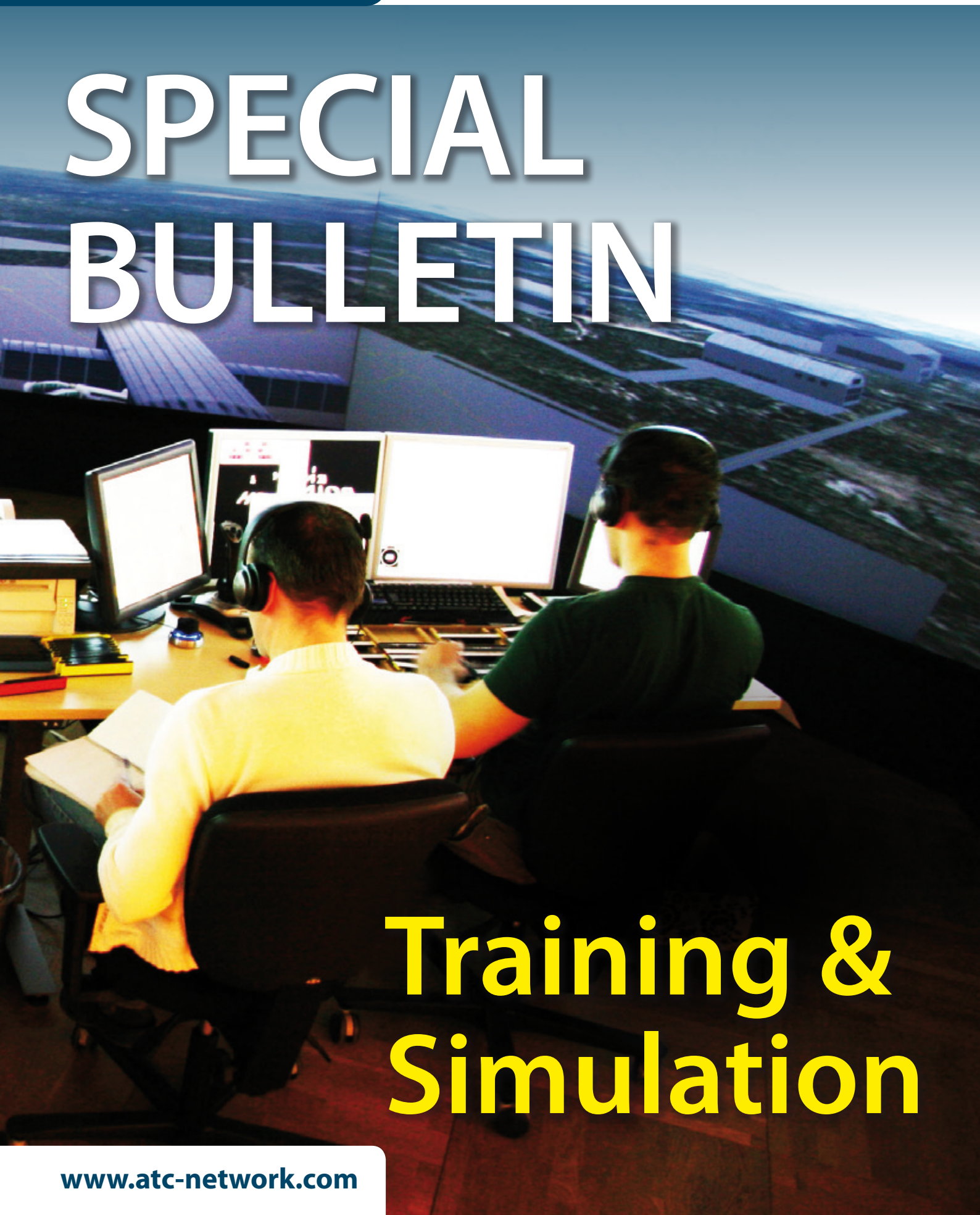
ATC NETWORK

Issue #1 September 2011

SPECIAL BULLETIN



Training & Simulation

www.atc-network.com

Welcome to the first 'Special Bulletin' -Training and Simulation published by ATC Network. Training and Simulation is a broad subject and has a hugely important key role in the ATM industry. As our industry is a fast evolving one, the training methods and technologies are having to adapt and revolutionise at a similar rate.

Our lead article from IFATCA, looks at the world-wide ATCO shortage and how the industry needs to approach this problem.

NATS approached this issue by focusing on how to improve the efficiency and productivity of it's training facility. You can read how this was done in their article on page 16.

My own contribution to this first issue is an article about the Eurocontrol (MUAC) Maastricht Upper Area Control Centre's Simulator. Patrick Cromheecke, Deputy Head of Training & Proficiency, kindly gave me a tour of the new simulator at the centre earlier this month.

Patrick explained how the simulator can be used not only for Ab-Initio training but also for refresher training of ATCO's and development of new ATM procedures and technologies.

Versatile use of simulators is a subject which is also covered in the article from Entry Point North. EPN has recently become the latest supporting organisation of ATC Network and we are looking forward to this co-operation.

I do hope you enjoy this first themed publication and would like to thank all members of the Network and our team who helped in compiling it.

If you would like to contribute to the next two 'Special Bulletins' (CDM & Meteorology) we would be pleased to hear from you.

Chris Wade.

ATC Network.

ATC NETWORK

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EUROCONTROL

IFATCA

Contents

News

The Jumpseat returns - Arinc and the FAA plan to allow controllers back into the cockpit

After a ten-year pause, U.S. Air Traffic Controllers will once again be allowed into the cockpits of commercial airline flights to observe operations under a renewed Flight Deck Training program of the Federal Aviation Administration.

Following recent discussions with the FAA Academy, ARINC Incorporated has agreed to enhance its widely used CASSSM Cockpit Access Security System to include screening of Air Traffic Controllers as well as pilots.

Most domestic airlines use the ARINC CASS system to verify the status of pilots flying in the jumpseat on U.S. domestic flights. The change will allow Controllers to ride in cockpit jumpseats to familiarize themselves with cockpit operations during a flight.

Controllers have not had access to jumpseats since the FAAs original Flight Deck Training (FDT) Program was discontinued following the events of 9/11/2001. The voluntary jumpseat program will provide a valuable training perspective which Controllers cannot obtain otherwise. said Tim Ryan, ARINC Director of New Service Development. We are pleased to help the FAA re-introduce this educational program.

'ATCO Regulation' marks a new era of harmonised air traffic controller licensing in Europe

This month saw the entry into force of new European rules for the licensing and medical certification of Air Traffic Controllers (ATCO). Commission Regulation (EU) No 805 / 2011 creates uniform requirements and mandates the Europe-wide recognition of all air traffic controller licenses, associated ratings, language endorsements and medical certificates. Upon the request of the Council of Ministers and the European Parliament, EASA prepared a draft proposal to establish a Regulation in the field. Published as Opinion No 3/2010 on 28 May 2010, the proposal was further developed by the European Commission in close cooperation with the Agency and Member States until its adoption on 10 August 2011.

Building on a European Directive from 2006, the Regulation replaces potentially differing national rules and offers greater professional mobility for air traffic controllers.
Air traffic controllers holding a license issued in accordance with the Regulation will be able to work in all Member States.

The legislative process has ensured continuity with previous rules, as demanded by stakeholders. Changes are limited to the most necessary, and adaptation periods are granted to concerned parties. The grandfathering of privileges of already acquired licences is ensured via transitional arrangements.

With the entry into force of the ATCO Regulation today, EASA has contributed the first `Implementing Rule of the extension of the Agencys competence to Air Traffic Management, said EASA Executive Director, Patrick Goudou. The harmonisation of air traffic controller licen-sing will make an important contribution to the achievement of a high and uniform level of safety across Europe.

Entry Point North introduces ICAO ATC Training Courses

As supplement to ab-initio training based on Eurocontrol Common Core Content, Entry Point North now introduces ICAO Air Traffic Controller training courses carried out in accordance with ICAO recommendations and standards. Professional multinational staff surrounded by long Scandinavian training traditions and competencies offer fully ICAO compliant training courses at its academy facilities in Sweden.

The ATC courses address customers that require training based on the ICAO standards and recommendations. By adding ICAO training courses to our product portfolio, we have made an important step in being able to offer training to new markets. Being a total training provider and one of the largest academies in Europe we are eager to respond to the demand of new clients with these optimised courses. Moreover, we are proud to be able to ensure best-in-class training. says Flemming Eske Hansen, Commercial Director at Entry Point North.

Each module has been constructed based on the ICAO recommendations and has a duration of 8 weeks. The following ICAO training courses are now available:

- Air Traffic Control Assistant/Basic Induction (ICAO 051)
- Aerodrome Control (ICAO 052)
- Approach Control - Non Radar (Procedural ICAO 053)
- Area or Approach Control - Radar (ICAO 054)
- Area Control - Non Radar (Procedural ICAO 055)

http://www.trynorth.com
info@trynorth.com

UFA ATCOACH and ATTOWER Air Traffic Control Simulators Accredited by the US Army

UFA, INC. announced that the UFA ATC simulators in use by the 2nd/130th Army National Guard Airfield Operations Battalion at Ft. Bragg have received formal accreditation by the US Army Directorate of Simulation for ATC Tower and Radar training. With the accreditation of these simulators, Air Traffic Controllers will be able to count simulation hours towards their qualifications. The simulators were accredited using UFAs industry-leading ATVoice® voice recognition and response product to allow Controllers to train without the need for support staff. UFA simulators have previously been accredited at the US Army Air Traffic Schoolhouse at Ft. Rucker, Alabama.

COMSOFT Revamps Indonesian ATC/ATM Training Centre with Leading-edge Technology

The Indonesian aviation school and training centre STPI continues to modernise its laboratory facilities with German state-of-the-art technology. Being able to offer latest technologies, as stipulated by ICAO for upcoming years, will advance STPI to the leader among flight schools in the region. STPI opted for COMSOFT, as their superior products already fulfil future ICAO standards, and consequently allow their use in a future-oriented education. With COMSOFTS AIM solution CADAS, AIS officers-to-be are able to practice workflows that will be part of their daily routine when applying the ICAO roadmap from AIS to AIM. Trainees will learn how to generate a modern electronic AIP, thus consequently adhering to the latest EUROCONTROL eAIP specification which defines working processes for teamwork and quality control.

Micro Nav Ltd.

MICRONAV
SIMULATION & TRAINING

"Micro Nav's BEST simulator supports all levels and types of ATC training to international standards."

Micro Nav is an award winning leading specialist in simulation and training systems for civil and military ATC operations, airport design and fighter control. Established in 1988, the company develops, delivers and supports systems worldwide for both civil and military authorities.

- The BEST range of simulation products covers Tower 2D & 3D, Radar and Fighter Control. They support all levels and types of training to international standards.
- The BEST simulation engines are also used to stimulate real ATC systems giving maximum realism with full control over the environment and training progression.
- The Fast Airport Builder (FAB) is a unique software tool that allows users to create their own 3D visual models of airports and harmonise them with the associated ATC database quickly and easily.
- The Airside Driver Trainer (ADT) provides a safe, versatile and realistic environment in which airport drivers can be trained and evaluated.

Micro Nav won the UK's most prestigious award for business performance, the Queen's Award for Enterprise for International Trade 2010. Micro Nav was placed 55th in The Sunday Times Microsoft Tech Track 100 league table and in 2011 Micro Nav was placed 62nd on The Sunday Times HSBC International Track 100 league table which ranks UK private limited companies' international sales growth.

Contact Details
Email: sales@micronav.co.uk
Tel: +44 (0)1202 545074
Web: www.micronav.co.uk

Smarter planning for ATCO training delivers operational excellence and significant savings

What if you could:

- Increase your training capacity – without increasing your training budget?
- Optimize the use of expensive resources such as simulators, trainers, pseudo-pilots and training rooms?
- Ensure that training is focused on those most likely to succeed?
- Effortlessly integrate training schedules with ATCO rosters?
- Swiftly create 'what if' scenarios to anticipate future training requirements?

You can do all this, and more, when you plan your ATCO training with Quintiq.
Quintiq is a leader in planning and scheduling systems, with customers that include the FAA, DFS, NAV Canada, Airservices Australia and PANSA. We are uniquely able to deliver a planning solution that fits your present – and future - training requirements perfectly.
To experience the quantifiable efficiencies you will gain with Quintiq, please contact:

David Hillis
Direct +44 1753 892926 Mobile +44 7836 756238
david.hillis@quintiq.com
www.quintiq.com

Photo courtesy DFS

Personnel Qualifications and Training

Paul Neering, Liaison Officer EU - IFATCA

IFATCA is the world wide Federation of Air Traffic Controllers' Associations, representing the global voice of ATCOs. IFATCA represents over 50'000 Controllers in more than 130 countries. IFATCA sets out the corporate standards (where they do not exist elsewhere – e.g. at ICAO or other international organisations) in form of global policies. IFATCA has policies on training, on selection and various other topics related to the title of this bulletin. Starting year 51 with the motto: One Sky One Voice. What follows is an outline of some of the challenges IFATCA has identified so far when it comes to Personnel Qualifications and Training. From time to time more questions than answers will be given.

ATCO shortage

IFATCA recently conducted a survey among its Member Associations. The results revealed a significant disparity about the perceptions of staffing levels between the MA's and the ANSPs. Most MAs reported that the staffing numbers and/or principals reported by their ANSP are insufficient or incorrect. Traffic in most cases is increasing at double the rate compared to the staffing increases for last year. Some ANSPs are opting not to replace retiring staff at this stage. Appropriate Planning for staff by ANSPs is lacking and it is only realised that there is a critical shortage when it is too late. It seems like accurate preplanning is missing and acknowledgement to the public and users that there is a staff shortage are kept hidden up to the last possible moment. Last minute drastic measures are then implemented to try and correct the staff shortage and most of the time it involves the remaining ATCOs to help save the day. Many rosters do have the mysterious Mr. and Mrs. Overtime listed as unreliable colleagues. This situation adds more pressure to the current system and can lead to fatigue and potential sickness due to a lack of adequate rest periods. There are many factors influencing this situation, including, but not limited to:

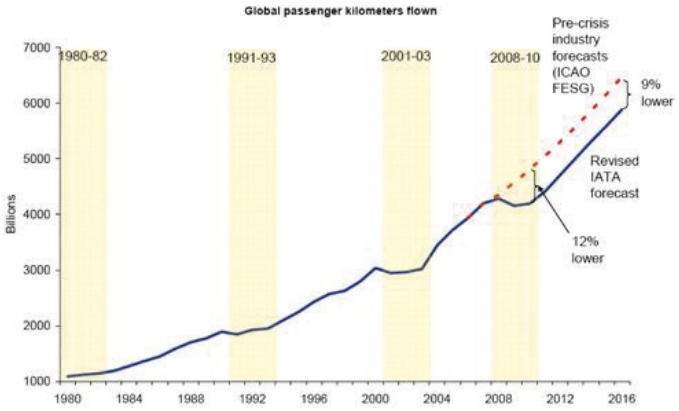
- The ability to attract new trainees into profession
- The willingness and capability of ANSPs to carry out sufficient ATCO training
- The increasing age profile of the existing ATCO workforce
- Major initiatives requiring extra ATCO staffing for their implementation
- A reliance on overtime to sustain 'normal' operations
- Booming Asian economies, resulting in rapid infrastructure expansion

Staff shortage figures go from 5% to up to 50 %.

Traffic forecast
Right shows an example in RPK (Revenue Passenger Kilometers) forecast. Though we might have lost 5 years in high growth scenario the traffic will continue to increase an average of 5% a year. Modernisation programs require additional staff while continuing to work.
Major initiatives, such as SESAR and NextGen, will require extra staff to develop and implement those changes. For example, at a recent Eurocontrol meeting it was stated that 500.000 man-days are required for validation of SESAR IP1 & IP2. This will essentially double the expected staffing shortfall from 10% to 20% in Europe. IFATCA's estimate for Europe is that there is a shortage of 1000 ATCOs below the number required for current normal operations. The shortage of ATCOs will inevitably jeopardize major initiatives such as these, and thus delay the benefits they can bring.

IFATCA is convinced, and has previously stated, that even with advanced automation starting to be introduced widely, through various projects such as SESAR and NEXTGEN, in the future there will be a need to have traditionally trained and selected ATCOs in the system until at least 2020. A potential reduction of workforce per movement will not become a reality before 2030 (it is not likely that the numbers of ATCOs will decrease, but rather each ATCO will handle significantly increased numbers of aircraft). So, industry has to accept and be prepared for the scenario that a potential reduction in ATCO numbers due to automation will not be possible until after a further generation of ATCOs (the ATCOs working the future system are currently in pre-school or primary school age or are not yet born!)

During the transition phase from the current to future systems, there is a need for more than the minimum numbers of ATCOs (we have never seen optimum staffing levels) to handle the day-to-day traffic. If SESAR and NEXTGEN are to be introduced



in a promising way, then there is a need to involve the current workforce in validation, "modeling", conceptual work and simulation, which all require work outside of the control centers and towers.
Further, the introduction of Safety Management Systems and the moving from the current 'technology driven' to a 'performance driven' approach to ATC will require more experts with an operational background outside of the control centers and towers.
IFATCA estimates that there is a need for at least an additional 15% above the minimum staff numbers required just to handle the traffic.

There are new forms of training: a more commercialised approach (not necessarily the answer), more Computer Based training etc. The failure rate has however not significantly reduced in ATM. There is a challenge to attract sufficient candidates to get the right "Stuff" (between 8000 – 800 candidates for one qualified Controller!). It takes between 36 – 72 month to get an ATCO fully trained.

For example, in the United States, trainees are frequently being rated on just one position and left to work only that position, rather than being progressed through full development. This can indeed be a false economy, and in fact prolong the overall training time.

There is incidental evidence to suggest that many prospective recruits to the ATC profession are being discouraged form applying due to the widely held views about the deterioration of ATCO wages and conditions and the chronic staff shortages requiring considerable amounts of overtime to be worked.
It is our view that most ANSPs, due to the different perceptions about staffing numbers, are not doing enough to recruit and train sufficient numbers of trainee ATCOs to sustain current operations, and much less address the shortfall.

Training is not cheap. ATM staff is not a mobile workforce as such (lower than 10%) and conversion training can take between 3 – 24 month . Average costs per ATCO from selection to first day as a qualified Controller amounts € 600.000.

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"An Air Traffic Controller is being checked up to seven times a year"

IFATCA jointly with CANSO produced a brochure on The Next Generation Aviation Professional which can be downloaded from the websites www.canso.org and www.ifatca.org.

Current and future needs.
An Air Traffic Controller is being checked up to seven times a year (from medical fitness, over theory, practical, simulator training to emergency training). What are the regulatory needs to remain adequate – and what are the needs with regard to regulation for the future systems which are currently being developed. There is a need for robust, adequate and not "only" administrative regulation capturing medical fitness, training institutions , CBT training, appropriate training at facilities (on the job), sufficient refresher training, audit elements etc. All this has to be economically and practically sound. Any new initiative needs to be assessed both from a safety and an operational point of view .

Regulatory needs.
The people who are selected and undergoing training today are the future: will their training needs be fully catered for? Do we know what they are?
What about the thirty-forty year olds who are training those above - what about their training needs?
Could we be facing an era of differential ATCO training?

CPD - controller professional development should be a regulatory requirement for the preparation of ATCOs for the changing operational environment and maintaining professional skills, personally and institutionally.

Changes in ATC paradigm need to be supported by a change in the safety paradigm and vice versa. Ergo there is a mutual dependency that needs to be understood and acted upon.
The relationship between pilot and controller also changes. So we should see a mandate for more meaningful training that provides the required knowledge to support the ATM - Flight deck interface.

TCAS, EGPWS, TAWS, ASAS, 4D trajectories are all examples where the ATCO needs more information not less. Do we understand the knowledge requirements? And how to train them?
Citing Amalberti (2002):

'…Things change for human factors and safety strategies. First the day-to-day regulation becomes more and more opaque for the executive level. Front line actors and first line management make it unofficially.

A paradox for the executive level. Because of the fear for complexity and for their position in case of problems it would precisely reduce delegation and start giving orders. The job is done, but violations are more numerous.

So the true value of training can be measured in millions if you get it wrong. Management needs to understand the true value of effective training and management thereof. The regulatory need points in that direction: managerial and supervisory training requirements.

The human has to be seen as a key element for the complex socio-technological system as ATM.
- in the system
- in the working environment
- as part of the staffing
- in training and development
- in procedures, roles and responsibilities
- as part of Teams and in communication

The Human will remain a key player for decades to come.


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Over 40 Worldwide ATM
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Includes weekly email update
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Versatile use of ATC simulators

Can ATC simulators be used for chopping wood or brewing coffee? Maybe not, but join Training Specialist and controller Anders Halskov-Jensen from ATS Academy Entry Point North as he reflects on how to use simulators in a broader context.

ATC-simulators are used to prepare students for handling real traffic. It's all about safety in our environment, and we don't want to inflict any risk on aircraft or humans by letting inexperienced students "have a go".

The traditional controller education is therefore a journey from classroom theory, through hours of simulation and ending with OJT (on job training) with live traffic in an operational unit. And there is nothing wrong with that. It works. But how about considering using simulators for other purposes? Simulation is not only for students at ATC academies, it can be a useful tool for OJT as well as for operational controllers.

Combine OJT and simulation.
It's not always that "live" traffic provides the situations that students need to practise. But simulators can provide any scenario with preparation.
Maybe final OJT could be combined with simulation targeted towards specific topics i.e. spacing, speed control, holding, final line up and so on. New controllers would be able to start with broader experience while the OJT-period (and associated costs) could be reduced. Maybe even the national regulator could be convinced to let the simulation count as part of the mandatory required hours of training? The simulator experts at Entry Point North recently created a simulation airport and exercises for the specific purpose of training a student on final OJT. The reason for creating this special training for the customer was that instructors were reluctant to validate the student. But with a targeted effort in the simulator, the student gained the required skills and was validated in a month.

Simulation for Controllers.
Just as pilots, controllers must receive refresher training regularly. Aircraft simulators are exactly like "the real thing" allowing pilots to go through some very advanced training. In ATC, simulators are also used for unusual events training, but often it's just a typical exercise like "Control, we have a sick passenger and would like to divert to.." thrown in.
Operational controllers, however, may also benefit from practising scenarios that affect their work even more. It could be exercises with reduced radar coverage or passing all estimates on phone in a "no data connection"-simulation or the closure of a major airport in heavy traffic etc.
It can all be done in the simulator, and it's worthwhile to sharpen controllers' skills this way.
Think "out of the box" when planning refresher training. Snow removal, blocked RWY's, capacity training, ops-room evacuation, there are a lot of items that could be trained and practised in the simulator besides the common "and suddenly something happens to one aircraft"-scenarios.

Simulator capacity and HMI.
Not all ATS-units have simulator-positions nearby or the necessary resources to develop simulator exercises beyond the required. In that case a solution might be to contact an experienced training academy where help can be obtained. At Entry Point North, we can assist in any part of training from mere simulator rental to exercise development or actual training. We have equipped a large trailer with simulator positions, enabling us to bring the simulator to i.e. small remote airports without training facilities and then give the staff refresher training on the spot.

Traditionally, huge efforts have been made to make ATC simulators emulate the HMI of the operational system.

The idea is to minimise the time students have to spend on learning how to operate the controller working position. But unless the HMI is mimicked 100%, controllers on supplementary training will question the small differences between their operational system and the simulator, which is often delivered by a different manufacturer than the ops-system. So don't be afraid to train on a simulator with a different HMI. It's just like driving a car. Your present car is probably not the same make and model as the one you had your driving lessons in, am I right? But as long as it has pedals and a steering wheel you can operate it, once you've noticed the location of lights, buttons etc. Same with simulators. It might actually be easier to adapt to a completely different HMI than one that only emulates the operational one 90%. Those last 10% will become a surprise and a nuisance every time, and will take focus away from the purpose of the training.

"Don't be afraid to train on a simulator with a different HMI. It's just like driving a car."

Think open minded, when considering the use of ATC simulators, regardless of whether you have your own or use a Training Academy. Check with your simulator experts if your ideas are possible. Most likely, they are.

Eurocontrol Maastricht's Simulator

A state-of-the-art Facility

Chris Wade - ATC Network

After we decided to dedicate a "Bulletin Special" to "ATC Training and Simulation" I enquired with Maastricht Upper Area Control Centre (MUAC) if I could visit their Simulator. I started my own career in ATC at Eurocontrol. Arriving at the Luxembourg Institute of Air Navigation Services (IANS) in 1994 'Ab-Initio 20' followed 6 months of intense study and simulation training. Following that, we had to re-locate to Maastricht in the Netherlands for 6 months. Here we learnt the airspace routes of the MUAC by drawing the airspace routes over and over again. As well as learning the job of a Flight Data Assistant, a job which is now largely automated. Another 6 months in Luxembourg followed, Simulation and theory, after which we would return to Maastricht for the final training.

This was the training from 15 years ago and now quite a lot has changed. The operations room we used in Maastricht is now the simulator and the controllers at the MUAC are now working in an operations room which is arguably one of the most advanced in the ATC world.

MUAC Training & Simulation
It is an impressive simulator to say the least. A vast room which at first glance you would presume is an operations facility. MUAC is well known in the industry for rolling out new ATM technologies and procedures and many of these new technologies are first put to the test in the simulator.

As Maastricht, part of Eurocontrol, is permitted to employ Ab Initios from all of it's member states, the Ab-initios that will arrive on a particular training course could be from any one of 39 countries. This in itself causes an extra challenge for the training staff at both Luxembourg and Maastricht.

The Training department in Maastricht has set up a confidential counselling section to help and support the young Ab-initios with issues such as homesickness, housing, language assistance and personal problems. These issues can be paramount for a young person at the beginning of their career and any extra hel p is gladly received. The training is extremely demanding and intensive and students who are not happy in their personal lives, will more often than not, be unsuccessful in their training cycles.

The Simulator
The current simulator was opened shortly after the new operations room became active in November 2002. So the room has seen ATC operations since 1972.

The Simulator room: MAESCAPE (left), ATC Training (right)

The Maastricht simulator consists of two sections.

The MAESCAPE section
MAESCAPE (Maastricht EUROCONTROL Simulation Capability and Platform for Experimentation) is the section of the simulator which is used as a stand-alone simulator. But this section does have the capability to connect to the Eurocontrol centres in Luxembourg and Brétigny in France to help with training or exercises there. This networking can allow Maastricht simulator staff to assist in exercises being run in these centres.

MAESCAPE consists of 9 CWPS. (Controller Working Positions) Each position has on one side an executive controller and assistant position. At the back are 3 positions – 2 pseudo pilots and an adjacent unit. The positions are also equipped with a CHIP tool (Controller Hybrid Interface Panel).
This tool allows the trainer (sitting with the student controller) to communicate via a touch screen with the pseudo-pilots and adjacent unit during the simulation exercise to add extra elements without interrupting the session.

The simulator exercise can be played back after the end of a session to walk the trainee through any issues encountered. The trainer can check-mark sections of the live session and refer back to these points during the play-back. This avoids pauses by the instructor and a more real-time simulation is achieved.

ATC Training section
ATC training is the section of the simulator which takes care of advanced training and also testing of new ATM technologies and procedures which will eventually be rolled out into the Operations room. A few examples of these are:

Free Route Airspace
• http://www.atc-network.com/News/38531/Free-Route-Airspace-in-high-density-airspace-enters-new-phase
CPDLC - Controller Pilot Data Link Communications
• http://www.atc-network.com/ShowCase/29216/CPDLC-Controller-Pilot-Data-Link-Communications-

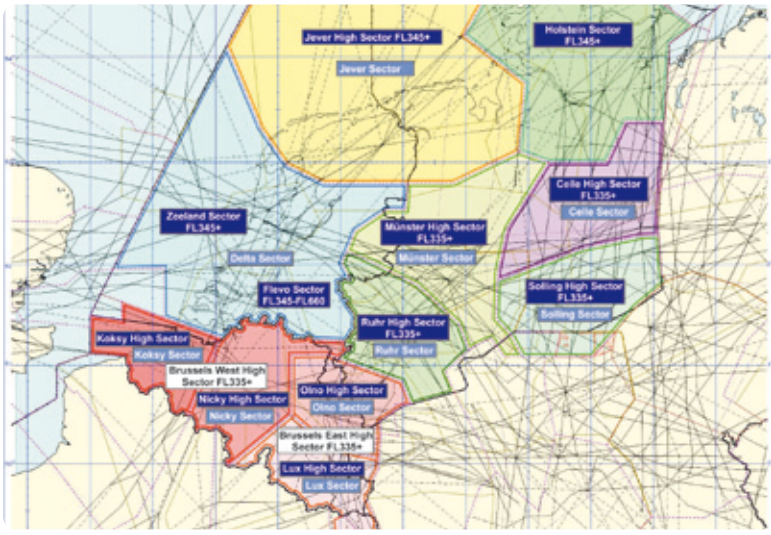
The ATC training section has the ability to feed from the live radar picture from the MUAC Operations Room. It is mainly used for advanced training of Ab-initios and also "refresher" training of current licensed controllers.
This section of the simulator has the ability to therefore replicate all sectors of the MUAC airspace including high-low splits, collapsed sectors etc. which most trainees are very unfamiliar with until they start "on the job" training.
This part of the Simulator is also used by engineers to put new technologies through their test phase.
Ab-Initio Training

Not everyone is lucky enough to win a position on a training course at Eurocontrol.
On an average intake between 1500-2000 candidates apply. The initial selection procedure, testing and interview selection, results in around 15-30 operational controllers.

The training consists of 5 phases:

- Phase 1, Basic Training,18 Weeks
- Phase 2, Rating Training, 21 Weeks
- Phase 3, Transition Training, 8 Weeks
- Phase 4, Pre-OJT, 16 Weeks
- Phase 5, OJT, approximately 50 Weeks

After finishing Phase 2 an important decision is made as to which airspace the Ab-initio student will continue to train. This can be either the 'Brussels' sectors (covering Belgium, Luxembourg as well as parts of the Netherlands, Germany and a portion of French airspace), the 'DECO' sectors (covering most of the Netherlands and parts of Germany) or the 'Hannover' sectors (covering parts of the Netherlands and the North-West of Germany). These cover the Brussels Upper Information Region (UIR), the Amsterdam Flight Information Region (FIR) and the Hannover UIR. The sectors are designed for maximum efficiency from the ATM point of view and transcend national borders. In almost all cases once assigned this will be the airspace the student controller will continue to work on for their ATC career.



The Maastricht UAC airspace and Sectors

After this they go into an on the job training phase where eventually they will be evaluated and receive their certificate as an Air Traffic Controller once the training Officers deem the student ready to 'check out'.

It will be a long demanding and hard road for the students but for those who do make it a rewarding career awaits.

"On an average intake between 1500-2000 candidates apply."

NATS transform ab-initio ATCO training

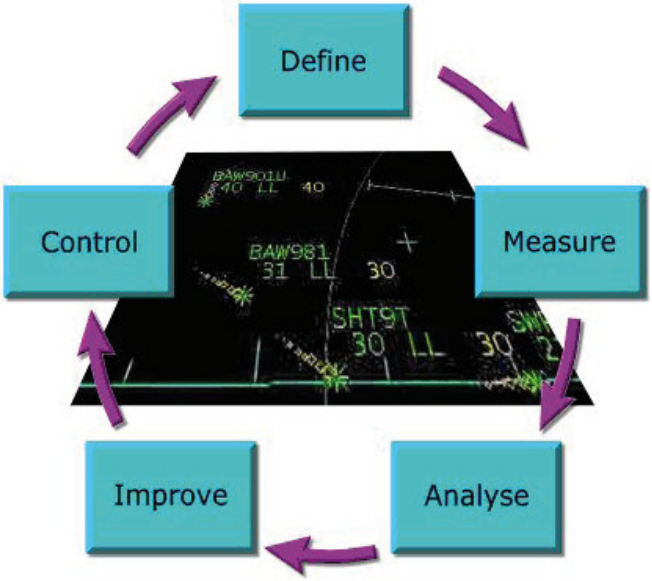
In this article we find out how the UK's ANSP NATS (En Route) have spent the last four years transforming ab-initio ATCO training. Their starting point was the application of Lean Six Sigma techniques in a unique way to tackle the challenge of training new ATCOs for its business. The rigour and insights gained from applying Lean techniques created the right platform for a robust improvement programme. These put NATS in exactly the right place for a move to a stunning new facility and deliver significant improvement in its course results.

Back in 2008, NATS, in common with many ANSPs, faced a forecast manpower shortage of en route controllers. The training process at that time was long, expensive and subject to quite a bit of variation as to whether trainees would make it or not. Not unnaturally the business sought to solve the problem of not enough successful trainees by recruiting more thus loading up the process and further compounding the problem.
Garry Jackson, (Director, Training and Simulation) "The uncertainty of how many qualified trainees would be delivered to the operational units was a major cause for concern. Growing demand combined with an aging ATCO population meant that we had to find a way to meet our numbers".

Garry Jackson

Garry was appointed to take over the running of the Training College in 2008 and set about making changes. "NATS' Business Improvement group offered support to run a diagnostic on the training process and provided help in the form of external consultancy firm Northstar, who supported NATS with the deployment of Lean Six Sigma. "It was a great opportunity for us to showcase the power of Lean Six Sigma in a business-critical area."

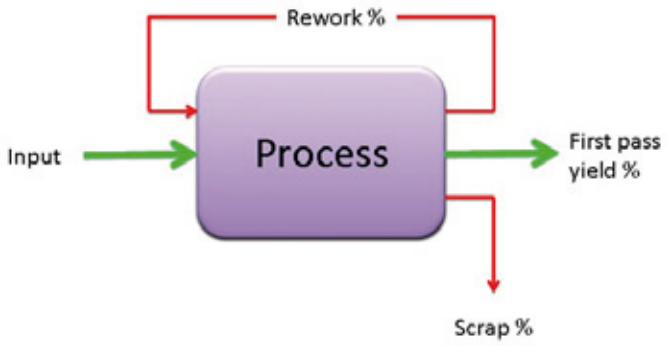
commented **George Tosh,** Director at Northstar. "We followed the DMAIC process, **Define** the problem, collect data to establish **Measures, Analyse** the data to find root causes, implement **Improvements** following good project management practices, and create **Controls** to maintain and continue the improvement process.



Improvement initiatives had come and gone at the college; this was different. For a start the scope of the improvement project was the End-to-End process, from recruitment through to unit training.
A holistic approach was considered essential from the outset to make sure each element of training was linked to the next.

Why Lean? Lean has been around for many years and has been traditionally used as a methodology to improve manufacturing productivity. At its core the approach focuses on identifying and removing 'waste' from processes and making sure product 'flows' to meet demand.

The figure below provides a simple view of any given process step:



All very well in a factory, but how does it apply to the people-intensive process of training?
George explains, "This manufacturing analogy worked well in the training college, particularly in relation to how we identified and quantified waste, and tying a financial value to that waste meant that we had all the attention and leverage we needed to implement changes". Getting those involved to think in the factory model was initially a challenge, George again, "This took a bit of time to bed in, professional trainers found it difficult to accept trainees as 'product'; 'these are people we're talking about here' being a typical response. Introducing a different slant to the thinking was crucial to getting everyone to buy in to the changes we were making."

As mentioned earlier the focus on treating causes, as opposed to symptoms, meant that improvements were tangible. "Using the data collected we were able to clearly demonstrate the impact of rework (re-coursing failed students) on the overall training capacity, quantifying the cost-of-poor-quality and the bottleneck. Armed with these data we were able to build an overwhelming case for where to make improvements".

The data collection and analysis exercise included input from all areas involved and culminated in a one-day management event to brief the findings. "This was a major turning point in the project.", said Garry, "Everyone involved in training, from the CEO downwards, had a data-rational view of the end-to-end process and complete visibility of the issues and causes. Everyone bought in to the need to drive positive change".

The Analyse phase identified a number of key changes which needed to be implemented, the most critical being courseware changes required to enhance radar skills during Basic training.

The next challenge was creating the space in the training schedule to make the changes. As with any other business keeping the production line going and freeing up resources to make necessary changes is a major trade-off. Garry Jackson – "We knew we could not meet our output and implement the changes we needed with the instructor resources available. Given the weight of the evidence and the improvement in pass rates we could achieve if we implemented the changes the decision was simple – we had to focus on improvement."

A dedicated, collocated project team was created from the instructor community, and a plan of work created to redevelop Basic courseware and simulator exercises, fully adopting the guidelines and taxonomy provided under ESARR5 T14 (later replaced with the Specification for the ATCO Common Core Content Initial Training).

The revised course was created, tested and rolled out for en-route training in a 4 month period. The results were dramatic, first pass yield more than doubled to over 70%. In simple terms this created a third more training capacity, exactly what was required to meet demand.

The team found other issues during the Measure and Analyse phase, and prioritised these to form an improvement plan for the college. The college established its own internal improvement capability by training 25 of its staff in Lean and Six Sigma Techniques.

A programme of Continuous Improvement was established with key projects undertaken including:

- Improvement of the Recruitment & Selection Process for trainees.
- Advanced Teaching Learning and Assessment Skills training for ATC instructors and support staff (called the ATLAS Programme).
- Introduction of Trainee Progress Tracking to support decision making and the identification of supplementary training requirements.
- The introduction of Modularised Training course Design enabling trainee output to be tailored to customer requirements.

Alongside the training improvement activities, NATS further demonstrated its commitment to training by investing in a new, purpose-built,
training facility at its Corporate and Technical Centre in Whiteley, Hampshire.

The new centre is a 4000 square metre state-of-the art facility that will train air traffic controllers from across the globe. There are 6 simulator rooms with a total of 45 trainee positions which recreate the live air traffic control environment and ensure the best possible learning experience for controllers of the future. The facility also has 6 purpose-built classrooms and access to other training rooms and meeting rooms at the centre. Each room has SMART board technology and flexible furniture so the instructor community can take the advanced teaching techniques given to them through the ATLAS Programme to new levels.

One of the most valuable lessons NATS has learned over the years is to create an environment that enables its people to be actively involved in the improvement process. With this in mind, NATS took the bold step to offer its staff the opportunity to design their new training facility. NATS applied change management best practice and established a User Group made up of staff from the Instructor, Support and Administration departments. The User Group was tasked with defining the training centre requirements and then working closely with a core project team in the design, development and implementation of all aspects of the project including workstation design, building layout and classroom design. A governance process involving all key stakeholders was established to ensure the facility was fit for purpose.

Reflecting on the move of the college, which was successfully delivered in August 2011, Garry Jackson said "This is the culmination of a whole series of changes and improvements we have made within Training and Simulation. We now have a completely new working environment – one developed by our User Group and the wider college community in association with the project team. We have created something that ensures we can provide world class training to all our internal and external customers for many years to come."

The new location is just 3 miles from the Swanwick Centre. This close proximity has many benefits because it is now so easy for all members of the training community to be in closer contact, and break down the perceived barriers of the end to end process.

The delivery all NATS simulations is now an integral function within the Training and Simulation area. This means that simulations to help shape the future design of UK airspace and beyond, as well as trials of new tools to help controllers deal with future increases in traffic, are fully co-ordinated thus future-proofing NATS' training capability for emerging technologies.

Additional phases of improvement activity are underway to further integrate the transition elements of the End To End ATCO Training Process to deliver improvements to NATS Validation rates.

Rob Denman, NATS Business Manager for Training explains: "The co-location of the College at the Corporate & Technical Centre with Swanwick Area Control Centre will enable us to join up a programme of improvement across Strategic Manpower Planning, Recruitment & Selection, Initial and Unit Training. This will deliver further opportunities to stream line processes, improve training validation and reduce the cost of training."

Does Lean work in an ATCO training environment? The NATS experience is an overwhelming yes – the methodology enabled a logical and data driven change and improvement programme which has allowed informed decisions to be made transforming ab-initio ATCO training at NATS.

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The Positive Impact of Voice Recognition

Daniel Webster College, Thibeault

"United Two Sixteen Heavy turn left heading three six zero, descend and maintain six thousand – verify information Mike."
This is an example of a clearance issued by an Air Traffic Control (ATC) student running a simulation exercise. Typically, the clearance is read back and executed by a pseudo-pilot. However, at Daniel Webster College (DWC), Ray, one of 16 embedded voice files, reads back the clearance. Execution of the clearance occurs internally, without the assistance of a pseudo-pilot, and the student moves on to the next task. The benefit of Voice Recognition and Response (VRR) has been realized. As we enter the second decade of the 21st century, voice recognition is firmly entrenched and universally accepted in many facets of society. Recall the last time you phoned an airline to check on your flight status or reservation? How about your drive to work today? Did you use voice recognition to change your music selection or to interact with your navigation system? In order to improve and expand the services offered to an increasingly technical and savvy customer base, while simultaneously remaining competitive in the marketplace, both academia and industry leaders have embraced VRR. Why is VRR rapidly becoming a staple of ATC simulation? Simply, VRR has matured, and is being used regularly in the education and training of the next generation of controllers.

Need for Specialists
According to the Federal Aviation Administration (FAA), Revenue Passenger Miles (RPM) or one paying passenger traveling one mile, are projected to more than double over the next two decades, from 787 billion to 1.7 trillion in 2031. U.S. airlines will reach the one billion passengers per year mark by 2021, two years earlier than last year's prediction of 2023. 1 For more than 25 years, DWC has been a major player in the field of educating tomorrow's aviation workforce; especially in the field of Air Traffic Management (ATM). Like any career field that is experiencing a shortfall of qualified employees, an ATC-based education is in great demand. (This is not unlike what the field of nursing is currently experiencing due to the retirement of the baby-boomer generation.)2 In the face of this demand, DWC-ATC has positioned itself to meet the influx of students while ensuring the program's high standards
are being adhered to. Simulation, and in particular VRR, has been a critical ATM program component.

VRR and DWC
For generations ATC simulation has been conducted byhaving an individual work as an air traffic controller trans•mitting clearances to a pseudo-pilot, or as the United States Navy references them, "bug runners." The pseudo-pilot, at his own work station, listens to the clearance, responds as a "real" pilot would, and then makes keyboard entries to ensure the simulated target performs as cleared. In a VRR simula•tion environment, instead of using a pseudo-pilot, tasks are accomplished by
the software installed in the simulation system. The software recognizes the grammar spoken by the air traffic controller, converts the voice clearance into a text message using the same format that a pseudo-pilot would apply via keystrokes – and voila! – The clearance is executed.

Manchester TRACON
The simulated radar environment at DWC is a four corner post TRACON, with similar airspace that is being used daily at Level 11 and 12 TRACON facilities in the United States. Besides having a number of secondary airports in the air•space, the primary airport, Manchester, has four runways;18R/35L, 18L/35R, 08/26, and 07/25. This set-up allows for a wide range of airspace and air traffic concepts to be taught,with a heavy hand from VRR. For instance, from a simple single runway instrument or visual approach configuration, to a complex simultaneous independent parallel runway and/or converging runway, the simulation lab "hums" along, mimick•ing a working facility.
The DWC radar laboratory has four Radar Control positions,four Radar Associate positions, and four Pseudo-Pilot posi•tions. During the current 2010-

11 school year, lab demand has been at an all-time high. Specifically, demand for AT310 and AT315 (Junior year ATC courses) and AT410 and AT415 (Senior year ATC courses) (see table).

Training Cost Savings
From the numbers presented, it is evident that simulation demand and expense could be overwhelming. If DWC employed pseudo-pilots in lieu of VRR, and demand remained constant, the current program could not be offered because it would be too costly. Specifically, if four pseudo pilots were employed during each scheduled lab session, and each earned $45 for each two hour and fifty minute per lab (a $15.90 hourly rate), annual salary costs alone would be $50,400 for 280 scheduled sessions. The expense for pseudo-pilot support for the practice time each student is required to invest would be $100,170. Thus, excluding annual volunteer and tutoring lab use, which is considerable, VRR is saving DWC over $150,000 annually. Imagine the financial benefits a large ANSP might experience?

Fall 2010/Spring 2011 radar lab use

AT310 and AT315

28 semester weeks x 7 labs per week	= 196 instructor led lab Sessions
196 scheduled labs x 4 scenarios per lab	= 784 scenarios run
3 hours min practice time required per week	= 84 hours of practice time required per student
84 hours of practice time x 51 students	= 4,524 hours of practice time

AT410/415

28 semester weeks x 3 labs per week	= 84 instructor led lab sessions
84 scheduled labs x 2 scenarios per labb	= 168 scenarios run
3 hours min practice time required per week	= 84 hours of practice time required per student
84 hours of practice time x 24 students	= 2,016 hours of practice time

Total *radar lab use Fall 2010/Spring 2011	Increase over 2009/2010
280 scheduled lab sessions	43% increase
952 scheduled scenarios	44% increase
6,300 hours of practice time required	55% increase

*does not include voluntary lab use per year. The radar lab is available for unlimited student use and tutoring anytime outside of schedule lab sessions. VRR is used exclusively for each of the requirements above.

DWC Simulation Functionality
Financial benefits are worthless if the quality, quantity, and variety of ATC concepts offered are diminutive. In other words, it is fair to say that deploying VRR has to equal and/or exceed what pseudo-pilots bring to the table. DWC has worked extensively with UFA software engineers to ensure their VRR product – ATVoice – contains extensive functionality and is easily updatable.

Consider what occurs thousands of times a day in the United States when an aircraft checks on frequency with a departure controller. The aircraft calls departure, usually stating what altitude it is leaving and the altitude it is climbing to on a specific heading and is cleared on a published Standard Instrument Departure (SID). The controller needs to be able to apply the various approved radar identification methods ,ensure mode C accuracy, confirm altitude assignment, vector the aircraft to join its cleared routing, perhaps issue a speed restriction, issue a traffic call applying merging target procedures, and ultimately issue a frequency change as the aircraft is handed off to the next sector. Employing ATVoice with ATRadio, DWC students can not only do all of these tasks, but they can do them in any order desired, while using standard phraseology as stated in FAAO 7110.65T, completely free of live pseudo-pilot support.

Another typical scenario is a simulated arrival rush. Envision simulating an approach wall at a busy TRACON. The wall might have two to three Feeder and Final positions open in order to provide service to an arrival rush that equals an Airport Acceptance Rate (AAR) of 72 -80 aircraft to parallel runways, 36L and 36R. The final controller for runway 36L is conducting ILS approaches while the final controller for runway 36R is conducting visual approaches. The following information and clearances might need to be issued:

>>

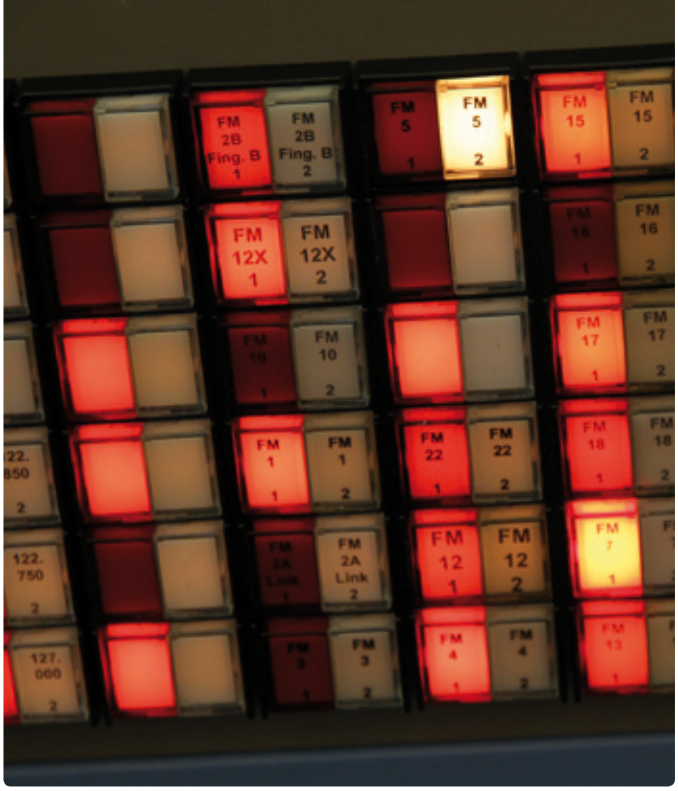
ATIS verification, altitude and speed assignments, wake turbulence advisories, instructions to intercept the localizer, PTAC ILS clearances, clearance to maintain visual separation from the parallel runway traffic with instructions to follow the preceding traffic that has been reported in sight, and runway assignment changes. These clearances and many more are practiced over and over again by students at DWC – solely using VRR.

According to Thibeault, "Having worked most of my ATC career at a busy TRACON, one of the most important aspects I needed in order to both achieve CPC status and remain an accomplished controller was repetition." He continues that, "Working similar situations over and over again allowed me to gain the experience necessary to excel. Not only does VRR allow this repetition to occur at an extremely low cost, but most importantly, it allows an individual to learn how to correctly apply classroom concepts and theory in a greatly reduced period of time." For example, a student might have difficulty learning how to run an efficient ILS final and applying the required PTAC phraseology. In a pseudo-pilot driven environment, the student may get the opportunity to practice on the simulator a few hours a day or week. With VRR, the student can practice as many hours as the simulator is available. If the student is also using ATCoach, the student can review recorded simulation runs performed by instructors-to see how it should be done and/or they can review their own recorded simulation runs so that they can see and listen to how they have performed.

The student quickly sees what improvement may still be necessary. Students are often asked to review a recorded simulation run which has purposely 10 to 15 errors. Errors might include incorrect phraseology or proceduresin the recording. Students are then assigned the task of viewing and listening to the scenario. Upon completion they must document all of the errors, provide the proper references for each, and state how the operation should have been conducted. This type of assignment has proven to be highly effective in shortening the time required to learn required tasks.

Is VRR Truly Viable?

On paper VRR appears to be an ideal tool for the next controller generation. In 2006, the FAA requested that NASA-AMES Research Center assess the effectiveness of VRR being used on a STARS simulation system. The research was conducted in the training room of the Boston Consolidated TRACON, located in Merrimack, New Hampshire. Twelve scenarios actually used in training – varying in complexity and type – were run in two phases. Boston TRACON Certified Professional Controllers (CPCs) were used to run these scenarios, Both VRR and pseudo-pilots were used, and data points were collected. VRR evaluation measures included scenario development time, VRR errors, and



the impact of errors on training. Results of the study indicated that VRR is acceptable for TRACON instructional purposes and it performed well as compared to the existing Pseudo pilot based system."3 the NASA-Ames team recommended that VRR be tested using developmental controllers exclusively. NAV CANADA has not only done testing, but has begun VRR installation. Deutsche Flugsicherung GmbH (DFS) is also in the early stages

NAV CANADA

NAV CANADA has integrated VRR into simulated Air Traffic Control Tower (ATCT), Terminal, and En-Route environments. The company is well underway with deployment plans in each of its seven Area Control Centers (ACCs). Developmental controllers, who are selected for either a Terminal or En-Route option, receive generic IFR training followed by specific IFR training for their area of responsibility. Working directly with UFA, NAV CANADA has been able to redesign the grammar the VRR engine must recognize so that it can be used by its developmental workforce while also meeting ICAO requirements. There are many reasons why NAV CANADA pursued VRR.

Professor Thibeault recently interviewed Garry Brown, NAV CANADA Manager Operational Training Initiatives, to discuss VRR.

Thibeault: *Why did NAV CANADA pursue VRR for its training platform?*

Brown: *To reduce the bottleneck restriction a centralized train•ing facility placed on student throughput, and to enable more student practice without a support resource dependency.*

Thibeault: *Where are you now concerning implementation of VRR at your facilities?*

Brown: *Generic IFR training is the process and has been deployed at five of seven sites. Generic Terminal Training has been delivered at one site and is the prerequisite to the Specialty VRR.*
Specialty IFR VRR has been installed at Vancouver. Moncton and Winnipeg are scheduled for Spring 2011, Gander and Toronto will be Fall 2011, and Montreal requires a bilingual solution.

Thibeault: *Have you seen that your phased implementation plan of doing Generic IFR first and then Specialty IFR is the proper course to follow?*

Brown: *NAV CANADA developed a Generic Terminal Course that leveraged an ATCoach Generic Terminal Voice module that has proven to reduce the Specialty training requirement. The Generic portion also ensures the student's capability using VRR is improved and they do not have to re-learn another process.*

Deutsche Flugsicherung GmbH (DFS)
Led by the dual efforts of Karl-Heinz Steffens, Ph.D., head of the DFS ATM Simulator Center, and Michael Slotty,ATM Simulator Center Project Manager, DFS has begun the process of integrating VRR into its training process. In the summer of 2011, training will begin for over one hundred developmental controllers who will be working high altitude sectors, specifically Flight Level Three One Five and above. In preparation of using VRR exclusively, field trials are currently underway at Munich Center.

According to Uwe Gaudlitz, Munich Proficiency and Simulation Manager, trial results are exceeding expectations. "From the first day this project began, I have been amazed at how many diverse clearances can be issued and how efficiently VRR accepts these clearances using English with a German accent," he says. "The flexibility we will gain in our training program will be enormous. No longer will training be negatively impacted by a lack of pseudo-pilots, and lab availability. Developmental controllers will have much more access to simulation equipment, which will result in a reduction of the time necessary to be in training." The future of VRR is exciting and promising. Tremendous strides have been made in the last few years which have positively impacted the training and education of tomorrow's controller workforce. It should definitely be a component that is available to meet the increased demands aviation will bring in the decades ahead.

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About the Author

Greg Thibeault is an Assistant Professor with Daniel Webster College (DWC) based in Nashua, New Hampshire. Professor Thibeault has over 29 years of experience within military and civil Air Traffic Control and Academia. Currently, Thibeault manages and teaches in the DWC School of Aviation Sciences, Undergraduate Air Traffic Management Program and the Graduate MBA for Aviation Professionals Program. Currently, Thibeault helps manage and teach in the DWC School of Aviation Sciences, Undergraduate Air Traffic Management Program and the Graduate MBA for Aviation Professionals Program. He also serves as an Air Traffic Control Subject Matter Expert for UFA and other corporate clients.

Simulation of Biomathematical Models to support Fatigue Risk Management Systems (FRMS)

S. D. Satyamurti, Ph D., P.E.

Sleeping is common for all mammals. Throughout the world, people go to sleep after the sun sets on the western sky. They follow the circadian rhythm and the sleep-wake cycle is tied to rising and setting of the sun. According medical professionals, an individual needs at least 8.5 hrs of sleep to stay in shape to perform his/her work and duties in an efficient manner. Telltale signs of sleep deprivation are fatigue and weariness; individuals are also known to lose alertness, frequent yawning, rubbing eyes and inability to function diligently. At the same time various body functions gets disturbed if one misses his/her sleep-wake cycle. Several medical studies have been conducted on groups of people and on individuals to ascertain the effect of sound sleep and lack of it. The psychological and physiological impact is profound and requires medication and treatment. Rest and relaxation will aid in overcoming fatigue. Sleep deprivation is also known to cause heart/digestive disorders as well as reduction in family and social interaction capabilities. It has also been found that the human circadian rhythm gets automatically adjusted to the new location when an individual moves from one time zone to another time zone because the sleep-wake cycle synchronizes with the movement of sun (exposure to day light)

Our work pattern has changed from the typical day time activities to around the clock shift work that requires adjusting to work during sleep time affecting the circadian rhythm. Especially in Aviation due to increased traffic and long distance travel across various time zones the aircraft crew has to adjust their life style and sleeping patterns in different parts of the world. New location, lack of rest, unfamiliar surroundings, different foods, and discomfort with sleeping places influence their ability to function at expected levels could even provoke judgmental errors affecting safety.

It is of interest to compare the definition for fatigue from ICAO, FAA and others and finding ways and methods to overcome the stress to due to lack of necessary sleep time on personnel in various fields of aviation.

ICAO definition of fatigue is "A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety related duties" [(1)]

FAA definition "Fatigue is a condition characterized by increased discomfort with lessened capacity for work, reduced efficiency of accomplishment, loss of power or capacity to respond to stimulation, and is usually accompanied by a feeling of weariness and tiredness. [(2)]

Professor Ann Williamson et al (University of South Australia) gave a definition of fatigue as "a biological drive for a recuperative rest." In this perspective, fatigue covers a range of manifestations (physical and cognitive) that results from the absence of rest"

The ICAO and FAA have introduced the Fatigue Risk Management System (FRMS) (6) which is currently under the umbrella of the Safety Management System. To facilitate the scheduling of operators in the ATC tower and in the cockpit of aircraft there is a push towards application of the results from simulation of biomathematical models that have been developed in the academia to study and forecast the behavior of individuals for the purpose of evaluation of fatigue in Flight Operations and Air Traffic Control operations (3). Feedback from operating personnel is used in the model to predict the behavior and the sleep-wake times by adding rest and sleep cycles within the normal eight hour shift.
It has been observed that individual who work in the night shift have more reasons (looking at the dark sky or computer screens with blinking dots) to be

ineffective and inattentive while at the controls. Therefore the operators are forced to take a nap by administering medications followed by reduced lighting and comfortable environment for sleeping. The study found that the sleep inertia or waking from the short sleep, twenty minutes or less causes a person to lose orientation, alertness and to have power over a good mental judgment.[4]

Many biomathematical models recently developed in the academia are tested, calibrated and validated to support the implementation of FRMS, specifically for ATC staff scheduling and flight crew scheduling. These models tend to simulate the behavior of groups of people or individuals and recommend when the subject may need rest or if fatigue impacts their ability to stay alert at the controls and safely direct the air traffic or fly an aircraft.

List of six biomathematical fatigue models currently in testing state in the aviation industry [6] [7]:

- Circadian Alertness Simulator (CAS)-USA:- This model incorporates sleep history (homeostatic) and circadian components, and an estimator of sleep timing.
- Fatigue Audit InterDyne (FAID):- Australia This model originated from research at the Centre for Sleep Research, University of South Australia and was designed to predict worker fatigue directly from shift schedules.
- Interactive Neurobehavioral Model (INN)-USA: - This model has been developed based on laboratory studies examining both fatigue factors and adaptation of circadian phase to light exposure.
- Sleep, Activity, Fatigue and Task Effectiveness (SAFTE)-USA:- This model includes a sleep reservoir, circadian rhythm and sleep inertia compo nent and has an "auto sleep" function that calculates likely sleep times based on work schedules and sleep physiology.
- Sleep/Wake Predictor (SWP)-Sweden. This model is an improvement over the two-process model, but also accounts for sleep-inertia effects, predicts likelihood of sleep onset and sleeps termination based on physiological parameters and considers constant sleep restriction conditions.
- System for Aircrew Fatigue Evaluation (SAFE)-UK:- Sponsored by Civil Aviation Authority (CAA) this model has the objective of supporting as sessment of permissible Flight Time Limitations for Operators.

Model data input

Sleep input

- Actual Sleep time-The quantity and timing of actual sleep acquired is the primary determining factor in predicting fatigue related to sleep deficit.
- Actigraphy Measuring the physical activity of an individual over a twenty-four hour period, typically using a wrist-worn accelerometer, provides a motion signal which manual or computerized analysis can estimate wake and sleep periods.
- Scheduled sleep When a person takes a nap or sleep time based on a predetermined sleep period
- Work schedule Sleep periods that are likely to occur between on-duty shifts

Circadian Input

- Light exposure, directly influences the shifts in the timing of an individual's circadian biological clock cycle. Adaptation to a new time zone, for instance, occurs due to exposure to the shifted hours of daylight and the resulting gradual synchroniza tion of the circadian biological clock.

Aviation Specific input

- Crew type, sleep locations, number of sectors, and departure/destination points

Model components

The internal components of fatigue models are the characteristics of human neurobehavioral psychology that are described by the biomathematical model equations in the model. Some of the following characteristics are included in the models.

- Homeostatic sleep drive. The deficit in sleep du ration between the actual awake period and sleep period
- Circadian process. The biological clock simulation
- Chronic sleep restriction. Inability to sleep due to long hours of work beyond the normal hours of sleep time
- Circadian phase adaptation. Natural adjustment to day and night in the new location
- Sleep Inertia. Inability to perform in a normal manner when the sleep duration is not sufficient to reduce fatigue
- Individualization Predict the alertness of a normal person
- Caffeine. In the form of a medication provides a temporary alerting effect that decreases the desire to sleep
- Time-on-task. Greater time spent on task reduces the period available for sleep.

Model Output

- Objective measures of neurobehavioral performance
- Subjective assessments of fatigue
- Fatigue related task errors
- Fatigue related risk of operational accidents
- Estimated sleep/wake times
- Confidence intervals
- Sleeping is a natural phenomenon for humans

Conclusion

Present day 24/7 work schedule has forced humans to work side by side with computers and machines diligently, unwavering and persistent like the machines in their work place. Technological advances in modeling and simulation of biological clock coupled with human behavior and medicines to control sleep-wake cycle are helping to reduce the risk of fatigue's impact at work places. Sleep inertia and forced sleep patterns require in depth study. Sleep patterns and human behavior after forced nap (20 minutes or less) necessitates further study as the sleep inertia is not the same with all people around the world, and should differ with other nationals and women as there are rapid changes in demography. Disturbing sleep-wake cycle may also have a long term impact on people's life and health. It is suggested that an extensive research should be undertaken to study the health and sleep behavior of retirees who had worked long hours exhibited high degree of professionalism, team work and work ethics have since left their work place in the ATC towers and aircraft cockpits. Many of the mathematical models postulated require thorough scientific validation, testing, reliability and calibration.

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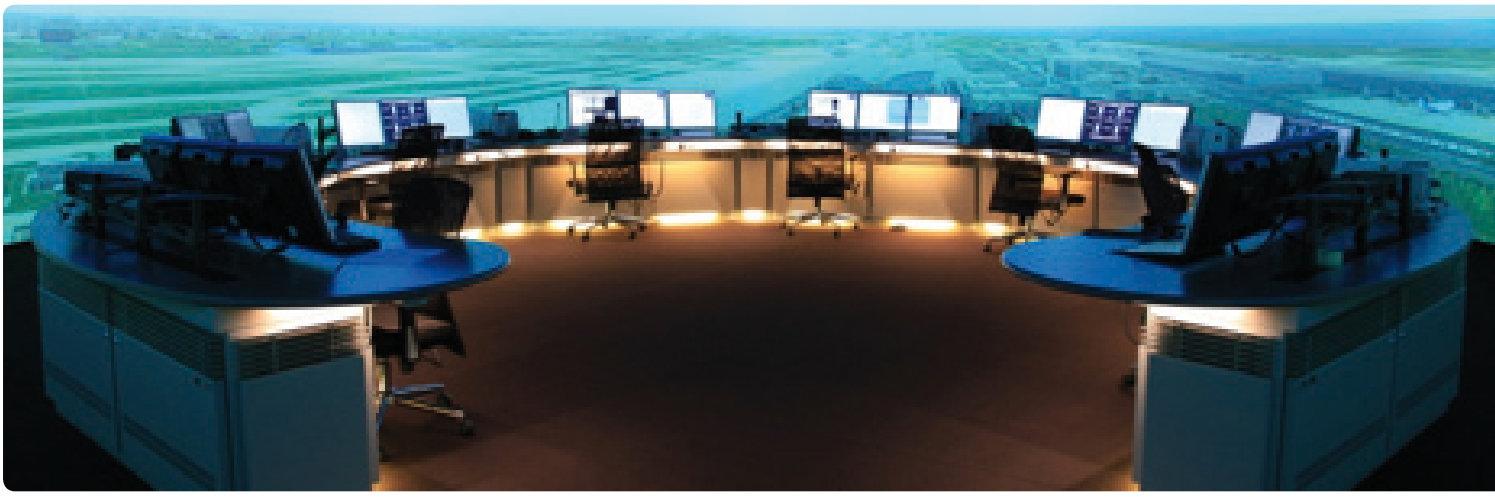

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Headquartered in Woburn, MA, UFA is a privately held software engineering firm specializing in Air Traffic Management (ATM) simulation products. UFA's product line is in use around the world and includes ATTower, ATCoach, ATView, ATRadio ATVoice, and ATSpeak. UFA maintains additional offices in Gaithersburg, MD. The company's wholly owned subsidiary, ATCSim GmbH, is located in Mainz and Kaufbeuren, Germany.

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