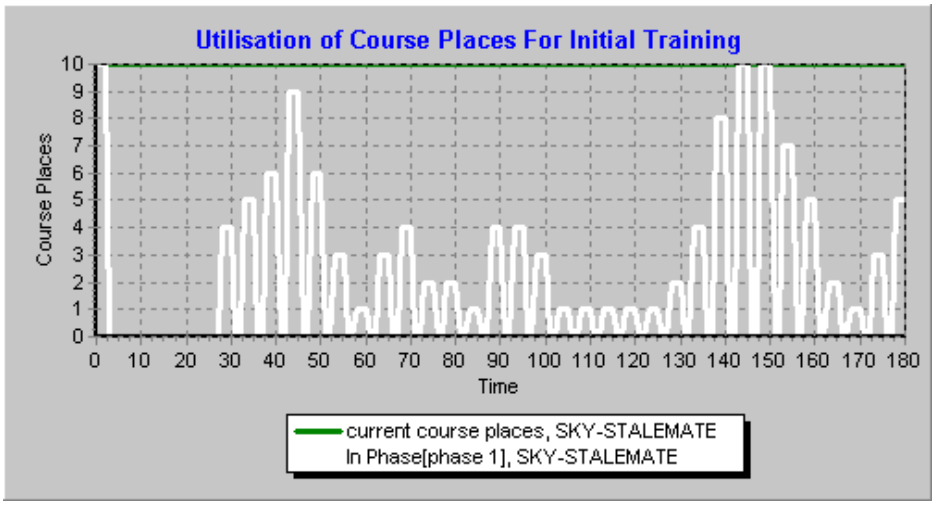
ATCO margin

The results on ATCO margin as indicated in the following graph show that there is a high surplus from month 20 (2002) to month 80 (2008) and then sliding into a shortage from month 100 (2009) to month 180 (2015). Even though there is a levelling off of traffic as from 2007, Skycontrol in the longer term will still experience a shortage. However, constraints in the training process may also exist.



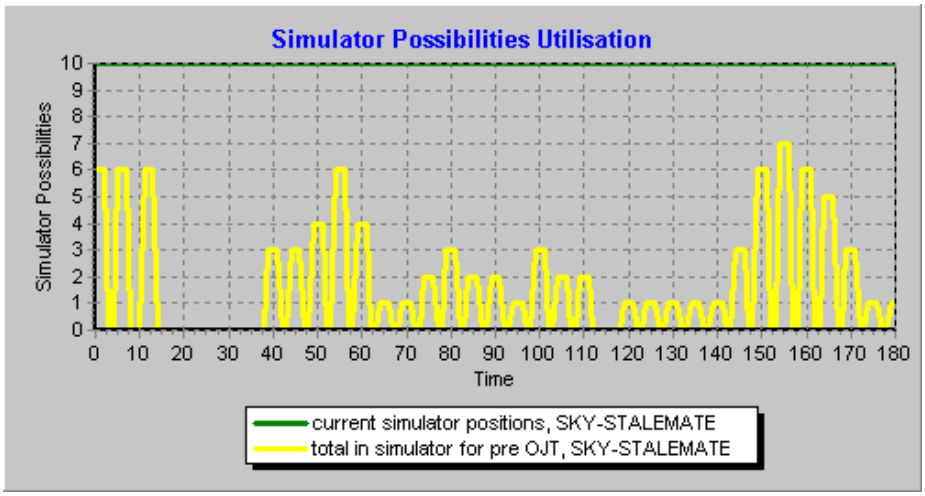
Initial training utilisation

The results in the graph below for initial training utilisation show that only in 2012/2013 (month 130/40) there is maximum use of initial training places. Therefore, the number of intakes could be increased to alleviate the shortage, provided that there are no constraints in Pre-*O*JT and OJT.



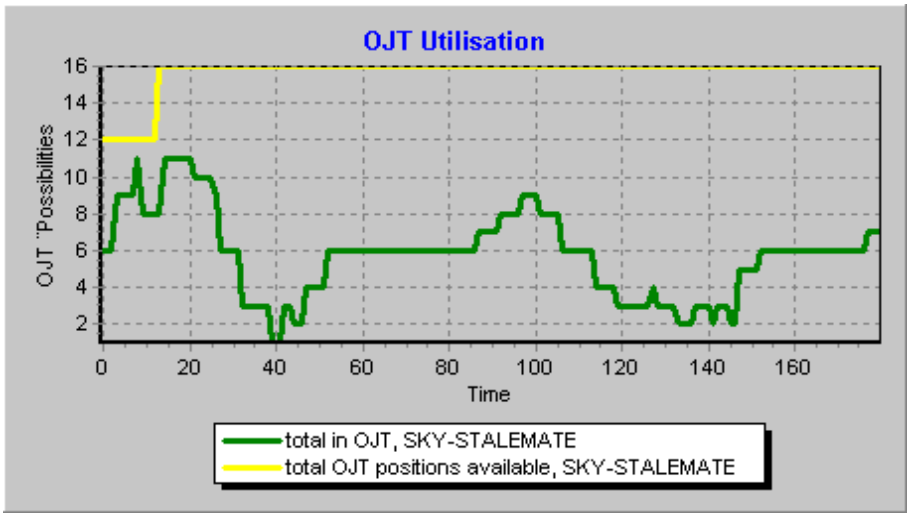
Simulator possibilities utilisation

The following graph shows how the simulator possibilities are being utilised over the fifteen-year timeframe. It is evident from the results that the ten places are adequate but are being constantly underutilised over the fifteen-year period. Measures to improve the success rate for initial training could be considered and a possible increase in the initial training intake.



OJT utilisation

The graph below shows how OJT possibilities are being utilised over the fifteen years. In month 10 (2003) the number of OJT places increased by 4 (two for Sector Group 1 and two for Sector Group 2). However, the results show that from month 10 (2003) onwards OJT possibilities are not being used fully utilised. Again, measures to improve the simulator and OJT success rates could be considered.



Summary

The 'Stalemate' world shows that air traffic demand levels off, which results in a shortage from month 90 onwards. There are opportunities increase the intake for initial training and improve the success rates for initial training and simulator and OJT utilisation to offset the shortage.

Scenario 'Gate to Gate'

This scenario takes the view that the volume of flights will increase. Leading to increase in income from route charges. This will encourage investment in new technology to aid the ATCOs job. However, the increase in the quality of technical infrastructure will be at as low rate i.e. a delay before realising investment. In the short-term training capacity could be increased to deliver more ATCOs within three and half to four years. However, in the long-term implementation of new technology might result in a need for less ATCOs. The ATCO job is considered an attractive career option. There will growing pressure to increase ATCOs performance in order meet capacity demands. There is also a need to improve working conditions to relief stress/high workload situation on a constant level in the longer terms.

Changes to LAMPS

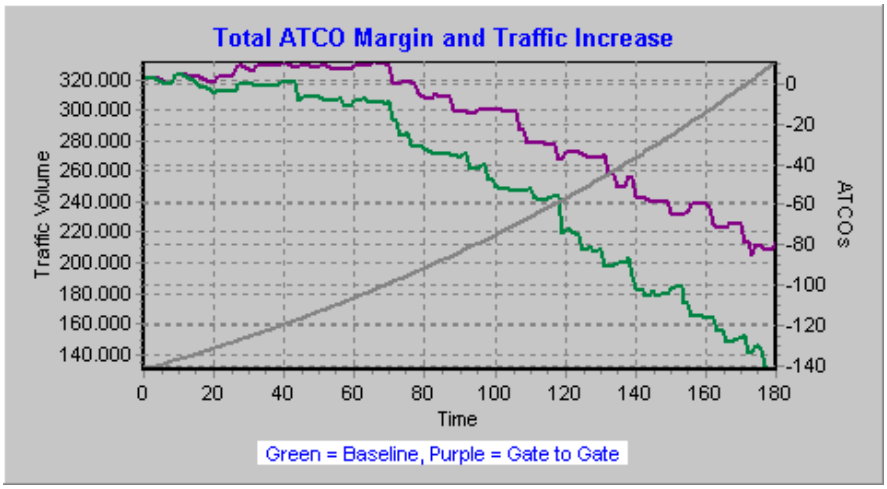
The following variables were changed in LAMPS using the gaming function:

- **January 2002 (Month 1)**: Traffic handling capability increased by 10% due to the introduction of RVSM for Sector Groups 1 and 2 to 98.36 for Sector Group 1 and 95,26 for Sector Group 2. Also, there are two extra OJT possibilities – increasing the number of OJT possibilities for Sector Groups 1 and 2 to 6.
- **January 2003 (Month 13)**: Due to the move to the new OPSroom and increased number of positions, traffic handling capability increased by 10% to 108.20 for Sector Group 1 and 104,79 for Sector Group 2.
- **January 2010 (Month 109)**: Implementation of new technology improvements to the ATCO job results in increase in traffic handling capability of 5% to 113.61 for Sector Group 1 and 110.02 for Sector Group 2.
- **January 2014 (Month 157)**: Implementation of new technology improvements to the ATCO job results in increase in traffic handling capability of 5% to 119.29 for Sector Group 1 and 115.52 for Sector Group 2.

Results

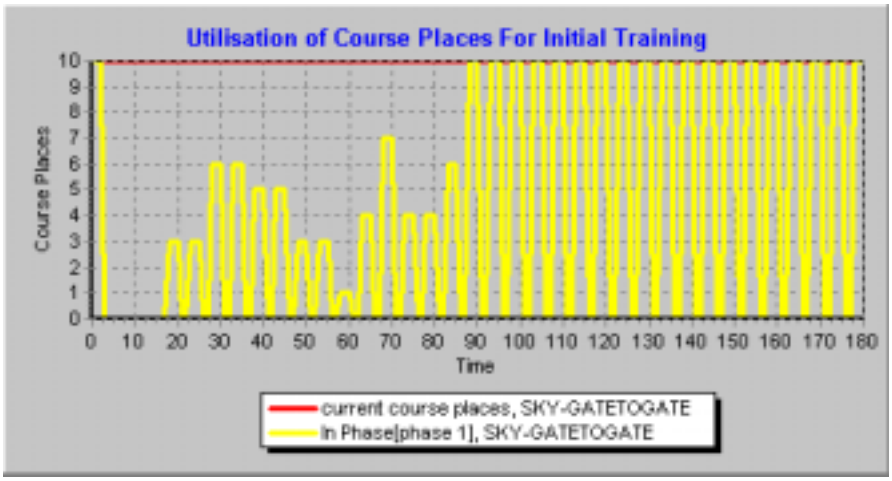
ATCO margin

The results on ATCO margin as indicated in the following graph show that there is a high surplus from month 30 (2003) to month 80 (2008) and then sliding into a shortage from month 80 (2008) to month 180 (2015). It is evident that the improvements in traffic handling capability are not realised early enough. However, constraints in the training process may also exist.



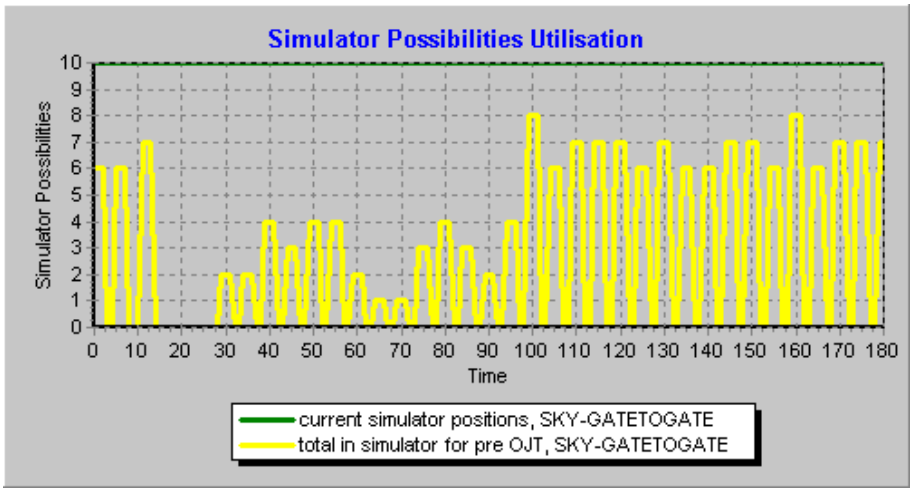
Initial training utilisation

The results in the graph below for initial training utilisation show that the number of initial training places are used to the maximum from month 90 (2009). However, there is underutlisation from month 10 (2003) to month 90 (2009). Therefore, the number of intakes could be increased to alleviate the shortage between 2003 and 2009, provided that there are no constraints in Pre-OJT and OJT. In addition, the feasibility of increasing the number of initial training places could be considered from month 90 (2009) onwards should also be considered.



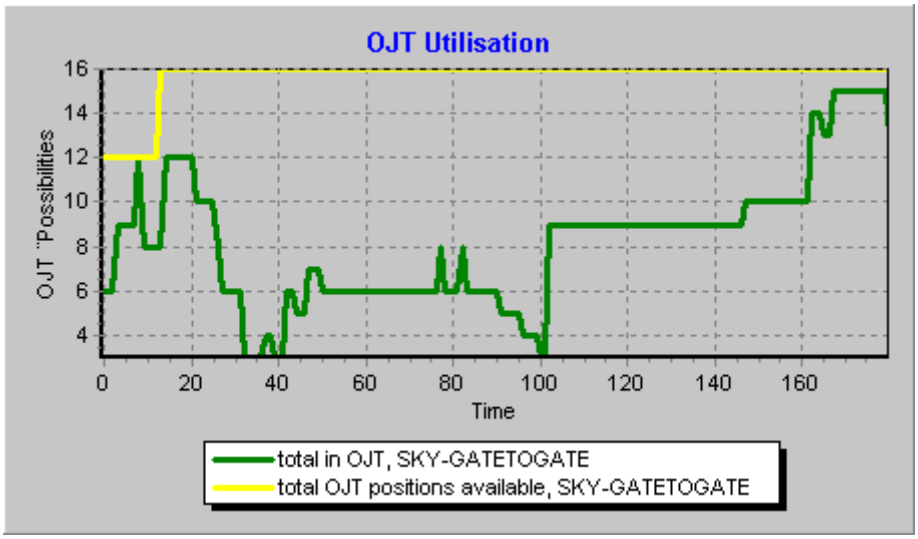
Simulator possibilities

The graph overleaf shows how the simulator possibilities are being utilised over the fifteen-year timeframe. It is evident from the results that the ten places are adequate but are being constantly underutilised over the fifteen-year period. Measures to improve the success rate for initial training could be considered and a possible increase in the initial training intake.



OJT utilisation

The graph below shows how OJT possibilities are being utilised over the fifteen years. In month 10 (2003) the number of OJT places increased by 4 (two for Sector Group 1 and two for Sector Group 2). However, the results show that from month 10 (2003) onwards OJT possibilities are not being used fully utilised. Again, measures to improve the simulator and OJT success rates could be considered.



Summary

The 'Gate to Gate' world shows that in response to a steady growth in traffic, Skycontrol experiences a shortage as from month 80 onwards. Again, initial training, simulator and OJT training utilisation, and success rates, would need to be investigated to see what opportunities they present in alleviating the shortage.

Scenario 'Euroland'

This scenario takes the view that the volume of flights will level off resulting in a decrease in the amount of route charges. Thus, investment in technology would be at a slower rate which would lead to possibility of a gradual reduction in staff numbers. It is expected that there will be a decrease in utilisation of capacity and the amount of new intakes levels off. Job less challenging, less attractive, more people leaving the job. Working conditions remain stable and less options for flexibility and choices. Pressure on the job status - defensiveness in relation to professional pride. More demand from ATCOs on improving working conditions, i.e. salary and allowances. Salary would not increase very much due to traffic decrease.

Changes to LAMPS

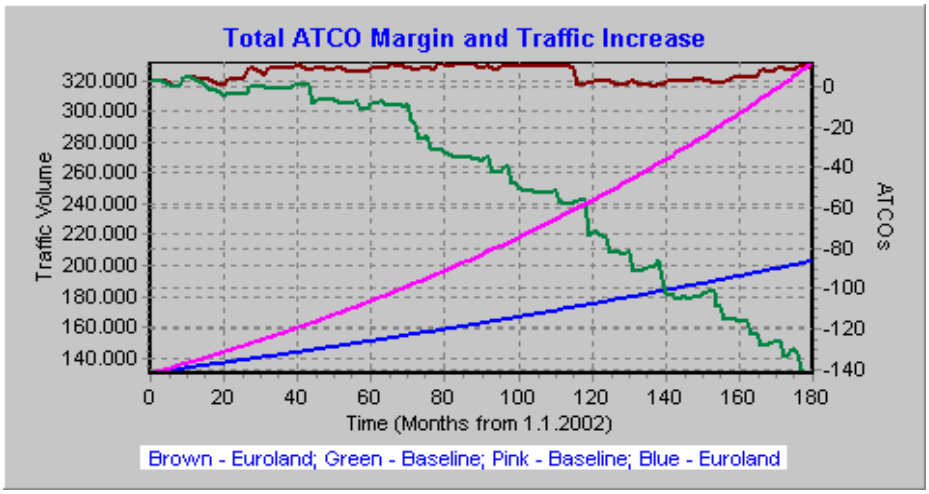
The following variables were changed in LAMPS using the gaming function:

- **January 2002 (Month 1)**: The expected traffic growth is reduced to 3% for all sector groups. Traffic handling capability increased by 10% due to the introduction of RVSM for Sector Groups 1 and 2 to 98.36 for Sector Group 1 and 95,26 for Sector Group 2. Also, there are two extra OJT possibilities, increasing the number of OJT possibilities for Sector Groups 1 and 2 to 6.
- **January 2003 (Month 13)**: Due to the move to the new OPSroom and increased number of positions, traffic handling capability increased by 10% to 108.20 for Sector Group 1 and 104,79 for Sector Group 2.
- **January 2005 (Month 37)**: Implementation of new technology improvements to the ATCO job results in increase in traffic handling capability by 3% to 111.44 for Sector Group 1 and 107.9 for Sector Group 2.

Results

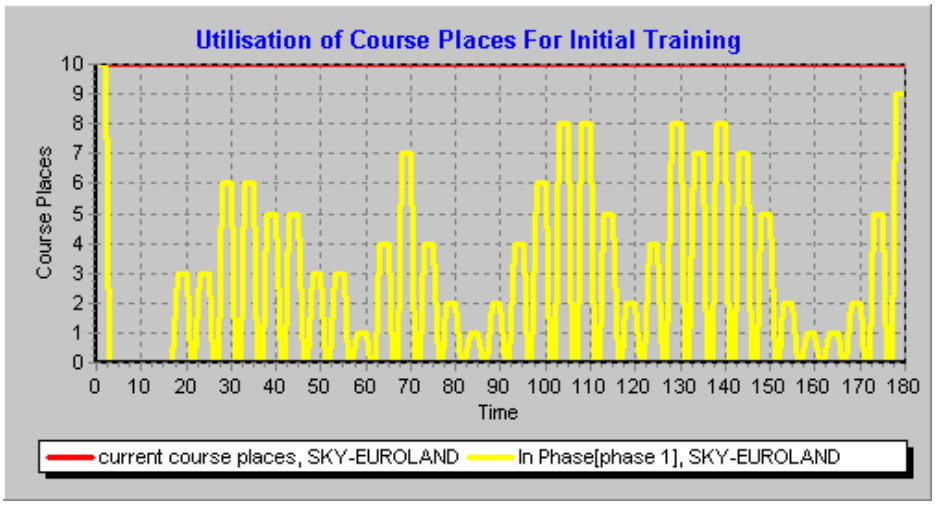
ATCO margin

The results shown in the graph below highlight a surplus from around month 10 (2002) to month 118 (2010) and then levelling off until a surplus occurs between month 160 (2015) and 180 (2016).



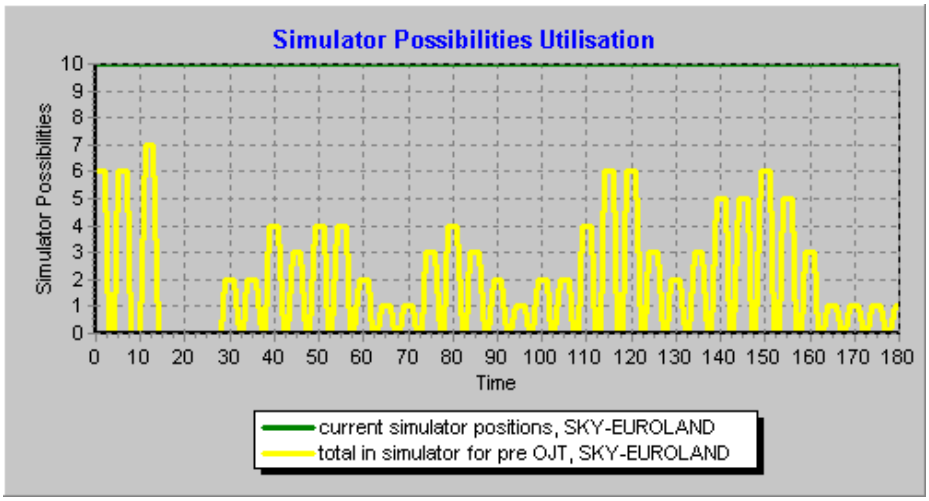
Initial training utilisation

The results for initial training utilisation as indicated in the graph below show how the number of ten initial training places is used over the fifteen-year timeframe. As there is a surplus of ATCOs from month 10 (2002) to month 118 (2010). The number of *ab initios* intake should be reduced, the consequences is that the initial training places will not be fully utilised over this period.



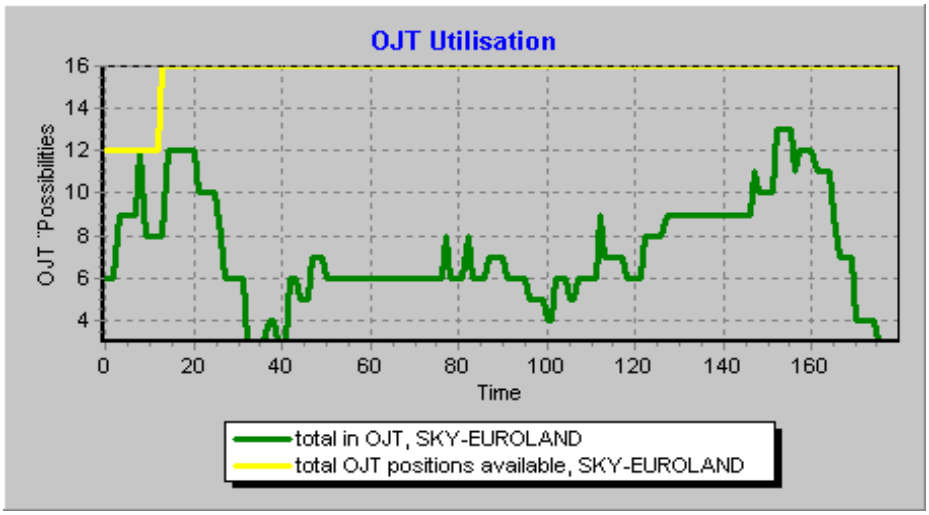
Simulator possibilities

The graph below shows how the simulator possibilities are being utilised over the fifteen-year timeframe. It is evident from the results that the ten places are adequate and are underutilised over the fifteen-year period.



OJT possibilities

The graph below shows how OJT possibilities are being utilised over the fifteen years. In month 10 (2003) the number of OJT places increased by 4 (two for Sector Group 1 and two for Sector Group 2). However, the results show that from month 10 (2003) onwards OJT possibilities are not fully utilised.



Summary

In the 'Euroland' world it seems that there is a decrease in traffic volume which results in Skycontrol experiencing a surplus of ATCOs during the fifteen-year timeframe. Initiatives to reduce the surplus need to be investigated.

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Appendix 4a

Assessment of Scenario Implications for ATCO MP

Scenario	Business Issue *What are the main challenges to the business idea?*	ATCO Capability *What is the ATCO capability required to meet the challenges?*	HR Practices *How do the HR Practices need to be leveraged to create, reinforce and sustain ATCO Capability?*
No Frontiers	▪ Increase in traffic and capacity – high workload ▪ Increase in technological tools for the ATCO job	▪ Ability to respond to a constantly high traffic demand. ▪ Ability to learn and adapt to new technological and operational procedures changes.	▪ Marketing the ATCO Job ▪ Selection ▪ Planning of refresher training – high demand due to technological and operational changes ▪ High requirement for training utilisation ▪ Staff costs gradually increasing ▪ working conditions need to be flexible
Stalemate	▪ Initial growth in traffic and then levelling off	▪ Static workload ▪ Attractiveness of the job decreasing	▪ Selection ▪ Training utilisation – constant ▪ Staff costs ▪ Refresher training – maintaining skills level
Euroland	▪ Levelling off of traffic	▪ Workload decreasing ▪ Attractiveness of the job decreasing ▪ Motivation issues	▪ Selection – levelling off ▪ Refresher training – less requirement ▪ Training utilisation – levelling off
Gate to Gate	▪ Traffic increasing	▪ High workload ▪ Performance driven	▪ Marketing the ATCO job ▪ Selection ▪ Planning of refresher training – high demand due to technological and operational changes ▪ High requirement for training utilisation ▪ Staff costs gradually increasing ▪ Working conditions need to be flexible

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Appendix 4b

ATCO HR Strategic Options for Scenarios

No Frontiers

- Increase marketing of ATCO Job in order to attract more people to the job of ATCO
- Improvement in recruitment and selection to improve quality and reduce processing time and cost
- Training *ab initios* (initial, OJT, simulator)
  - Alleviate bottlenecks in internal refresher training
  - Maximise utilisation training places
  - Measures to improve success rate
  - reduce lead times
- Internal conversion training
  - Maximise utilisation of ATCOs
- External conversion training
  - Maximise external conversion training with ANSPs who have a surplus
- Implications of new technology and increase in capacity
- Working conditions improve
  - Increase measures to reduce stress and burnout

Stalemate

- Promote ATCO job in order to attract more people to the job of ATCO
- Recruitment and selection levelling off but quality levels should be maintained
- Training of *ab initios* – levelling off but not to stop and maintain quality levels
- Working conditions are flexible and incentives to maintain motivation

Euroland

- Promote ATCO job in order to attract more people to the job of ATCO
- Recruitment and selection levelling off but quality levels should be maintained
- Training of *ab initios* – levelling off but not to stop and maintain quality levels
- Working conditions are maintained and incentives to maintain motivation

Gate to Gate

- Increase marketing of ATCO job in order to attract more people to the job of ATCO
- Improvement in recruitment and selection to improve quality and reduce processing time and cost
- Training *ab initios* (initial, OJT, simulator)
  - Alleviate bottle necks in internal refresher training
  - Maximise utilisation training places
  - Measures to Improve success rate
  - Reduce lead times
- Internal conversion training
  - Maximise utilisation of ATCOs
- External conversion training
  - Maximise external conversion training with ANSPs who have a surplus
- Implications of new technology and increase in capacity
- Working conditions improve
  - Increase measures to reduce stress and burnout
  - Social dialogue issues on salary increase
  - Money is a motivator

Appendix 5

Key Elements of ATCO HR Strategic Options Evaluation Report

Scenarios / ATCO HR strategic options	Scenario 1	Scenario 2	Scenario 3	Scenario 4
ATCO margin				
Training inflow				
ATCO capability and motivation				
ATCO utilisation (OPS and non OPS) - training and project days				
Continuation and refresher training - licensing and PCD				
Recruitment and selection - marketing the ATCO Job				
Training utilisation - Initial, pre-OJT, OJT				
Working conditions - Leave and absences - Rostering - Time leakage - Overtime				
Salary and training costs				
Overall conclusion				

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Appendix 6

ATCO HR Strategic Manpower Plan Template

Name the plan: ATCO HR strategic plan

Activities	Target	What needs to be done to achieve this?	When does it need to be achieved?	Who is responsible?	Any risks and what would be preventive or contingency actions required?	What control checks should be in place and when should this take place?
Recruitment and selection						
Initial training						
Simulator training						
OJT training						
Continuation and refresher training						
Working conditions - Rostering - Leave and absences - Working time - Overtime						

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GLOSSARY

For the purposes of this document, the following definitions shall apply:

Air Navigation Service Provider (ANSP): An organisation that provides the service of managing the aircraft in flight or on the manoeuvring area of an aerodrome vested in it and which is the legitimate holder of that responsibility.

ATCO margin: The difference between the number of ATCOs required and ATCOs available.

Air Traffic Management (ATM): The ground part of ATM comprises the functions of air services, airspace management and air traffic flow management. The air traffic services are the primary component of ATM.

Air Traffic Services (ATS): A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service) (ICAO Doc 9569 Definitions).

Baseline: A line serving as a starting point of analysis showing the current picture.

Business idea: An organisation's mental model of the forces being its current and future success**.**

Causal loop diagram: Diagram representing a closed loop of cause-effect linkages (causal links) which is intended to capture how the variables interrelate. The five steps of constructing a causal loop diagram are:

1. Choose variables.
2. Link variables with arrows pointing from cause to effect.
3. Assign a direction of effect (same or opposite) to each link.
4. Indicate delays.
5. Assign *polarity* to overall loop.

Collaboration: To work jointly with others in an intellectual endeavour.

Competitive advantage: The factors that make an organisation distinctive from other organisations in the same sector.

Contextual environment: Relates to societal, environmental, political and technological factors.

Decision-maker: Person responsible for a judgement, conclusion or resolution reached or given.

Distinctive competencies: Unique qualities or skills in an organisation that are difficult to copy or imitate.

Driving force: The external contextual environmental forces impacting an organisation which may be predetermined or uncertain.

Facilitation: The process of supporting everyone to do their best thinking i.e. full participation, cultivating shared responsibility and promotes mutual understanding.

Facilitator: The person who supports everyone to do their best thinking. The facilitator encourages full participation, promotes mutual understanding and cultivates shared responsibility. By supporting everyone to do their best thinking, a facilitator enables group members to search for inclusive solutions and builds sustainable agreements.

Feedback system: A closed system influenced by its past behaviour. Feedback systems have feedback loop structure that consists of closed paths of cause and effect. They are self-regulating and can be either a *positive feedback* system or a *negative feedback* system.

Human Resources Management (HRM): The conscious and specific direction of effort towards the quality of the workforce in the short and long-term. It involves all processes and activities aimed at managing the human resources of an organisation: manpower planning, recruitment, training, and development and career management.

Management: Effective use and coordination of resources to achieve predefined objectives.

Manpower: The total supply of individuals available and qualified for service.

Manpower modelling: A model used in conjunction with shift roster software to calculate the optimal number of shifts needed each day to provide adequate cover of the Operational Requirements.

Manpower Planning (MP): Consists of providing a sufficient number of qualified personnel, on a timely basis, to ensure the provision of air traffic control services.

Mental model: A model representing the relationships and assumptions about a system held in a person's mind. Mental models are often correct in system structure, but frequently draw wrong conclusions about system behaviour.

Negative feedback: Feedback that works to cancel deviations from a goal. It exhibits *goal-seeking behavio*ur. The control decision attempts to adjust a system level to a value given by a goal introduced from outside the loop.

Parameters: Numerical values that describe relationships in a system and are considered constant, at least during the computation span of one model run. Parameters are shown by a circular *converter* in STELLA and by other symbols in other software.

Positive feedback: Feedback that contains *reinforcing loops* which produce *exponential change*. Change in one direction results in more and more change in the same direction. Positive feedback produces growth that would be out of control if it weren't for *limits to growth*.

Practice field: A platform to try out and test various decisions to see how they will play out in the longer term.

Predetermined force: An external environmental factor that it is known that it will occur sometime in the future.

Process: A series of logical and normally sequential actions, which result in the transformation of an item form one state to another or some development.

Reinforcing loop: Loop that occurs when an action causes change that accelerates that action, reinforcing the effect of the original action. Associated with *positive feedback.*

Scenarios: Narratives or stories that describe alternative paths towards the future.

Simulation: Conducting dynamic experiments on a model instead of on the real system.

Stakeholder: People or organisations having an interest in the organisations activity.

Strategic planning: The longest range planning / goal setting / ambitions of an organisation.

Synergy: Combined action or cooperation.

System: A system tends to be a set of interconnected, interdependent parts, forming an identifiable, organised complex and dynamic whole. It may encompass elements, activities, people or ideas.

System dynamics: A discipline which illustrates the interdependencies within a current system and reveals a variety of potential actions to be taken.

Systematic feedback: A small portion of the system's output taken to and compared with, one or more of the earlier stage inputs on a regular and routine basis.

Systems thinking: Thought process that involves:

1. seeing interrelationships *(feedback loops)* instead of linear cause-effect chains.
2. seeking processes of change over time rather than snapshots. Systems thinking involves understanding many concepts of *system dynamics*, most notably, *feedback.* It helps thinkers see things on three levels: events, patterns of behaviour, and system *structure*.

Tacit knowledge: Implied or indicated knowledge which has not been actually expressed.

VENSIM: Modelling software for system dynamics. VENSIM offers a 'Workbench' featuring simulation tools for tracing sources of behaviour in a model.

ABBREVIATIONS AND ACRONYMS

For the purposes of this document, the following abbreviations and acronyms shall apply:

ACC	Area Control Centre
ANSP	Air Navigation Service Provider
ATC	Air Traffic Control
ATCO	Air Traffic Controller / Air Traffic Control Officer *(US/UK)*
ATM	Air Traffic Management
ATS	Air Traffic Services
ATSA	Air Traffic Services Authority *(Bulgaria)*
CEATS	Central European Air Traffic Services
CHAMP	Collaborative and Harmonised ATCO Manpower Planning
DAS	Directorate ATM Strategies
DAS/HUM	See 'HUM'
DFS	Deutsche Flugsicherung GmbH *(Germany)*
DGAC	Direction Générale de l'Aviation Civile *(France)*
DNA	Direction de la Navigation Aérienne *(DGAC, France)*
EATCHIP	European Air Traffic Control Harmonisation and Integration Programme
EATM	European Air Traffic Management
EATMP	European Air Traffic Management Programme
ECAC	European Civil Aviation Conference
ENAV	Ente Nazionale di Assistenza al Volo *(Italy)*
EUROCONTROL	European Organisation for the Safety of Air Navigation
HR	Human Resources

HRM	Human Resources Management
HRS	Human Resources Programme
HRT	Human Resources Team
HUM	Human Factors Management Business Division *(also known as 'DAS/HUM')*
HUM	Human Resources (Domain)
ICAO	International Civil Aviation Organization
IFATCA	International Federation of Air Traffic Controllers' Associations
LAMPS	Long-term ATCO Manpower Planning Simulation
LVNL	Luchtverkeersleiding Nederland *(ATC The Netherlands)*
MSG	Manpower Sub-Group
MP	Manpower Planning
NATS	National Air Traffic Services Ltd. *(UK)*
OJCT	On-the-Job Conversion Training
OJT	On-the-Job Training
OPS	Operations
OPSroom	Operations Room
OR	Operational Requirement
PCD	Personal and Career Development
RVSM	Reduced Vertical Separation Minima
SD	Senior Director, EATM Service Business Unit
UAC	Upper Area Control Centre
Vensim	Ventana Simulator
XLS	Excel

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