PROCEDURAL OVERKILL: UNDERSTATING THE REQUIREMENT TO FIND THE RIGHT BALANCE OF REGULATED ATC WORK

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Date of submission: 2007

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How is it possible to write a procedure for absolutely every possible situation, especially in a world filled with unexpected events? Answer: it is impossible. Yet procedures and rule books dominate industry.
Donald Norman

Abstract. The complicated task of providing Air Traffic Control (ATC) in a specific portion of airspace has always been regulated via procedures, instructions and specifications. While a few early ATC guidelines around the time of radar introduction generously regulated work, Europe's air traffic services sector has been subjected to a flood of new procedures and specifications over the last few years. Eurocontrol is striving to harmonize the continent's air traffic management; national regulators are creating specifications about every imaginable situation; and Air Traffic Management (ATM) providers are seeking to control the sector through rules and regulations. The industry's air traffic controllers are forced to sign every paper they read and every instruction they receive. And all the while, the issue of legal liability is prompting ATM Providers to protect themselves via additional regulations. The results of this tendency have brought out into the open a kind of paradox: while regulations aim at simplifying and conciliating operations they can produce the contrary. Excessively used, procedures and regulations might actually degrade system safety. Drawing on my own decade of experience as an Area Controller in Switzerland and from a European wide survey conducted as part of this research, my attempt is to clarify the current situation concerning ATC regulations and rules. Highlighting the dangers of overregulation (e.g. false sense of high safety level) aims at increasing the awareness for possible hidden safety implications and the need for a well-balanced equilibrium between freedom to handle delegated responsibility and useful directives. Rules and regulations are a basic and useful tool but are not capable of being the only organizational format which supports ATM in its' attempt to guarantee a safe flight from take off to landing.

Keywords. procedures and practice, ATC, working to rule, rule-violation, over-regulation, system thinking, adaptation, safety

Introduction

Safety is a dynamic non-event
Karl Weick

The research topic originates in my own professional life and experience as an air traffic controller. Over the last 10 years my profession and the work as such has changed a lot. Controllers were formally trained to take full responsibility as a team member and to decide according the situation what course of action would be the safest and most efficient one. Nowadays, one must contend with and comply with a great number of restrictive and ergonomically-unsound procedures (noise abatement, political, economical and organizational motives, delegation of responsibility etc.). An ATCO's main task is to monitor and acknowledge new technical warning tools which requires to a lot of routine work. However he is also supposed to maintain the flexibility to be creative enough to override the rules when the system and the context shifts and requires him to act differently as prescribed.

While reading and studying other phenomena of human factors and system safety I learned with interest how other complex cognitive systems are organized. The structure and the build up of an organization shapes and characterize the output as well as the social interactions, the behaviour of the workforce, the risk perception and the inherent systems safety. How can it be, that scientific research has shown again and again the inevitable limitations of prescriptive procedures (Reason, Parker & Lawton 1998 / Hollnagel & Woods, 2005 / Lawton, 1998 / Dekker, 2003 / Klein, Feltovich, Bradshaw & Woods, 2004) as a single source of organizing safe work behaviour and still many complex industries put safety on one level with compliant rule following?

The tendencies in European and Swiss Air Traffic Management towards more and stricter regulations reinforced my aim to study what happens to organizations when they get overregulated; either by the sheer number of rules or by their strict and detailed character. Recent literature has identified the imitations of administrative control but to my knowledge no study so far explicitly explains the reaction of the system to overregulation. It is a study with its roots in ATC but any growing multilayer system will face similar periods during its life time especially when an accident or incident has happened recently.

To see if my personal impression about the procedural situation in ATC is shared within other air navigation systems provider's, I conducted a web-based survey among members of the European ANSP's. I did not analyse the results statistically, but used them as a barometer of practioneers perceptions, which shaped my further investigations and questions. A focus group session of managers and Swiss ATCO's gave a more precise and detailed insight into the actual state and how the problem issues are handled today.

Research will continue to look for more systemic approaches towards system safety especially since error counting did not lead to a progress in the safety of fields like nuclear power, medicine, aviation and aerospace or rail transport. In the scientific world of human factors, sociology and organizational performance we can find innovative efforts towards new organizational concepts, e.g. Resilience Engineering (Hollnagel, Woods & Leveson, 2006), Common Ground (Klein et al., 2004) or others. But as long as the system thinking is not in the head and blood of policy makers, operational managers, organizational leaders, system designers and regulators, the pressure of knowing when to follow and when to break a rule remains with the operator at the sharp end.

The aim of this paper is to reveal the weak points of a purely proceduralized ATM system, to challenge the current belief that writing another rule will avoid a bad outcome next time and to show normal reactions of operators and managers confronted with an overregulated system. On the practical side I hope that the pendulum of regulating European ATM has not swung too far and that with effort and systems insight we will be able to find a workable safety balance once again. Scientifically I hope to encourage others to challenge this study and the questions raised will continue to improve further concepts of systemic organizational approaches.

European ATM environment

With ATC there was no "big bang"; it wasn't discovered or invented but it has evolved gradually, driven by demand.
Andrew Cook

Contextual sensitivity: Since this a very specific study about ATM in Europe and Switzerland I will provide some background information about the historical and current situational context. Social institutions and organization can only be studied within their present settings and backgrounds. Particularly an accident like the Überlingen crash changes the context overnight and hindsight becomes a strong argument for the future organizational structure. We have to be aware of these kinds of forces and the following chapter indicates the main settings and developments from their beginnings to the recent years.

SITUATION AND CONTEXT IN EUROPE AND SWITZERLAND BEFORE 2000

Following World War Two, on a global level the International Civil Aviation Organization (ICAO) was developed and international agreements and regulations were formulated. In the wake of studies initiated by the USA and the allies, the American government invited 55 States in November 1944 to an international civil aviation conference in Chicago. Thirty-two of the States that participated in the meeting established the new organization. Even more important however, was the creation of the Chicago Convention on aviation, which set the foundations for the rules and regulations concerning air navigation in all its aspects, and which enabled a common air navigation system to be created around the world (ICAO, 1944). Each state was then responsible for providing air traffic services as a public service and as the Chicago convention stipulates in article one: 'the contracting states recognize that every state has complete and exclusive sovereignty over the airspace above its territory' (ICAO, 2000). For operational purposes, a state might delegate part of its airspace to a neighbouring state.

About 20 years ago, almost every European state operated its own national Air Navigation Service (ANS). These governmental owned and directed companies provided civil and/or military air traffic service and were responsible for the states airspace. Starting around 1990

the tendency developed to form independent companies fulfilling a state's mandate but operating more commercially. According to ICAO, ANS should be provided by independent authorities, independent entities or companies established to operate these services, rather than by civil aviation authorities. ICAO established three forms of ANS at the national level:

a) A government department depending on the state budget with staff having the status of civil servants (this used to exist in Europe in a previously less-regulated environment, but no such examples persisted)
b) Autonomous bodies belonging to the public sector, which are separate from the state, while still remaining state property (functional separation)
c) Independent bodies – mainly, or fully, in private hands

At present the ANS of Ireland is an example of a company operated as in (b), whilst the other European countries have resorted to independent bodies, with the single exception of the British air navigation service provider (NATS – National Air Traffic Services), 46% of whose share belongs to a consortium of seven British airlines. (Cook, 2007)

The international agreements and regulations granted a consistency in the making and application of rules but there remained local interpretations and nationalistic approaches to much of the problem solving. So, while there existed now an International Civil Aviation Organisation which promulgated standards that most national administrations subscribed to, it was the individual controllers who took the initiative to address the existing operational demands. It marked the beginning of the International Federation of Air Traffic Controllers' Associations – IFATCA in 1961. One of the objectives of the founding conference read: ‚Assist in the development of new procedures and facilities necessary and useful for the safety of international air traffic' (Vidler, 2001, p.18).

IFATCA already understood the need for close cooperation amongst European ANSP's and warned in 1966: 'We recognise the necessity for early steps to ensure compatibility of equipment and development. Automation is the only way to provide tools for fast data processing and exchange, which is a condition for improved coordination between ATC units. If the systems used in different countries are not made compatible, automatic international coordination will be severely restricted' (Vidler, 2001, p.294). Little resulted however, from this panel and the various administrations in Europe continued on their independent,

nationalistic ways. ‚The traffic crisis in Europe in the late seventies and eighties accentuated the situation and, with some thirty States, fifty four ATC centres, twenty two computer operating systems and more than thirty programming languages' (Vidler, 2001, p.294).

In comparison with the American air traffic system the nationally grown European one was split into many small airspace sections all operated by different centres and different states. This led to a very complex patchwork of centres and sectors. ‚It is also hampered by heterogeneous working practices and constrained by air route networks which, in the main, are based on national borders and not air traffic flows'. (www.eurocontrol.int, 2006c)

‚The tight national boundaries, the seeming jingoistic approach to localised problem solving and the almost insatiable demands for airspace by the military generated for the Europeans a professional jealousy for the wide open spaces and virtual seamless air traffic control systems of their North American and Australian counterparts' (Vidler, 2001, p.11).

With the steady increase of air traffic (compare Fig. 1) the system was pushed to the capacity limit, although a parallel technical upgrade took place (Hopkin, 1999), resulting in a lot of delays (Fig. 2). The ideas and plans for a 'Single European Sky' (SES) developed in the mid 60' called for state spanning solutions but caused many political questions about ones state airspace sovereignty. Eurocontrol, the European organisation for the safety of air navigation, was created in 1960 for the express purpose of creating a single upper airspace by its six founding member states. This purpose was only partially fulfilled at the time - but the idea remained a tenacious one.

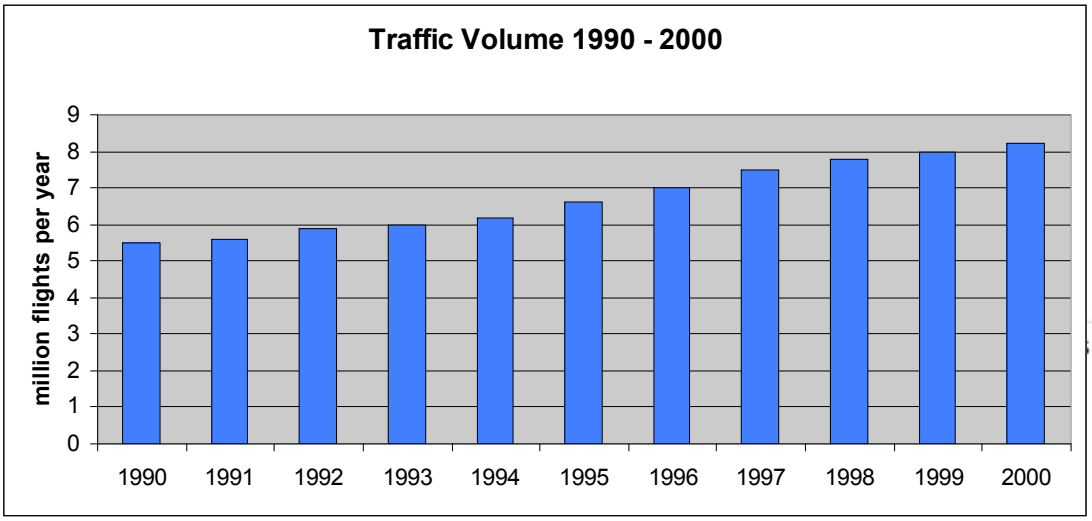

Figure 1: Traffic volume 1990-2000. Source: Eurocontrol, 2006b

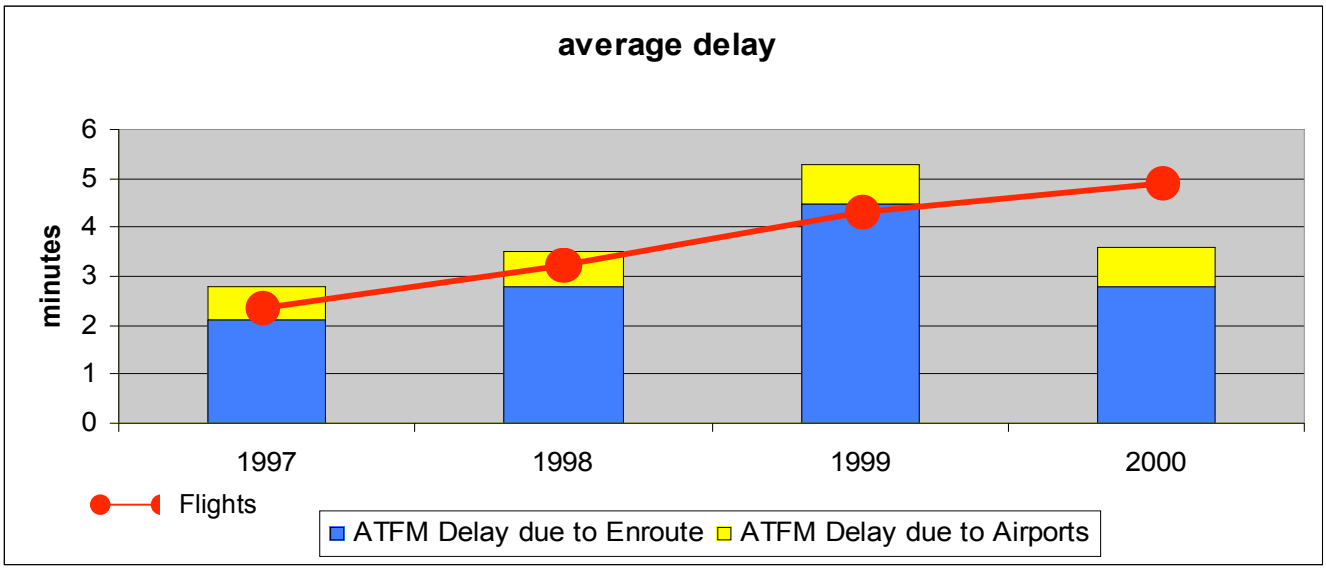

Figure 2: Air Traffic Flow Management (ATFM) Delay Enroute/Airports 1997-2000, Source: Eurocontrol, 2007a

Switzerland: In 1996 Switzerland's governmental ANSP 'swisscontrol' became financially independent of the Swiss Confederation and a joint stock company under civil law.

Most of the current rules and regulations were grown over time and were best practice based. ATC was not discovered or invented but it evolved according demand. Circumstances dictated the development of this highly complex and technology dependant occupation. ANS in Europe were and continue to be a changing project influenced by capacity demand, economical pressures and safety targets. Since most of the newly formed ANS providers evolved from a former state agency where owner and regulator were the same body, external controls were fairly rare in the first years of independence.

Swiss airspace was operated from two different centers, one situated in Geneva, the second one in Zurich. Not only in European context the differences between states were enormous but even between the two centers existed ample cultural, technical and functional discrepancies. They may have faced similar complications (staff shortage, increasing traffic demand, incompatible systems, new technologies) but the solutions were strictly regional.

The regulator's position was not yet clearly developed. The main interest was on the oversight of national airlines and the licensing process. ATC was a small branch considered safe with no recent incidents or accidents. There was no exact policy or monitoring process in force.

SITUATION 2000 - 2007

During the last few years European ATM has gone through many changes. Political and economic strategies forced ANSP's to rethink their structures, as one consequence the amount of control centers was reduced. The workforce had to move sometimes considerable distances to be able to keep their jobs. The aim is of course to put oneself in a favorable position to negotiate about state spanning ATC centers and to better fit into a compatible European solution. Up to now all these discussions and projects are still future plans. So far no state has de facto delegated sovereignty and airspace management to a neighbouring country. The only exception is Maastricht Upper Area Centre which is run by Eurocontrol and is responsible for Dutch, Belgian and parts of German airspace.

Different projects on European level have been developed and introduced (SES 2004, ATM 2000+, ECAC) but I will not present them here in detail. The current situation still features about 60 ATC centers and ANSP operate more or less their own states' airspace.

Continental air traffic figures have increased considerably after the low mark of 2001/02 and with that the delay due to ATM constraints has increased again. 'Despite the initial drop in civil air traffic following 9/11, traffic is likely to continue to increase due to passenger demand, thereby putting more stress on the system' (Kirwan & Perrin., 2004, p.1). That is what Eurocontrol predicted in 2004 and recent figures proved them right. (Figure 3 & 4) The European ATM system is once again confronted with harsh capacity problems and the requested demand exceeds in some places the available offer by far. 'Forecasts by the European Commission and the European Organization for the Safety of Air Navigation, Eurocontrol, predict that the air traffic will double by 2020' (Van Houtte, cite. in Arvidsson, Johansson, Ek & Akselsson, 2005, p.119)

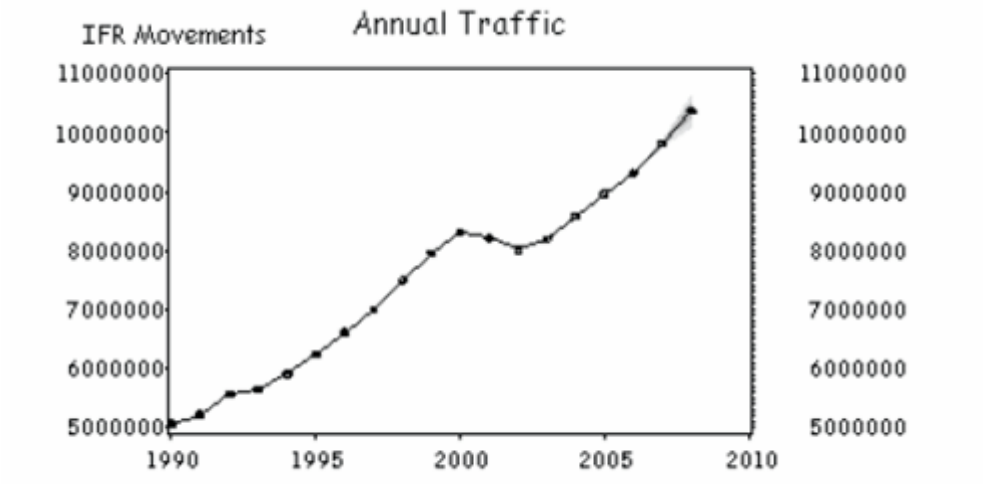

Figure 3: Traffic volume 1990-2007. Source: Eurocontrol, 2007b

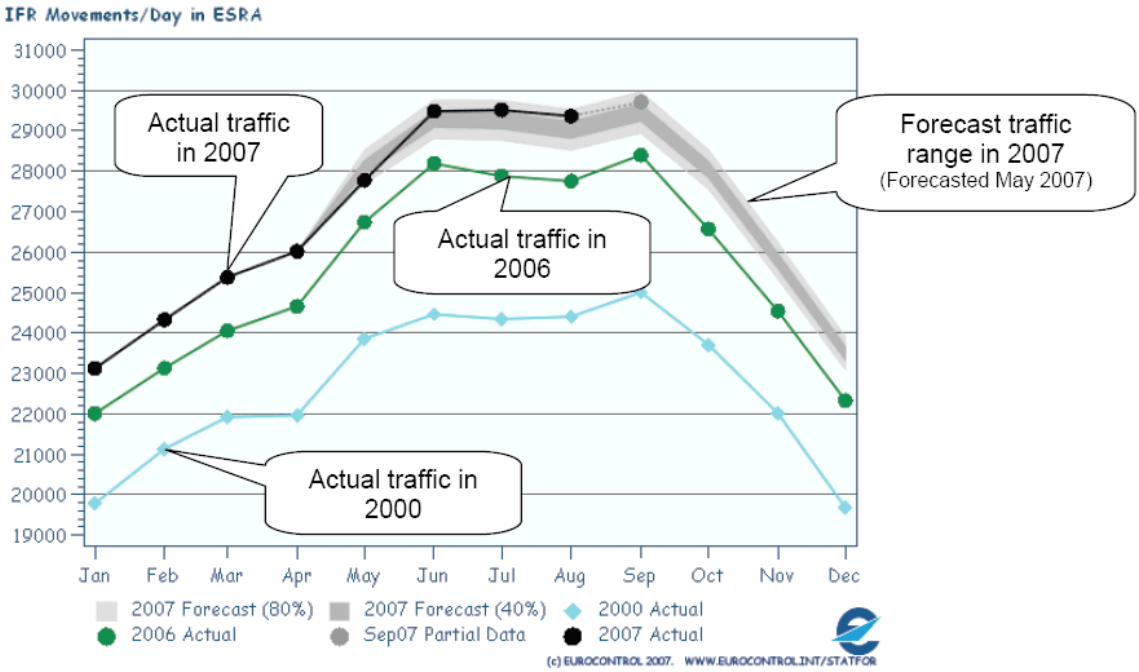

Figure 4: IFR movements per day: 2000 / 2006 / 2007. Source: Eurocontrol, 2007b

Switzerland: On 1st January 2001, the military and civil air navigation services merged into a single authority responsible for the management of all of Switzerland's skies. In order to mark this amalgamation, the company changed its name to 'skyguide'.
The mission of skyguide is defined as follows: On behalf of the Swiss Confederation skyguide ensures the safe, smooth and economic handling of air traffic. Its mandate (Article 40 of the Federal Aviation Act and Article 2 of the Federal Ordinance on Air Navigation Services) includes civil and military air traffic control, telecommunications services, the aeronautical information service and the technical service for installation, operation and maintenance of air traffic control systems.
Given its central position within Europe, including two of the busiest airway crossings, the sky above Switzerland is always densely populated with airplanes. Constant staff shortage, political disputes about landing and departure regulations for Zurich airport and military training areas reducing the narrow airspace even more, are amongst the main problems of skyguide in these years.

In the night of 1st July 2002 the tragic accident above Überlingen shocked not only Swiss ATC but everyone who was sure that in today's automated and redundant safety environment the possibility for such an air crash no longer existed. The following years turned out to be much more difficult for the organization than anyone could have imagined. What happened thereafter organizationally is best described by Garry Klein when he explains the problems of uncertainty: ‚key pieces of information are missing, unreliable, ambiguous, inconsistent, or too complex to interpret, and as a result a decision maker will be reluctant to act' (1998, p.276). 'Sensemaking in crisis conditions is complicated by the fact that a delicate tradeoff exists between dangerous action that produces understanding and safe inaction that produces confusion' (Weick, 1988, p.306). The immediate pressure from politics, media, stake holders, regulators and management to the organization's own strong will to learn not to let a similar causal chain reaction happen again, turned into total overreaction and stagnancy at the same time.

No matter how complex the temporary breakdown of the system was, the question of how similar failures can be avoided in the future requires an immediate answer. It does not matter if rule breaking has played a role or not, compliance will be intensified, sanctions for violations increased, new procedures introduced. Mascini describes the situation as following: 'the more or less automatic reflex to tighten the enforcement of the rules is understandable. It

gives a clear signal to the victims and citizens that disasters are taken seriously and that authorities act strongly in response to them. In this way, the authorities responsible try to restore the loss of faith among the population. As such, this measure has an important symbolic meaning' (2005, p.472). This initial presentation of action is problematic however, because it only pretends to increase safety. Because 'these data (accidents or incidents) only reflect moments of unsafety rather than the system's intrinsic resistance to its operational hazards' (Reason et al., 1998, p.1). Reactions to events need to be studied carefully and are otherwise prone to fail. ,Moreover, since there is a large chance component in accident causation, these negative outcome data yield unreliable information regarding the true state of an organization's safety' (1998, p.1).

When we later on discuss the procedural situation in Swiss ATC and the implications for operators we need to consider the above circumstances. It might not be possible to transfer the findings one by one to other ANSP which has not experienced a recent accident, but as Sagan wrote in his *Limits of Safety*: 'Things may not be as they seem. One should never assume that the machine does not need to be fixed, simply because one has been told that it "ain't broke"' (1993, p.259).

Rules and Regulations in ATM

When it comes to control, less is sometimes more.
Scott Snook

Historically aviation, as other aspiring industries, has learned from its mistakes. As aviation technology matured, aviation safety progressed accordingly to the level that it became feasible to conduct transport services, by private enterprises. This clearly required some form of regulation in order to protect the flying public from unwanted hazards. This led to the definition of initial national rules and regulations. The main objective of these regulations was to set a minimum acceptable standard of aviation safety. Air traffic control matured similarly and started with rough guidelines which developed into international agreements and world-wide harmonization.

Every state and organization adapted these standards differently and there are many different organizations involved in ATM safety regulation. This has contributed to a complex regulatory situation as seen today. To give a rough overview I present below how the Single European Sky ATM Research Programme (Eurocontrol, 2006a) defines the current framework:

Legislation: issued by legal bodies, is legally binding and clearly names the liable person. However, legislation only outlines the legal boundaries of expected behaviour. Usually legislation does not describe in detail what needs to be done in order to show compliance with the law.

Standards: issued by standardisation bodies. Standards are usually industry agreements or specifications for equipment or processes (e.g., ISO 9000). They are often fairly prescriptive in nature and on how the responsible person should show compliance. However, standards are not supported by any legal enforcement mechanism. Nevertheless they may have a legal role after accidents in lawsuits: violations of standards may be interpreted as failing to apply best practice. However any system provider can deviate from standards if it can be shown that they are no longer state of the art (e.g., due to technology developments a standard for a certain technology may become obsolete) and if the solution chosen by the provider can be shown to be as safe as a standardized solution.

Safety regulations: lie between legislation and standardisation. They link the relatively abstract legislation and the detailed prescriptive standards. Safety regulations allocate certain accountability to an organisation to fulfil legal requirements. Usually they do not go into detail regarding technological solutions (i.e. they are usually objective based) but may be detailed in case of specific technological aspects if these are safety relevant (e.g., Mode S transponder). They might be enforceable in their principles but can also be supported by high level standards (e.g., acceptable means of compliance), which are not enforceable.

Regulation is one element in a structured process of legislation, regulation and standardisation. In particular this holds for safety regulation.

Global Regulation: at this level rule making should focus on areas where global application across the air transport industry is required. In the area of ATM safety this is likely to be limited to rules on high level objectives, although there will also be

requirements for safety related standards for interoperable ATM systems involving both the airborne and ground components. The role of Global regulation in ensuring conformance should be limited to oversight of the regulatory organisations in the lower levels. This ensures that Global rules are consistently enforced.

European Regulation: rule making at the European level should focus on areas which need to be applied consistently across the whole of Europe and also for providing a common interpretation of Global rules and requirements. This layer of regulation will be required to ensure conformance to Global regulations within Europe and also overseeing the functioning of national ATM safety regulatory organisations.

National regulation: in order to ensure a harmonized system the role of national ATM safety regulatory bodies in rule making should be limited in the future. The main role at this level should be ensuring conformance with European rules. National regulation will be necessary for elements of the ATM system that have significant ground based components as an in-depth knowledge of the national situation and an understanding of national legislative and regulatory requirements form outside the ATM safety area may be necessary. Note: At present local regulatory bodies are equivalent to State regulatory bodies. In the future, as the ATM industry consolidates, there may be scope for equivalent consolidation of ATM safety regulatory functions on a regional basis.

Most of the introduced standards and regulations have led to major improvements in aviation safety. There have been cases in which coordination and harmonization did not work out; for example the introduction of TCAS in Europe. ‘With TCAS, we witnessed a classic example of systems designers developing a product without due regard to the effects it would have upon the front end users of the airspace system. No air traffic control input was made to the facility’s design or specifications, no training was conducted to explain or manage its use. Worse still, the concept was invoked at political whim, by executive dictate rather than through an operational driven need’ (Vidler, 2001, p.307). It took years, many severe accidents and incidents (learning by doing) until the benefit of TCAS could pay off because all users agreed to shared applications.

An interesting side note might be that the formation of the first European ATC union developed after a row of Dutch approach controllers against impracticable radar procedures. The procedures designed by the Dutch Administration for the introduction of the new Schipol

Approach Radar facility caused the controllers to revolt and one result was the formation of the Netherlands Guild which drafted an acceptable set of procedures. (Vidler, 2001, p.11)

Switzerland: A study conducted by the National Aerospace Laboratory NLR about aviation safety management in Switzerland (NLR-CR-2003-316 & NLR-CR-2006-536) reviewed in one chapter the implementation of the aviation safety policy. Since June 2002 an agreement between the Swiss Confederation and the European Union concerning air traffic manages the cooperation. Switzerland is a member of Eurocontrol and has adopted the Eurocontrol Safety Regulatory Requirements (ESARR). The report identified only minor differences in the application of international recommendations (e.g. confidential reporting) and they write: 'The Swiss legislation does not differ significantly from the legislation in other western states and the Swiss legislation is well developed in its provisions to make international regulations and standards mandatory in Switzerland' (p.46). The following regulations apply for air traffic control in Switzerland:

1. International Regulations: ICAO Documents and Annexes
2. European Regulations: Eurocontrol ESARR1-6
3. Swiss Law: OR, Luftfahrtsrecht, ATMM CH
4. Additional Regulations: ISO Certification
5. Regional Regulations: ATMM 2-4
6. Neighbour Agreements: Letter of Agreements
7. Internal Regulation: Service Orders, Safety Letters, Protocols, technical manuals, internal information

Method and research

Qualitative research is mulitmethod in focus, involving an interpretive, naturalistic approach to its subject matter.
John Creswell

The purpose of this grounded theory study is

1. to highlight the dangers and traps of an overregulated complex ATC network,

2. to show why procedures remain amongst the widespread organizational format to handle work,
3. and finally to see if new forms exist within human factors literature which could stand in for the limitations of procedural work.

The study postulates the orientation of the subject, being in my case the regulatory framework of ATC, it is both a departing and an aiming point. Rules and regulations alone are however, of minor interest; it is how people work with them, how they influence each other, how they historically grow and what role they play within the system.

The rationale behind the theme is a personal concern experienced during my professional life as an air traffic controller. The mismatch of authority given to ATCO's to perform their task and the responsibility expected of them to do always the right thing (Dekker, 2005, p.201) is something every trainee gets accustomed to and learns to live up to. My own impression is that the gap has widened considerably and I wanted to know why, how and how others deal with the present situation.

The emic study employed the following three qualitative methods:

- a web based survey;
- a focus group interview; and
- a comparison of relevant studies.

To be able to contrast different perspective I gathered data from ATCOs and operational managers from 9 different countries (Switzerland, Germany, Austria, Belgium, Netherlands, Denmark, Finland, the UK and Italy), used my own experience and the current sociological knowledge about human factors in complex socio-technical systems.

The problem of being an insider, and at the same time studying from an outside perspective of what is happening, might bear a trap. What I expected to find, might have shaped what I would have found in the first instance. Silverman describes this as: ‚a tendency to select data that fit an ideal conception (preconception) of the phenomenon' (1993, p.279). I tried to integrate this bias and instead of neglecting it, my aim was to make best use of the advantages, namely to bring out what is common sense. Using particularly the help of the partially unstructured focus group interview, I tried to overcome the disadvantages and hoped to find peoples own questions and answers.

Just as credible qualitative research seeks to find a middle ground and to manage the tension of reality versus representation I tried to find my position between ATCO (profession) and researcher (idiographic writing). What turned out to be most difficult with the data I analysed was the temptation to conclude from the evidence found in Swiss ATM to a broader European wide conclusion. The critical rationalism idiom (Popper, 1959) which seeks to falsify the initial hunches about the relations between phenomena in the data was difficult to adapt, especially in my position as an insider of Swiss ATC. I try to give consideration to this difficulty by only speculating about possible connections. Still the analysis of the survey was done from a holistic point of view whereas the focus group interview shows the embedded, specific aspects of the current situation.
To validate my findings about overregulation, more investigations have to be accomplished and systems with similar lifecycle positions need to be compared.

Analysis web based survey

Rational analysis reduces the chance that an
important option will be overlooked.
Gary Klein

Background: A web based survey was conducted amongst air traffic controllers and operational managers throughout European ANSPs. Around 150 personal invitation emails were distributed, and 69 responses were received within the one-month deadline. The aim of the questionnaire was to confirm (or refute) my personal impression about an increasing overregulation of the daily work procedures in ATC. In this connection I tried to identify the main problem areas of complex socio-technical systems which are mainly organized via rules and regulations. My intent was not to write up a statistical analysis with the received data, but to present a valid picture of the current situation and the problems operators and managers face in today's ATM environment and how they work with them. The composition of all these answers delivers an insight into the industry and the perception of controllers and managers but they are not meant to be torn apart or viewed without context. To illustrate the varieties I quote single answers and show selected graphical data. Finally, to give the reader an overview

of the research in that field discovered in the last few years, I make the connection to existing literature and studies of ergonomics and organizational theory.

More then 75% of the respondents rated ATC as strictly regulated or even overregulated, so my main interest is to show how people within the system react to this phenomenon. By collecting data through an open questioned survey I found topics which group amongst the following titles:

I Current situation in Europe
II General attitude towards rule based work and procedures
III Rule violations versus compliance
IV Reactions to under- and overregulation

Note: The developed categories are all interrelated and can only be understood within the current ATM setting and with the background of the historical context. The emerging questions are then further researched in the focus group interview, following this section.

Layout web based survey (For more details see Annex 1): The survey consisted of 18 questions split up into 4 sections: a general administrative part, a part for ATCO's and for operational managers and separate ones for each occupation respectively. Of the 69 respondents, half were operators and managers of ANSP's in Europe (Germany, Austria, Belgium, Netherlands, Denmark, Finland, the UK and Italy) and half employees of the Swiss ANSP (Zurich, Geneva and regional aerodromes). Most of the respondents have worked between 5 and 20 years in the ATM business.

I CURRENT SITUATION IN EUROPE

When asked to compare the current situation of rules and regulations from the date when they started their career in ATC almost half of all respondent noted a drastic increase of procedures in ATC and particularly in their own ANSP. Considering their daily work today, 32% rated it as overregulated, 42% as strictly regulated. Generally they felt that the increase is still ongoing and they suspect it to continue in this direction.

This contrasts to some extent with the findings of Kirwan and Straeter. They discussed in a 2002 published paper that ATM is under regulated by comparing safety management in nuclear power production (NPP) and air traffic management:

There is a balance to be achieved between goal-based and prescriptive regulation, and in some cases regulation has been seen as overly prescriptive. This is a difficult balance, and ATM is probably under-prescriptive and under-regulated at present, though this is changing, but the danger is that of losing the 'implicit safety' that currently keeps ATM safe. (p.85)

It seems that the prediction of 5 years ago has been realised: ATM has changed in the direction they already saw in nuclear power production: 'The NPP world has become very proceduralized in certain parts of the world, and some consider this process has gone too far, perhaps to the detriment of safety' (p.85).

It is futile though, to predict at what position of the life cycle the ATM system is positioned at present, we cannot know. One approach is Amalberti's adaptation of Reason's illustration of system resilience. He draws a figure where competitiveness is in relation to safety (Hollnagel et al., 2006, p.264, Fig 16.3). His progression of a life cycle features initially a competitive but relatively unsafe system. After an incident or accident and a recovery phase, the system reverts to a next phase with a considerably lower capacity and performance because focus is on regulations and greater safety. These steps continue until 'a plateau where no further solutions exist to improve safety. This is generally the time of the death of the system' (Hollnagel, 2006, p.263).

The question is, if the increased proceduralization of ATC work is an inevitable progression of the life cycle of any complex system or a tendency we can, with better systems insight, avoid and thereby prolong its resilient progress.

Other difficulties of the progression of a life cycle are the ever growing complexity, the approaching of the edge of capacity and the inherent goal conflicts (Michel, 1995; Hilburn, 2004). Increased task complexity (Hollnagel & Woods, 2005) due to for example, growing performance demands or the prevalent accession of technological tools, generate a paradox by increasing complexity while trying to do the opposite. Capacity limits get adjusted with great effort for only minor output and contradictory organizational goals are omnipresent.

Switzerland: The increase of regulation was rated especially high amongst Swiss participants. When counting only their answers, 85% judged the number of procedures they have to deal with as 'many – too many'. From the more detailed answers one can infer that these responses are mainly connected to the Überlingen accident. The aftermath of such a tragic causal chain collapse might have accelerated an existing tendency. The company wide insecurity, the pressure from outside and the strong will to avoid such an incident in the future produced a lot of inconsiderate changes and detailed procedures. Swiss controllers feel that the reasons for most of the new detailed procedures they receive in a format called 'service order' (SO) are due to the on going legal investigation of the accident and the impossible search for the ones to hold responsible. The result is an exponential increase of paper rules. Last years counting showed the incredible number of 112 service orders introduced only for the area sectors in Zurich. Sadly this is exactly what organizational theory predicts and warns against (Perrow, 1984; Reason et al., 1998; Hollnagel & Woods, 2005; Dekker, 2003; Mascini, 2005 and others).

The tendency towards more and stricter rules however, is also noticeable in other parts of Europe too. I can not prove this with numbers or similes, but what I can confirm from the survey answers is that operators rate the augmentation as precipitous.

> 'We have so many rules but they still don't cover all situations, they restrict some of the creativeness and flexibility needed to work, an over reliance can cause unexpected, potentially dangerous situations' (anonymous, 2007, quote survey)

II GENERAL ATTITUDE TOWARDS RULE BASED WORK AND PROCEDURES

> *Rules are a functional equivalent for direct, personally given orders, since they specify the obligations of worker to do things in a specific way. Standardized rules, in addition, allow simple screening of violations and facilitate remote control.*
> *Mechanic, 1962*

What became evident was that both operators and managers see procedures as a very positive and almost the only tool to guarantee a standardized output (safe and efficient traffic flow). They feel that harmonized standards ease workload and enhance the stability of the process. They give team members the possibility to predict what to expect and to ensure uniform

practice. About 50 answers can be summarized into the following categories: standardized working methods reduce workload, enhance safety, facilitate operation, ensure efficiency and achieve a qualitative result.

> ‘The aim of a procedure is to standardize and regulate a process so safety and other constraints are sufficiently recognized’ (anonymous, 2007, quote survey)

This corresponds with the general wording in sociology theory. Routine tasks and commonly occurring situations should become easier to accomplish. Predictability is increased; and the rest of the work force can base decisions on predictable facts. Standardization calms inherently unstable conditions. Or as Isaac and Ruitenberg put it: ‘The function of well designed procedures is to support the controller by specifying a sequence of sub tasks to ensure the main tasks are completed efficiently and safely. Good procedures will also allow other people to coordinate their tasks within a common system’ (1999, p.199).

For a complete view I will include Eurocontrol’s definition of an appropriate regulation: ‚Regulation must be appropriate to the organisations being regulated and must make provision for the different types and scales of organisations providing services. Safety regulatory requirements should not exceed what is necessary to achieve the safety objectives and should be subject to periodic review to ensure that they continue to be consistent with best practice and support innovation’ (Eurocontrol, 2006a, p.24).

Only a minority of the respondents experience procedures as a misused form of management to protect themselves from accountability in cases when the system fails or as pure delegation of responsibility.

> ‘Responsibilities are shovelled to the front end operator’ (anonymous, 2007, quote survey)

If procedures get misused with such an intention, or the operator receives the introduction of new rules that way, they immediately lose all their possible advantages and operators do not trust the content. We will explore this point later on when looking at the character of a procedure. Ten answers fall into the category: 'good tool but not without drawback'. These respondents see the advantages of procedures in standard situations but are also aware of the limited use in special circumstances where the context changes.

> ‘It cannot take account all factors in dynamic real life without going into too much detail and complexity. Additionally, procedures can easily be used to compensate poor equipment and/or infrastructure.’ (anonymous, 2007, quote survey)

That is mainly what Eric Hollnagel and David Woods describe, in their case for good interaction design. I would use the same wording for procedures: ’What should not be forgotten is that this advantage has a price, namely that the very same displays may be less optimal – or downright inconvenient – in other situations. Just as there is no such thing as a universal tool, there is no such thing as a universal display format’ (2005, p.85) or in our case: there is no such thing as the universal procedure.
If we have a closer look, we can make out a range of disadvantages and even a ‘hidden agenda’ (Lawton, 1998, p.90) of procedures. The task of ATC is of cognitive nature (Hilburn, 2004), together with the problem of continuous changing context, procedure following faces great difficulties. If conditions no longer match the ones prescribed in the rule, the rule does not help in deciding or coping, but can on the contrary lead to loss of control because the enforced action is inappropriate.

Imagine the situation is slightly different to what the procedure says and still the outcome is positive. How does this come about? That is the operator’s daily job: they adapt to changing conditions, compromise between different goals, bend the rule according to circumstances or violate them altogether. And that is another drawback of a proceduralized work environment: **the discrepancy between procedures and practice**.

Procedures are thought to help, to facilitate but they may complicate the world as the case of the example below, drawn from an aircraft electronics manual, may illustrate:

The internal guidance system uses deviations to generate corrective commands to fly the aircraft from a position where it is to a position where it isn’t. The aircraft arrives at the position where it wasn’t, thus the position where it was is the position where it isn’t. In the event that the position where it is now is not the same as the position where it originally wasn’t, the system will acquire a variation (variations are caused by external factors and discussion of these factors is beyond the scope of this simple explanation). (Isaac et al, 1999, p.190)

ATC is not a simple task, and cannot be performed with a checklist approach. The situation is rarely as straightforward as an "if – then" decision. No two traffic situations are exactly the same. They may be similar but will never be identical; yet the rules we apply are the same. From this perspective, it may seem quite logical that detailed explanations on how to handle specific situations are help to nobody. And especially in fast developing critical situations like emergencies stiff rule following is useless. The conditions change so rapidly that cognitive adaptation is crucial. An example where local pressure produces systematic non-conformity (due to practice too far away from procedures, or as they call it knowledge from authority) found Dekker and Suparamaniam in disaster relief work. 'Cumbersome procedures stall decision making in situations that call for rapid responses' (2005, p.14). Another example is reported in Klein's 'Sources of Power' where he refers to a study by Emilie Roth (1997). She found that nuclear power plant operators during specific testing simulations 'took a variety of steps not found in the procedures' and still they were convinced 'that they were following the procedures at all times' (1998, p.307).

What we should not forget is that rules and procedures, their training and application, and the human interactions with them have to be seen in an organizational context. This is summarized best by Captain Daniel Maurino:

No matter how well equipment is designed, no matter how sensible regulations are, no matter how much humans can excel in their performance, they can never be better than the system which bounds them. (Issac et al., 1999, p.9)

III RULE VIOLATIONS VERSUS COMPLIANCE

...individuals who zigged where they should have zagged.

Charles Perrow

Survey question Nr. 7: Have you ever experienced situations where you had to act against or bend a rule?

Diagram 1:
Yes/No graphic to question Nr. 7

Although this positive attitude towards the importance for procedures, 77% of the questioned ATCOs confirmed that they bend or violate rules. Mainly two situations emerge from the given answers when rules get violated:

1. Cutting edges for efficiency and
2. Special situations where strict rule following no longer results in safest operation

> 'in a CB situation you are unable to obey to all the rules, as there are just too many…' (anonymous, 2007, quote survey)

In the article *The Varieties of Rule-related Behaviour* ten different kinds are summarized (Reason et al., 1998) and they state 'in many hazardous technologies, the important issue is not whether to violate, but when to violate. Nearly all operations routinely involve the commission of actions that lie outside the prescribed boundaries, yet are regarded as acceptable practice within the work-group' (p.3). Whether this perception is only shared by peers or the whole organization varies from company to company.

The reasons in turn, to violate rules are numerous: safety, efficiency, to reach requested goal, contradicting rules, old rules not up-dated, lack of knowledge, poor equipment, service, comfort and the inflexibility of the written standards, whereas efficiency was the far most mentioned factor.

> 'Too many rules raise the amount of complexity, so it can be helpful sometimes to violate or stretch a rule to keep complexity lower and safety high (rules which are in regard to safety are hardly violated)' (anonymous, 2007, quote survey)

ATCOs do confirm that their procedures are mostly practical, but only in standard situations. What makes them impractical is the change of context, the sum or the overlapping of contradicting procedures.

> 'If there are too many rules, there is a risk of getting lost in them, and thus violating one without knowing or remembering. Especially in stress situations. Then they do not give

space for the one ‘creativity’ and some of them are just too complicated.’ (anonymous, 2007, quote survey)

Another factor that can turn a normal regulation impractical is lack of time. Under limited time only the most basic rules get executed.

‘If you are under pressure you try to act according to best practices, so you cut or deviate from what you deem as the least important’ (anonymous, 2007, quote survey)

Most ATCO’s state that they have found quicker or safer ways around impractical, complicated or time consuming procedures, but they are aware of the increased coordination effort when departing from these rules. When the situation requires acting against a rule they do it and accept the responsibility for the created situation. They nominated ‘experience’ as the main help in deciding if they have to leave the path of strict compliance. They still feel bad about doing so, they want to avoid it and apologize afterwards. Some of them even advise management about the improper procedure. The general feeling is that if you have to break a rule – the rule is bad (formulated, designed, impractical, not ergonomically).

‘I do what is necessary and apologise afterwards’ (anonymous, 2007, quote survey)

‘Standards are rarely optimal but a questioning of these procedures is not appreciated and eliminated’ (anonymous, 2007 quote survey, translated from German)

Amazingly 65% of the questioned operators state that they can influence new procedures. There the question remains why the situation is not more satisfactory and still so many ‘bad’ rules remain in place or are not challenged as the quote above just mentioned.

There have been several attempts to classify violations or rule related behaviour. Basic distinctions are the variation of situational, exceptional and routine violations (Lawton, 1998). That is not the whole story, however. There are intentional and unintentional deviations from rules. If you are not aware of a certain procedure or you do not know when or how to apply it, you violate without knowing it. Intentional violations are deliberate actions to accomplish the task while taking into account the different goals. In the case of ATC, these goals may consist of safety, efficiency, customer service, environmental regulations, technical deficiencies, team work and individual ethical standards. Controllers face a probabilistic environment ,in which improper behaviour does not necessarily lead to a negative outcome’ (Reason cited in Hilburn, 2004, p.9).

The word “violation” implies that the action is part of a negative plot. This is delusive because we know that most of the rule violations result in a positive outcome and are needed to keep the system running. Whereas compliant behaviour stands for following formal rules and is equated with a positive outcome (shifting circumstances often get neglected). The following figure (Nr. 5) shall visualize the different paths. In an organization where strict rule compliance is equated with safe behaviour, the operators are pushed into rule following under circumstances where it is not applicable. (Path Nr. 3 instead of Nr. 4)

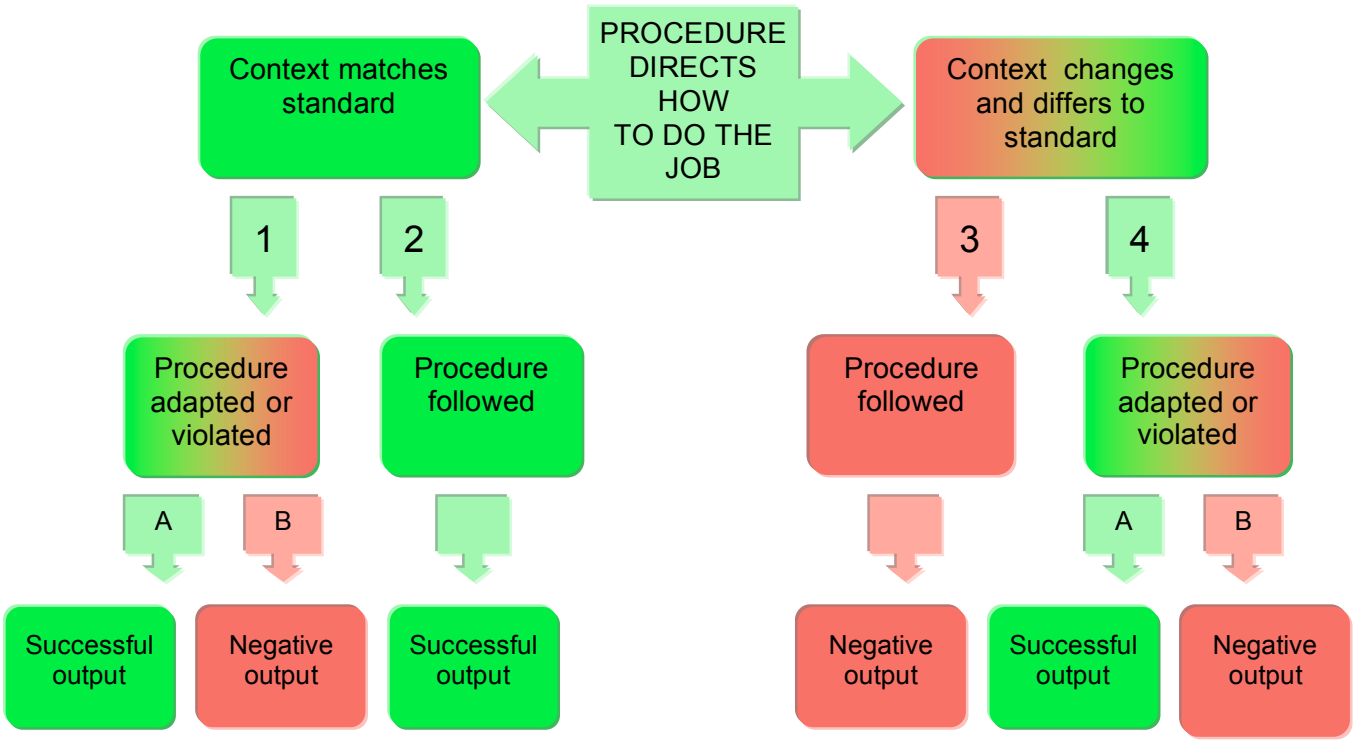

Figure 5: The 4 different paths of action. Own source

Path Nr. 1 represents corner cutting, small improvements and routine violations where experience has shown that they have a safe outcome (1A). They still can produce a negative course of action (1B). That might be when routine adaptations continue over time (i.e. practical drift (Snook, 2000)) and are not taken into account when introducing new procedures or when the hazard appraisal is incorrect.

Path Nr. 2 stands for the normal course of action where context matches the prescribed procedure and compliance is in accordance with rules and goals.

In path Nr. 3 and 4 the circumstances have shifted. That can range from small deviations to a total change of context. It might be very difficult or even impossible to decide if the situation no longer represents the standard. It looks quite straight forward on paper but to establish under time and pressure whether the 'if' condition of an 'if – then' rule is still valid is one of the most challenging tasks and one whose performance can only be assessed in hindsight. 'Clues that signal a problem are not always clear-cut. Conditions can deteriorate gradually, and the decision maker's situation assessment may not keep pace. If events occur infrequently, the decision maker may not have amassed the experience to recognize the signals associated with a different event' (Orasanu & Martin, 1998, p.102ff).

Path Nr. 3 is the one which is often chosen in an organization which demands strict compliance. Here an adaptation of the existing rule would be necessary, but the freedom to do so is not within the operator's limit. It is together with path 1B the most frequent and dangerous course of action.

Path Nr. 4A and B represent adaptation to local circumstances. Improvisation and creativity are required in order to achieve a positive output and training, skills and authority to do so are of great importance.

While the representation above in fact captures the possible paths of action it cannot reflect the reality constraints which hinder deliberate and thorough decisions. We live in a world where great value is attached to "abstract knowledge" and the focus is generally on formal description of work instead of the details of practice (Brown & Duguid, 1991). 'Documentation cannot present any close relationship to situated action because of the unlimited uncertainty and ambiguity involved in the activity' (Dekker, 2005, p.135). Why formal descriptive procedures still are the most widely distributed and preferred form of organizational work control in ATC is something I can only speculate about. Reason, Lawton and Parker wrote in their paper why organizations like rules: 'Procedures may also be a popular form of organizational control because they can be written and issued and therefore closure seems possible, but with other forms of organizational control, e.g. disciplinary systems, training, supervision, the process is ongoing' (1998, p.8). The formal nature of rules might be reassuring and organizations attempt to take refuge in them (Klein, 2003, p.33). These are hints we should consider and every ANSP and stakeholder should think about from time to time.

IV REACTIONS TO UNDER- AND OVERREGULATION

Nothing in this manual prevents a qualified Air Traffic Controller from using his discretion and initiative in any circumstances.
(Operational Manual 1, Eurocontrol)

As my own experience as ATCO brought me to the reflection that ATC in Europe is facing overregulation I was interested in understanding how operators and managers suspect the

system to react when confronted with either an under- or an overregulation and asked the question: 'What happens if your work is not regulated at all?'
I observed three negative categories (chaos, increased workload, safety collapse) and two positive ones (less bureaucracy, regulations closer to reality). A good quarter of the people suspect chaos, anarchy and a break down of the system to happen. Some would expect increased coordination and workload.

> 'well, I guess anarchy would break loose, the way we work as controllers is very individual, so without a unity I think too much could go wrong, it depends a bit on which regulations you choose not to have' (anonymous, 2007, quote survey)

There were also some answers which could imagine less bureaucracy and therefore quicker and shorter working methods. They presumed that new regulations would develop from within the team and that they would be closer to reality than the ones existing today.

> 'I am convinced that after a period of total uncertainty- creativity and self confidence of some individual ATCO will raise – unfortunately the 'rule based ATCO' couldn't live with this situation' (anonymous, 2007, quote survey)

This idea led me to consider why this is not already the case. How can it be that most new procedures complicate established working steps instead of make them easier? Should the operators not establish their preferred ways of fulfilling a task and agree on them? Before we dig deeper here, let us first see what the respondents answered to the question about over-regulation. We will return to the issue of why design and character of rules influences how they get accepted by the operators, later on in the focus group section.

The negative scenarios of an over-regulation were almost the same as described for an under- or unregulated setting: anarchy, chaos, blocked evolution and final breakdown of the system (catch 22, checkmate). Thirteen people wrote that they will start to ignore selected rules. The first procedures which get ignored or missed out are the ones ruling little details or tasks which are not absolutely necessary for safety. One respondent called this 'nursing the planes' i.e. costumer service. Prioritizing is individual but most controllers will adhere to the best known and best trained procedures (e.g. 1000ft or 5Nm separation) and give less concern to procedures which are farther away from the urgent goal of establishing safety.

Others suspected that they will not be able to keep all procedures in mind and that they will break some of them without even knowing it.

> 'Keeping the applicable rules in mind might be more and more difficult as there are plenty of them' (anonymous, 2007, quote survey)

Nine respondents stated that overregulation will result in unworkable situations and people would get frustrated and create ways around it.

> 'Either it leads to a situation where the effectiveness is decreasing or people start to violate rules to keep things moving' (anonymous, 2007, quote survey)

A general quote was that service and efficiency would suffer, although someone saw the only drawback in an efficiency decrease. One respondent added the following interesting and thought provoking comment:

> ‚Overregulation will give us a false sense of a high safety level which is even worse than a known low safety level' (anonymous, 2007, quote survey)

This is the big difference to an unregulated system. The many procedures, rules and regulations indicate that the system is well maintained, all possibilities covered, and that there is no more room for unexpected and unregulated situations. This is a fallacy. We would be better off preparing ourselves for situational adaptation of basic rules than to rely on the incorrect belief that we can cover all events with specified procedures.
The answers disclose that people observe the same problematic outcomes if the system is not regulated at all or as when the system gets overregulated. What will be crucial here is to find the balance. Two features shape this balance: the amount and the character of procedures.

AMOUNT OF PROCEDURES

However, the mere development and introduction of procedures does not ensure that they are actually followed.
(Lawton & Parker, 1999)

Survey question Nr. 4: Generally, to carry out your daily work, do you think you have the right amount of rules, regulations and procedures? (click on a scale from 0 = too less to 100 = too many)

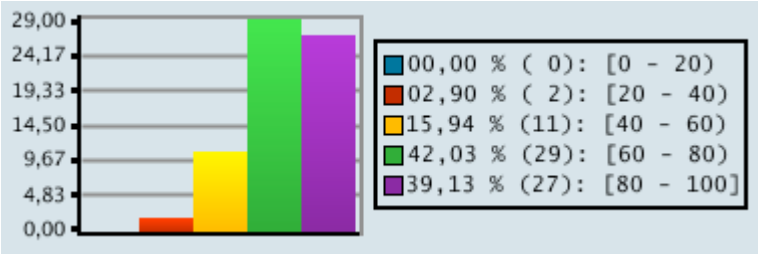

Diagram 2:
Scale graphic answers to question Nr. 4

The answers are explicit: 16% ticked the 40-60 scale box which indicates an appropriate number of procedures. 42% said that they have to deal with many procedures (60-80 on a scale of 100) and 39% think they have too many rules (80-100 box).

We talked about the inability to remember all rules if a certain number of them are exceeded. There are other points which make work with a certain amount of rules impossible. 'An additive way of accumulating safety rules produces more conflicts between enforcement and getting the job done' (Reason et al., 1998, p.7). This in turn affects the utility of rules and the result thereof is increased rule violation, created by procedural overspecification (Reason, 1997, p.64). The more rules the less chances an operator gets to train for them as specific circumstances may occur only seldom. If a certain rule gets updated and changed frequently the difficulty is to remember correctly which version is now in force. Very specific rules might specify assumptions contradictory to basic "If"- rules and the decision as to which one to apply is then impossible. 'Continuing standardization beyond necessity will result in either no effect or in negative consequences' (Hollnagel et al., 2006, p.271).

CHARACTER OF PROCEDURES

Many violations are created by procedural overspecification.
Reason, Parker & Lawton, 1998

During this study I discovered that it is not only the sheer number of procedures that indicate overregulation, but it is also the kind of procedure that counts. The difference of what is perceived as benefit/aid or as an unessential hindrance depends of the character and the applicability of the rule. (Cartmale & Forbes, 1999)

If we go back to the current Swiss ATM scene where a lot of new procedures are felt to be connected with the legal liability question, the acceptance or the comprehension of why an operator should follow them is blocked. He cannot understand the purpose of the new rule because from his perspective it does not help him to achieve his goals. This background makes a procedure useless and impractical. Lawton called this the 'hidden agenda of procedures' (1998, p.90). A procedure can have several functions. When the purpose of safety rules is no longer safety because it is misused for delegation of responsibility e.g. to minimize compensation claims, the acceptance and realization are negative. This sensation is equal to overregulation, because these rules are not useable and are therefore redundant.

With such misused procedures we reach a point where the gap between work completed as is prescribed in books, and work completed in reality, opens up before it has even started. This effect, when combined with the old rules which might have shifted due to practical adaptations and the established working methods shared amongst the team members but not formulated on paper, an overregulation of detailed procedures (administrative, technical, political, company policy, how to use tools, duties, working methods etc.) forms a dangerous ground and is a safety threat.

Managers are well aware that ATCO's feel their daily duties to be overregulated. When asked this question they even rate it higher then the actual numbers of the ATCO's responses show. Yet they do not see a way out of this dilemma. It seems that they just accept the fact and one might suspect that they do not anticipate the dangers of such a situation. When asked what other ways they can think of to facilitate or handle ATC work, their answers remain vague and uninspired. They postulate compliance or offer training in human factors and competence. None of them asked if ATM really needs that many rules, or if the way they are is not contemporary anymore.

My personal impression is that we lost the oversight of the whole regulative groundwork of ATM. The basic rules from the beginning of ATC around 1960 have been updated, changed, adjusted and widened so many times that the created network of rules, regulations, procedures and specifications is on the verge of falling apart. The evolution in the last 10 years has forced even more and formerly independent parts of the business to be regulated and harmonized, parts which are far away from the daily safe handling of aircraft through European airspace.

The resulting organization relies on an overkill of procedures which are too often impossible to comply with.

Analysis focus group interview

(Transcript in German see annex 2)

One of the most common use of stories is to understand.
Gary Klein

Background: While looking through the different answers of the survey and discussing with the respondents, it became quite clear that a deeper discussion would be necessary. I changed my initial idea to conduct follow up interviews, into a focus group session. The hope here was to discover also some new ideas that I may have missed so far and not only to answer given questions. Five participants with various Swiss ATM working backgrounds, ATCO's from different centres and additional occupations such as instructors or recruitment specialists and one operational manager, met one afternoon around a table and discussed topics I had extracted from the survey. The interview was held in their mother tongue Swiss German. The added transcript is written in German. For the better understanding I have translated relevant parts. Again, my aim is not to repeat word for word single responses but to capture the richness of detailed answers about the problems concerning systems overregulation, and to highlight topics which are not explored yet in sociology and ergonomics.

To start the group session I opened with the same question as in the survey: ‚Have rules and regulations changed since you started you career in ATM?' Here it showed already that this is an emotionally sensitive topic. The interviewees reported a drastic increase and much more detailed procedures. The outline seems to be more voluminous, all eventualities have special rules and there are frequent changes and updates. Some of them openly confirmed that they have given up trying to be up to date at all times and check only from time to time with someone they assume to be better informed.

> 'I think the volume is nowadays so big that you can't remember everything' (anonymous, 2007, quote interview)

They agreed that one consequence of the number of procedures is that you have to set priorities of what is important and what not and thereby you might miss a change or significant update. The requirement for someone who pre-selects became apparent, but who would it be? The intervention from the manager present, that nobody would neither accept the legal consequences nor take the responsibility for such a task, shows again how deadlocked the current situation is. Management chooses issuing too many and too detailed procedures for their protection and ATCO's do not rebel but live with the fact that they are no longer able to remember every detail. This fear, a result of the legal prosecution after the Überlingen accident, is particularly special for the Swiss ATM situation. I did not hear similar fears from other operators but such a situation could occur to any other ANSP and I suspect the outcome would be similar.

In the English Air Traffic Manual for example, one can read the sentence: 'the air traffic controllers may break the rules should they consider it necessary.' That such a sentence would relieve the legal binding character of total rule compliance was not agreed upon. Someone said that most of the rule breaking is not due to traffic (high workload) but due to ignorance.

> 'And who or how should we decide which rule is necessary to violate and which not?' (anonymous, 2007, quote interview)

> 'In the end it is still a safe and expeditious flow of traffic that is most important and stands above all other rules' (anonymous, 2007, quote interview)

At this point I tried to investigate a little deeper, how they decide which procedure overrules another one or what helps their situational judgment of what is right and what is wrong. But besides experience they could not really name their decision helpers. According to Vicente (1999, p.217ff) operators tend to have different strategies with respect to work load. When time permits they would increase customer service. The final task always remains the same, however with increased work load they adopt more economic or qualitatively different strategies (e.g. uniform speeds, assignment of different altitudes than an aircrafts' requested cruising altitude) to keep workload within their cognitive capacity limits. Workers can switch between several different strategies for achieving a particular task – and this might include different rule behaviour.

The discussion changed to the differences between ATC centres and how authoritarian leadership and threat of punishment influences compliant behaviour. One participant who had

worked in two centres mainly identified the discrepancies as cultural differences. Here again they see the recent accident as a factor which changed peoples perceptions due to the resulting insecurity of management and operators. In a situation where everything continued as it always had and the outcome was a serious accident – the conclusion is very delicate and difficult. The investigation however, focuses only on compliance and neglect of written rules. This in turn increases the pressure to follow procedures even when a trained operator sees a better path to come to a solution. The barrier to adapt to the current context may become too important. If controllers are pushed into strict rule compliance in view of legal threats or a company creed that following procedures is the only correct approach, then all the great advantages of cognitive thinking, making situational decisions or decisions based on experience, will simply be wasted.

The feeling sharply contrasts with a sentence from an internal safety bulletin I showed to the group. It reads as follows: *Who would dare to think that a complex system like ATC could be managed without bending or even violating rules, everybody relies on the controller for taking the appropriate decision to violate when it is required to maintain the safety or for other reasons.*

> 'This shows only that we have too many or not the right rules. If one can only work while breaking rules then something is really wrong' (anonymous, 2007, quote interview)
>
> 'But we all know that he is right!' (anonymous, 2007, quote interview)

For me this illustrates perfectly the contrast between the inside and the outside view. The outsider wants to believe everybody follows all rules and when they do so the system operates safely; the insider strives to comply but due to the ever-changing context he is put into an unsolvable dilemma. There are two possible ways out of this situation. Society, the regulator and management have to accept that non-compliance does not inevitably lead to an unsafe outcome and that contextual adaptation is necessary. The operators should also make sure they do not accept an overload of over detailed and impractical procedures which force them to routinely violate more than necessary.

We somehow have to find the balance between compliance and room to navigate according to the situation. Both sides driven to their extreme mark the systems' total break-down. Figure 6 lists the main complications of either non- or total rule compliance.

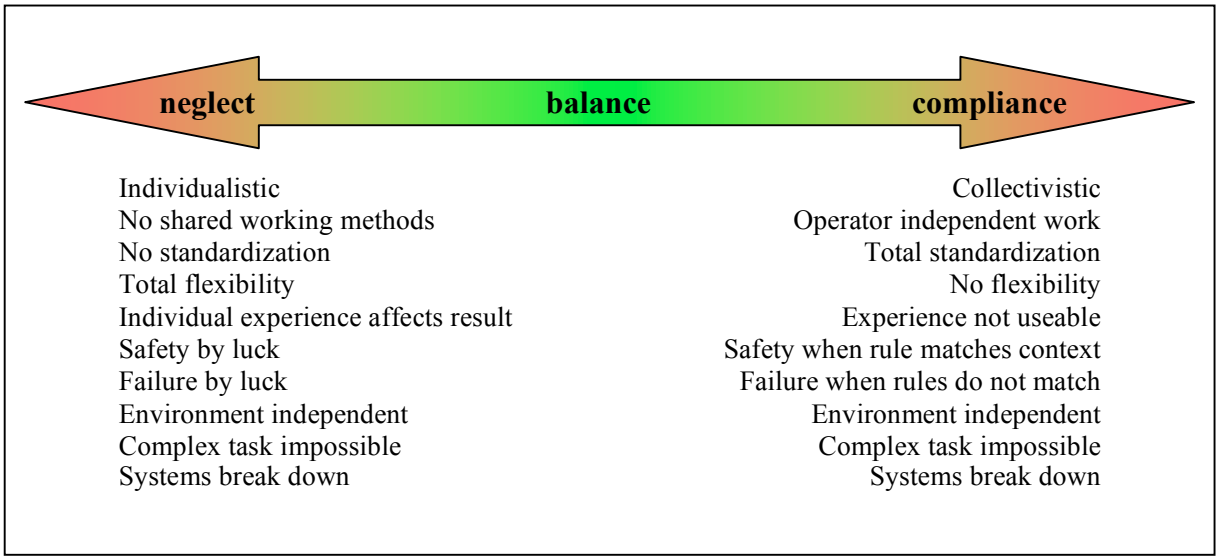

Figure 6: Neglect vs. Compliance. Own source

The next topic I wanted the group to talk about was how ideal procedures should look like, or in other words how we could bring more tolerance to them? First someone mentioned that this is a contradiction and that then there would not be any rules at all. Someone else argued that the legally binding character of the service orders should be deleted. He proposed that the controller should be granted sufficient legal "manoeuvring space" and that every ANSP be permitted to establish their own set of rules or guidelines but which would not be obligatory in detailed text. An ATCO should be committed to work in all conscience and follow the agreed guidelines, but he should also be trained and encouraged to use his capabilities and responsibilities to work. This suggestion found great approval. Someone added his observations during special weather situations: under these circumstances nobody can respect the original work procedures any longer, but after some time everything runs smoothly and seamlessly. This is a proof for him that there are too many rules and that it would work however, very well also with far fewer procedures.

The last part of the interview was thought to bring fresh ideas into the open of how we could organize ATC work besides using procedures and regulations. Unfortunately this question

produced great perplexity. One thing they discussed is to start all over again, write a new book, because the existing one has been updated and changed too many times. This is not really another way of doing it, it is just a revision or reformatting of the old organizational way. The same goes for the idea about the reduction of procedures. One additional point was that all changes which will be supported by the team members have to be grown from within. It would be pointless to force another organizational format on operators used to rule based work. The argument was that the same may be applied for cultural or behavioural changes. There is no use in writing and enforcing a procedure which intends to change for example risk perception. The sense of helplessness is captured in the following statement:

> ‚I just hope the pendulum will swing back on its own. We are so overregulated and regimented, it has to go back someday' (anonymous, 2007, quote interview)

The research amongst controllers and managers of European ATM revealed some of the daily confrontations with the current system and the difficulties faced in order to work within the double-bind of authority and responsibility (Dekker, 2005, p.201). Passengers trust the system and the operator's responsibility confidently but due to all too often incompatible goals (efficiency, maximum traffic handling, customer service and safety) operators do not have the required authority to act to the limits of their claimed responsibility. ‚Authority to assess, decide and act can be limited simply because of the nature of the situation. Time and other resources for making sense of a situation are lacking; information may not be at hand or may be ambiguous; there may be all kinds of subtle organizational pressures to prefer certain actions over others; and there may be no neutral or additional expertise to draw on' (p.201).

Discussion

There is always a tension between centralized guidance and local practice.
Helping people solve this fundamental trade-off is not a matter of
pushing the criterion one way or the other.
Sidney Dekker, 2003

The limitations and drawbacks of proceduralized work have been widely discussed and listed in the analysis above. They are an essential tool, but cannot meet all the demands a complex system like today's ATC generation places. Since a lot of ATC work needs a certain scope in

which to act, increasingly restrictive procedures reduce this frame to a point were a normal course of action is no longer possible. Rules and regulations can not be the only organizational form to control and direct safe work. Adding more and more regulations even destroys the positive effect of the basic rules. Human factors research, ergonomics and new insight in cognitive coherences propose additional ideas to administrative controls. They might act as an assistant in supporting and replenishing the present coping strategies.

Reason et al. suggested that the emphasis should not only be on the process control (via rules and regulations) but also on the output control. By shifting part of the safe behaviour burden to either social (group) control and/or self (individual) control. (1998, p.11) In order to achieve such a control mechanism, operators would need the freedom to act according to their trained skills, requisite imaginations and risk perceptions, which might even include rule violations, and this is exactly what an overregulation and a strict enforcement of rules is reducing further.

Cognitive Systems Engineering, an approach by Hollnagel and Woods offers another way of coping with complexity. Instead of trying to reduce or simplify it, they accept the difficulties and aim at supporting the general functions rather than prescribing exact ways of acting in particular settings. Design should always: 'support the natural human strategies for coping' (2005, p.88). They propose the introduction of a goal directed support. Instead of designing systems that contain a goal and enforce it top down onto the work force, people should establish the goals because this action requires creativity and comprehension of the existing patterns. 'People are better at achieving goals than at following instructions to the letter. Generating detailed procedures (prescribing the solution to the goals) requires massive computations and a meticulous following of rules which people notably are bad at' (p.97). This corresponds to the statements from the survey where controllers found the rules that forced behavioural or cultural changes were particularly impractical or dispensable.

Eurocontrol discussed the future structures of ATC in a presentation with the title 'Imagining Safety in European Air Traffic Management' and mainly suggests placing more explicit safety measures into the system because they suspect ATC relies too much on implicit safety. Their ideas are various: safety assessments, risk and hazard identification, safety learning, simulations, measurement of safety climate and others (Kirwan & Perrin., 2004). Not all of the proposals mentioned are new ideas, most of them exist (maybe under more conventional

names) or are used by ANSP's to organize their work, but they might all help balance a purely regulative approach.

Under the name 'Common Ground' Klein, Feltovich and Woods identified several concepts for coordination in joint activities (2004, p.32). They propose goal and interest alignments, achieved mainly by coordination among operators. This aim can only be reached when experience and expertise are shared and coordination is real, not substituted through guidelines and procedures. The common ground school requires investment in sharing perspectives and coordinations. The so used cognitive capacity applied is well invested because all team members work then with the same basis no matter if the situation is standard or not.

Social-organizational factors are not to be neglected or put aside when discussing work control. The design of the organizational structure influences the outcome as the design of devices and work tasks. Vicente argues that a mismatch in that field can lead to significant operational problems. (1999, p.272) He proposes modelling tools such as abstraction-decomposition space and information flow maps to define an exact role allocation and responsibility distribution throughout the organization. Strategies and authority relationships should be inline with the traced aim.

ATM could profit from other fields dealing with similar problem assignments. Since ATM organizations are often confronted with unpredictable situations, we might incorporate ideas from decision making. Klein talks in a chapter of his book *The Power of Intuition* about tactics for managing uncertainty (2003, p.123ff). These tactics include: delaying, increasing attention, filling the gaps with assumptions, building an interpretation, pressing on, shaking the tree, designing decision scenarios, simplifying the plan, preparing for the worst, using incremental decisions and embracing the uncertainty. We simply cannot devise a system of procedures which is so comprehensive that it could be substitute for expertise – so why not implement coping strategies into the organization's structure?

A very sophisticated and methodologically sound approach is the 'Resilience Engineering' concept (Hollnagel et al, 2006). Their proposal refers to the following principle: 'Success belongs to organizations, groups and individuals who are resilient in the sense that they recognise, adapt to and absorb variations, changes, disturbances, disruptions and surprises –

especially disruptions that fall outside of the set of disturbances the system is designed to handle' (p.3). 'Resilience engineering is a paradigm for safety management that focuses on how to help people cope with complexity under pressure to achieve success' (p.6).

This is only a small list of literature and people sharing experiences, research data, conceptual theories and examples from other industries in the search for solid organizations dealing safely with hazardous technologies. There are many more worth considering when finding a future path besides purely administrative control for a better balanced ATM service in Europe.

Conclusion

The first of those principles is interdependence.
Fritjof Capra, 1997

Aviation has reached an impressive safety level, considering number of passengers and tonnes of cargo it transports around the world on a daily basis. Similar to the analytic or reductionist approach of Western science, the progress of achieving greater safety (or deeper understanding of the system) has slacked and reached a plateau. Adding sophisticated technical tools, more detailed procedures, investments in accident investigation and situational awareness programs can no longer sufficiently increases overall aviation systems safety. The analytic maxim that every complex system's behaviour can be understood entirely from the properties of its parts has come to a dead end and twentieth-century science is slowly developing into systems thinking. As Capra wrote: ‚Systems thinking is "contextual", which is the opposite of analytical thinking. Analysis means taking something apart in order to understand it; systems thinking means putting it into the context of a larger whole' (1997, p.29). In this systems view, the parts of an organism are properties of the whole, in which none of the parts feature. I understand aviation, the socio-technical complex system as we know it today, to be such an organism with parts and interactions that emerge only out of the complex network and interplay of so many (sometimes hidden) connections.

When one part gets out of balance it can have several impacts. A living organism reacts differently to interference than does a machine. In a feedback loop, like the one propagated by

Norbert Wiener's concept of cybernetics, each element has an effect on the next, until the last feeds back the effect into the first element. This self regulation modifies the entire system (1997, p.56). If we stress the ATM system with overregulation this will feed back its effects onto other parts of the system, in our case the rule related behaviour and this in turn affects system safety. There are many possible ecology episodes which we could cite as an example, one is the river regulation. Small or only partial rebuilding can be adapted by the river. It still has enough room to swell and to evade if needed. Further corrections make the rise of water difficult and at a certain point the river will flood, most probably it will occur at positions not anticipated, because there have never been any problems beforehand. Similar examples could include climate reactions or forest clearance.

Understanding European ATM as a living organism within an ever changing context offers the opportunity to step back and to reconsider aviation in its whole. We should accept the existing gap of centralized guidance and local practice instead of closing our eyes and covering it with another procedure. The awareness that we cannot stress one part without influencing other actions should stop us from pushing the system towards its breaking point.

The point I would like to stress, is the crucial balance that must be achieved between the level of standardization and the individual operator's freedom and flexibility to react. Procedural work is only one part of the 'aviation organism' but when rule-related behaviour is misguided, an unstable situation is created. The positive effects of procedures as resources (Dekker, 2005, p.139) for safe actions are lost and we can not predict at which point the "river" will flood the overly-regulated "riverbank".

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Acronyms & abbreviations

ANSP	Air Navigation Service Provider
ANS	Air Navigation Service
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATMM	Air Traffic Management Manual
ECAC	European Civil Aviation Conference
ESARR	Eurocontrol Safety Regulatory Requirements
ESRA	Eurocontrol Statistical Reference Area
ICAO	International Civil Aviation Organization
IFATCA	International Federation of Air Traffic Controllers' Associations
IFR	Instrument Flight Rules
ISO 9000	International Standards Organization Certificate
NATS	National Air Traffic Services
NLR	National Aerospace Laboratory
NPP	Nuclear Power Production
SES	Single European Sky
SESAR	Single European Sky ATM Research Programme
SO	Service Order
TCAS	The Traffic alert and Collision Avoidance System

Annex 1

ATC survey Page 1/3 0%

Welcome

This questionnaire is part of my thesis work at the University of Lund. I'm writing about ATM procedures in Switzerland and Europe. I would very much appreciate if you could help me by filling out the questions below. It will take not more then 30'. All your answers will be treated absolutely confidential and anonymous.

For the purpose of this survey, regulations and procedures always refer to the rules and instructions you are using in your daily work. These can be general agreements, ICAO or Eurocontrol regulations, your national instructions, letter of agreements, coordination rules, service orders or any other regulation.

If you prefer, you can of course answer the questions in German.

I already thank you for participating!

1. **Where do you work? (place and company)**

2. **What is your position?**

Air traffic controller

Operational support

Operational manager

3. **How many years of experience do you have?**

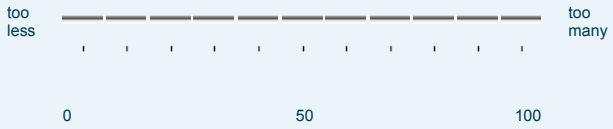
0-5 years

5-10 years

10-20 years

more then 20 years

4. **Generally, to carry out your daily work, do you think you have the right amount of rules, regulations and procedures?**
Please click on scale.



5. **What would you say is the aim of a procedure?**

6. **What are the advantages of rule based work?**

7. Where do you see disadvantages?

If you work as an ATCO please continue normally with the questions below.If you work in management or operational support please skip the next questions and continue with question Nr. 13

8. Have you ever experienced situations where you had to act against or bend a rule?

Yes

No

if yes, can you describe a situation?

What would you say is the main reason to violate or stretch rules?

9. Are your procedures practicable?

yes, all of them

most of them, with a few exceptions

more or less

no, very unpracticable

Please describe an impracticable procedure.

Did you find saver ways of doing the task?

10. **What do you do if a situation requires you to act against a certain regulation?**

11. **How much tolerance (situational adaptability) do your procedures allow?**

				conditions	tolerance	tolerance
Procedure						

T'.

12. Can you influence new procedures which affect your work?

Yes

No

13. If you compare the current situation about rules and regulations with the past, in which direction are we heading?

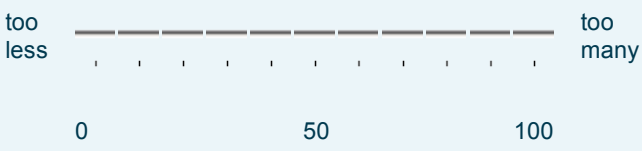
	loosly regulated	some parts regulated, others not	strictly regulated	over-regulated	
ATC in general					
your ANSP					
your daily work					

14. What happens if your work is not regulated at all?

15. **And what if it is overregulated? (i.e.: two contradicting procedures for the same task)**

The following questions are for managers only, ATCO please scroll down to the bottom of the page.

16. **What do you think how ATCOs answered the following question: 'To carry out your daily work, do you think you have the right amount of rules, regulations and procedures?'**
Please click on scale.



What is beside rules and regulations the best way to facilitate and handle ATC work? (TWR or Area)

17.

18. **How can you influence new regulations? (Either the ones you have to adapt or procedures you are going to introduce in your department)**

Thank you very much!

I'm really grateful for your time and help.

Your answers will help me to draw a picture of the current regulatory and procedure situation of ATM in Europe. I'm hoping to perceive tendencies and to find questions we should address in the next future.

Best regards
Sabine Zimmermann

Back | This survey has been created with '2ask' | Submit

Organizer: Sabine Zimmermann, Kasernenstrasse 77b, 8004 Zürich, Switzerland,

This survey is supported by 2ask within the framework of the 'Advanced Program for Research and Teaching'.

Annex 2

Focus Group Interview

Date: 6.8.07
Room: ANC 5-555
Time: 1415h-1530h
Leader: Sabine Zimmermann / **S**
Participants: anonym / **Ma** (ex ATCO ACC Zurich, operational manager), anonym /**M** (ATCO ACC Geneva and Zurich), anonym / **E** (ATCO ACC Zurich, head instructor), anonym / **R** (ATCO ACC Geneva and Zurich), anonym / **N** (ATCO ACC Zurich, recruitment ATCO training)

Topic: 'Is the current process of regulating ATC compromising the system safety?'
Keywords: past-current situation-future / CH – Europe /overregulation / rule violations / other possible means to achieve task

1. Begrüßung:

Zweck/Thesis, Gespräch wird aufgezeichnet ist aber absolute confidential, Aufzeichnung fürs Transkript und um das zu vereinfachen bitte ich euch Hochdeutsch zu sprechen. Es gibt keine Vorgabe für dieses Gespräch es darf und soll sich frei entwickeln. Äußert eure Ideen, Vorschläge. Auch kontroverse Gedanken sind willkommen. Ich werde versuchen die Inputs zu liefern und zusehen das wir nicht zu sehr vom Thema abweichen.

Thema: Generell Procedures and Regulations in ATC

2. Fragen (A-Allgemein V-Violation M-Amount O-Overregulation)

A Wieviele Jahre Erfahrung hast du? Verwendet

A Spontan: Was fällt dir zum Wort Vorschrift ein? Nicht verwendet

A Was oder wie haben sich die Regeln geändert seit eurer Ausbildung? V

A Welche Regeln lassen sich einfach einhalten, welche sind schwierig? nV

M Regeln und Vorschriften provozieren ein bestimmtes Verhalten. Bei zu wenigen Regeln müssen viele Entscheide eigenhändig gefällt werden, es gibt wenig Leitplanken/Hilfen man kann aber auch kaum Fehler begehen. Bei zu vielen Vorschriften wird die Einhaltung und Beachtung aller Regeln immer schwieriger und man sieht sich öfters gezwungen welche zu brechen.

a) wenn du heute arbeitest in welcher Situation befindest du dich? nV

b) was provoziert ‚rule violations' für Gefühle? Was würde dir die Entscheidungsfindung erleichtern? Was passiert wenn sie zur Routine werden? V

O Overregulation = loss of flexibility. Wieso braucht man als ATCO soviel Flexibilität? nV

V Im letzten safety bulltin von skyguide finden wir folgenden Abschnitt:

‘Who would dare to think that a complex system like ATC could be managed without pending or even violating rules? Everybody relies on the controller for taking the appropriate decision to ‘violate’ when it is required for safety or other reasons.’ Zitat Thomas Novotny

Was bedeutet das? Wie weißt du wann es angebracht ist die Regeln zu verletzen um Sicherheit zu gewinnen? V

A Im englischen ATM gibt es eine interessante Passage: ‚the air traffic controller may break the rules should they consider it necessary’. Ist das ein Freipass zu tun und zu lassen was man will oder hilft das? V

O 45% von allen Umfrageteilnehmern finden ATC generell und ihr Provider überreguliert. Verschiedene Vorschläge wurden geäußert was dies bewirkt. Einer war dass diese Situation ein falsches Bild der Sicherheitslage gibt. Könnt ihr das nachvollziehen? V

O Kann Überregulation veränderungsresistent machen? Könnte es ein System zum Kollaps bringen weil es schlicht zu aufwendig und teuer wird? nV

A ‚Rules are for the adherence of fools and the guidance of wise men’ Nur Dumme halten sich an Regeln, die Cleveren benutzen sie als Wegweiser. Gilt das auch für ATC? V

A Wie funktioniert ATC in anderen Kulturkreisen bei denen strenge Vorschriften nicht so verwurzelt sind? nV

A Wie könnte man unsere Arbeit noch anders organisieren als immer mit neuen Regeln und Vorschriften? V

A Was wünschst du dir für neue procedures? Teils V

System safety? nV

<u>3. Interview</u>

S: Vielleicht zuerst Mal müsste ich wissen, wie viele Jahre Erfahrung ihr habt. 00:00:19

E: ..ehh, sag du zuerst= 00:00:20

Ma: = 90 sind wir eingetreten, dann macht das 15 Jahre 00:00:39

E: also ich auch 15. 00:00:39

N: 19 Jahre 00:00:42

M: ähh (0.5) zehn, neun 00:00:13

R: sieben Monate, (allgemeines Lachen) nein, sieben Jahre 00:00:13

S: super Querschnitt habe ich hier ausgewählt!

S: Guet (.) ähm Frage: Haben sich die Regeln verändert seit ihr angefangen habt? 00:00:15

R: Ja, grundsätzliche. Alles ist viel strikter, es gibt Sachen die heute reglementiert sind welche früher nicht waren, 00:00:48

E: Ja. 00:00:27

N: immer mehr Kleinigkeiten 00:00:34

M: Sonderfälle hhh die reglementiert werden ( )

Ma: Es gibt einfach viel, viel mehr Regeln, immer mehr Kleinigkeiten, jeder Spezialfall bekommt seine eigene Regel, es wird versucht alle Eventualitäten abzudecken, zu umfangreich, Luftraum, Ca, Rp, Dom, Syma alle Arbeitsgruppen abdecken, sehr voluminös 00:00:57

S: und die Einhaltung? wie werden die Regeln heutzutage eingehalten? Besser, genauer? 00:02:02

E: Nur schon durch den Umstand das wir mehr Regeln haben muss man sie auch besser einhalten. politischer Druck ist gewachsen. Überwachung durch außen ob Vorschriften eingehalten werden, zb abdrehen Richtung minga, man sollte sich schon dran halten. Und auch so kleine Sachen, zb Essen am Sektor, lesen früher war das Ansichtssache, jedem selbst überlassen. 00:02:29

R: oder zum Beispiel als ich angefangen habe hätte ich theoretisch noch lesen dürfen am Radar 00:00:31

S: (lachen) ich habe noch gelesen am Radar! 00:00:33

Ma: ich habe auch nie gelesen am Radar!

M: Episode Marianne: Unterschiede zwischen Regeln in Genf und Zürich betreffend Einhaltung, faszinierend. Lesen als Beispiel. Jeder hat's gelesen aber nach 2 Monaten hat sich niemand mehr dran gehalten. 00:03:33

Ma: ich weiß halt auch nicht ob wir ein Sonderfall sind wegen Überlingen, wir sind halt schon geschädigt von dem Zwischenfall 00:02:01

S: Wobei der APP ja auch schon immer ein bisschen anders war als wir, auch vor Überlingen 00:02:04

M: es gibt natürlich schon auch den Effekt der Gruppendynamik 00:02:06

Ma: der App wurde natürlich auch immer viel viel straffer geführt als wir in der ACC. 00:00:32 00:00:32

S: die hatten ja auch den Heiter der aufgepasst hat

E: Wir haben auch viel bei uns verändert. Was wir früher am Sektor privat telefoniert haben?! Das merkt man jetzt selten. Und wenn dann nur kurz. Bei APP gab es damals schon nicht. sie haben sich schon da mehr an die Regeln gehalten 00:02:07

R: Ich habe das Gefühl, dass alles was in den letzten 4 oder 5 Jahren an Reglementen neu

dazugekommen ist hat Überlingen( ) eine Rolle gespielt. Bei praktisch allem habe ich das Gefühl gehabt dass ist jetzt nur wegen dem Unfall, alles ist strikter geworden. 00:03:58

S: dass das BAZL auch mehr darauf beharrt ist halt auch ein fact von Überlingen, sie sind ja auch dort darauf gestoßen worden mehr zu kontrollieren. 00:04:02

M: ich finde jetzt schon langsam, dass eine Fülle erreicht wurde wo man sich nicht mehr alles merken kann und dich an alles erinnern 00:04:24

N: das ist das Problem, ich denke wenn die Regeln nicht befolgt werden dann ist das auch ein Zeichen dafür das nicht mehr alles abrufbar ist, man nicht mehr mitbekommen hat was aktuell ist wegen Fülle 00:04:29

Ma: Die Regulations sind ja sehr oft eine Absicherung fürs Management um allfällige juristische Nachspiele abdecken sollen. Das sie dann sagen können: schaut: der Kontroller hat es abgehackt, dass heißt er hat's gelesen, wir haben vorgeschrieben wie in dieser Situation gehandelt werden soll, also uns kann man nichts vorwerfen. Es steht ja alles da drauf. Ich glaube dass ist es was Überlingen bewirkt hat. alles unsere neuen Vorschriften dienen zur Absicherung, zum sich dahinter verstecken zu können und das merkt man, gesunder Menschenverstand ist nicht mehr so gefragt. 00:04:38

R: es gab schon Doms die kontrolliert haben wie oft man das elektronische Briefing besucht hat, ob man alle neuen Weisungen mit 'read' angeklickt hat oder nicht. 00:04:39

N: ja weißt du weshalb? Weil das BAZL letztens kontrolliert hat und viele ihre Weisungen nicht 'abgeklickt' haben! 00:04:45

M: aber ich habe mir das letzthin auch überlegt. ich habe eine neue Weisung gelesen und sie nicht verstanden. also habe ich beschlossen nachher jemand drinnen im Saal zu fragen und ich habe sie halt einfach abegeklickt, obwohl ich eigentlich nichts verstanden habe. 00:04:33

E: also ich mache es oft so dass ich es mal lese und sie aber als ungelesen stehen lassen damit ich es später noch mal lese. Was mich aber mehr nervt ist das wir einfach alles kriegen, unsortiert, ob es uns etwas angeht oder nicht, schlecht aufbereitet, dass finde ich extrem verwirrend 00:04:38

N: man weiß gar nicht ob einem diese neue Regelung etwas angeht, betrifft. Es gibt so viel neues, man verliert dann auch die Motivation immer alles schön brav durch zu lesen 00:04:33

Ma: es ist halt auch cry wolf, bei so vielen Weisungen verliert man die Übersicht was wichtig ist und was nicht. Da kann dann auch Wichtiges untergehen= 00:00:31

E: =Ja genau! Man kann nicht mehr unterscheiden und Wichtiges geht verloren. 00:00:31

R: das ist dann kontraproduktiv. 00:04:40

Ma: für das hab ich immer die Trainees 'missbraucht'. wenn ich DT hatte habe ich immer mal nachgefragt was alles neues gültig ist, die sind ja immer up to date. 00:04:35

E: ja das ist so. 00:00:33

M: mmhh

S: Das kommt bei uns so ungefiltert an, eigentlich werden die Sachen aber schon separiert bevor sie uns erreichen, nicht? 00:06:21

Ma: Eigentlich schon, ja 00:06:21

S: aber dass man dann in denen sechsseitigen Weisungen auch noch raus findet was jetzt genau für meine Tätigkeit relevant ist, ist sehr sehr schwierig und bereitet oft Probleme. Vielleicht wäre da das Beispiel von anderen ANSP noch gut mit den mündlichen Briefings. Einmal im Monat bekommt man erklärt was neu ist. 00:06:24

E: Das wäre bestimmt nicht schlecht. Oder wenigstens jemand der sich bereit erklären würde die ganze Flut zu filtern für die Fluglotsen, vielleicht aufzulisten, ganz kurz was wichtig zu wissen ist. 00:06:22

M: Das wäre ja dann eine riesige Verantwortung.

N: Das wäre dann das was Marek gesagt hat. Irgendjemand ist dann der Dumme im Umzug. 00:08:12

Ma: Was sein müsste ist das die SO normal weiterlaufen würden und das es noch eine separate ATCO Publikation geben würde wo auf einer Seite alle wichtigen Sachen drauf sind die dich angehen, das sind dann vielleicht bullet-mäßige Aufzählungen wo dann drauf steht was sich geändert hat, das wäre dann juristisch nicht bindend es müsste halt wieder jemand geben der das macht.. Das ist ein riesige Aufwand 00:07:55

S: Und man dürfte dann auch nicht die Verantwortung auf die Abwälzen. 00:07:58

Ma: Nein, nein 00:07:58

Ma: da sind wir natürlich jetze auch geschädigt (Prozess) mit dieser Verantwortung. Ich war am Prozess jeden Tag dabei da ist es nur um das gegangen 'sie hätten ja sehen können....' 00:08:08

S: zu diesem Thema habe ich im englischen ATM einen guten Satz gefunden und zwar gibt es dort ziemlich weit vorne einen Stelle die da heißt: 'the air traffic controller may break the rules should they consider it necessary' Nützt so ein Satz etwas? 00:07:54

R: Ja! 00:09:17

M: Aber dann muss man ja wissen welche rule man brechen darf und welche nicht 00:08:05

S: ja, wie weiß man das? 00:08:05

M: Das ist es ja irgendwodurch[00:09:29

N:]schlussendlich[00:09:28

M:[das ist ja schwierig zu sagen, wenn du genau weißt was du machst, wegen dem muss ich jetzt das machen sonst wird es gefährlich, dann ist es auch ok für mich aber du musst ja

auch genau wissen, was du jetzt da brichst welche Regel 00:08:03

N: Klassisches Beispiel 'nicht drehen unter FL150 über Deutschland', das ist eine Regel die ich ohne mit der Wimper zu zucken breche. Wenn ich sehe das ist jetzt einfach die einzige Lösung die geht. 00:09:28

R: ja () 00:09:28

R: da kannst du mit Einhalten der Regel in eine schwierigere Situation geraten, als wenn du sie brichst ist es nachher viel safer und du hast die Situation im Griff. 00:09:29

N: Aber dort heißt es ausdrücklich: wenn du wegen traffic drehen musst dann ist erlaubt. 00:09:29

Ma: ja ich meine SAFE AND EXPEDITIOUS FLOW of traffic ist immer noch wichtiger als alles andere was wir machen, das ist immer noch das Ziel von ATC und dem ist auch alles andere unterworfen, mit dem kannst du auch immer argumentieren wen das BAZL kommt. Schlussendlich bist du verantwortlich für das was passiert am Radar 00:09:40

N: Natürlich aber wenn dann etwas ist, kommst du mit dem nicht weit 00:09:31 dann sind wir (.) oder wie jetzt bei Überlingen, wenn da ein Richter sitzt der keine Ahnung hat (0.5) von der Flugsicherung, der hält sich einfach ans Buch und du sagst dann ja ich mache das aber aus dem und dem Grund. Dann heißt es: ja aber...' Aber das ist unser Job und unsere Verantwortung ( )00:10:08

Ma: ja .... aber wenn wir jetzt schon bei Überlingen sind, das ist ja so wie der Pilot beziehungsweise die Russen argumentieren, der Pilot hat sich entgegen dem TCAS verhalten weil in seiner Situation versucht hat die Sicherheit retten und da hat er eigentlich auch Regen gebrochen= 00:10:09

N: = ja ja = 00:10:09

Ma: =und da hat er natürlich auch Regeln gebrochen 00:10:09

S: Genau das ist das. Gibt es den so Entscheidungshilfen? oder irgendwie (1) zum Beispiel wenn du jetzt da wegdrehen musst. Wie weißt du ob das jetzt eine Situation ist in der Regelbrechen hilfreicher ist als Einhalten? Oft sind es ja die Schnittstellen die Probleme bereiten. Wenn Regeln eingehalten werden weiß der andere mit was er rechnen kann wenn Regeln gebrochen werden bedingt das Koordination. Gibt's dann irgendeine Hilfe die du dann anwendest? 00:11:36

N: Gesunder Menschenverstand 00:11:39

R: ja. Erfahrung 00:11:36

M: finde ich auch 00:11:36

N: Quick look up and down. 00:11:37

R: genau, mitschauen und dann halt mal kleine Deviation erlauben damit nachher wieder alles gut kommt. Obwohl das natürlich kein Verfahren ist 00:11:39

E: man muss sich natürlich einfach bewusst sein dass das die absolute Ausnahme ist und es nicht tut weil es einfach praktischer ist 00:11:40

R: ja 00:11:34

E: das macht man ja nicht jeden Tag in jeder Session sondern nur genau wenn es eilt wenn man nicht warten kann 00:11:36

S: wenn wir jetzt sagen dass wir so viele Regeln haben, dass wir sie kaum einhalten können, dann wird ja auch das brechen der Regelen öfters 00:11:38

N: ja sicher 00:11:38

S: dann wird ja das Brechen aber auch schon fast zur Routine? 00:11:38

M: da muss man dann unterscheiden zwischen dem bewussten und dem unbewussten Brechen von der Regel. 00:11:38

() 00:11:53

S: die die man kennt oder nicht 00:11:56

M: ja genau, die Süddeutschland 150 Regel kennt jeder oder die Ausmaße der release boxes etc aber zum Beispiel inbound Friedrichshafen von Süden, die Regel ist kompliziert, der Norden hat gemeint es sie so und der Osten erwartet den Flieger so und dann kann man am Schluss noch eine halbe Stunde diskutieren und der Flieger ist längst am Boden und wir wissen immer noch nicht genau wie es eigentlich richtig hätte vor sich gehen sollen 00:11:38

N: dann koordiniert man es halt[00:11:35

M:] jaja 00:11:35

N: =weil miteinander reden ist ja auch gut 00:11:34

M: aber genau solche Sachen die nicht oft vorkommen 00:11:39

E: ja genau Buochs zum Beispiel, wo du nie recht weißt wohin muss ich jetzt den Flieger clearen *(häufige Änderungen)*, was erwartet jetzt der nächste von mir(0.5) es gibt große Missverständnisse weil man selber nicht sicher ist und jeder macht es ein bisschen anders 00:11:35

N: das wäre ja eigentlich das wofür procedures da wären, oder? Aber wenn sie dann halt unklar sind helfen sie auch nicht weiter 00:11:34

E: es irritiert 00:11:36

N: sind unlogisch 00:11:36

E: oder wenn ein Verfahren so selten zur Anwendung gelangt das man es dann auch nicht mehr weiß 00:11:43

S: Bei mir produziert das dann auch schlecht Gefühle wenn du oft Regen missachten musst.

00:11:46

R: mmh 00:14:05

Ma: das beste Beispiel ist outbound Mailand, bist du da bei Mailand telefonisch jemand erreicht hast und bis der versteht was du willst, in der Zwischenzeit hast du ihn schnell nach FL280 hoch gelassen und schickst den Flieger dem M2, du weißt der Mailänder sagt eh nie etwas, du siehst seinen Verkehr auch und es ist extrem efficient aber eigentlich ist es illegal 00:13:26

S: ich habe gehört in Genf wird das auch noch viel gemacht, in fremden Lufträumen Flieger drehen? 00:13:27

M: ja vor allem mit Frankreich, das ist eine andere Kultur, das merkt man ja auch in der Zusammenarbeit mit Reims. Die schicken kein Flugzeug bevor es nicht released ist. Wenn du ihnen den Flieger schickst, irgendwie ist er dann für sie released, mindestens für turn, drum schickt er auch das Zeug ewig nicht 00:13:26

Ma: aber das mit den dep Zürich haben sie gelernt, die lassen sie nicht mehr einfach steigen; 00:13:27

E: Nein das ist viel besser geworden 00:13:27

Ma: dort hat es auch extrem incidents gegeben! 00:13:27

S: im letzten safety bulletin der skyguide stand: 'who would dare to think that a complex system like ATC could be managed without bending or even violating rules, everybody relies on the controller for taking the approriate decision to violate when it is requierd to maintain the safety or for other reason'. 00:14:11

S: das ist ein Zitat von T. Novotny aus dem letzten safety bulltin. Dann stimmt also unsere Ansicht des täglichen Arbeitsablaufs nicht überein mit der Sicht von Außen, wie Richter oder das Bazl oder auch die Gesellschaft unsere Arbeit sehen? 00:14:05

M: aber das ist vielleicht auch das was du als Passagier gerne möchtest! (2) 00:14:06

M: du möchtest doch als Passagier annehmen das alles so sicher und einwandfrei läuft, alle nach den Regeln spielen. 00:14:05

S: Kann man den diesen Job effektiv nicht machen ohne Regeln zu brechen? 00:14:07

Ma: Weißt du eins der Probleme die wir in Skyguide haben ist, generell, wenn du verschiedene Leute fragst was 'safety' bedeutet. Wenn du den Controller fragst was 'safety' für ihn heißt, gibt er dir zur Antwort: 5Nm, 1000 ft', der safety experte sagt dir: (greedom) of unexceptable risk (.) Wenn du noch mal jemanden fragst sagt er: strict adherence to the rules ist safety. Es haben alle ein bisschen Recht, aber es ist nicht so einfach, weil jeder etwas anderes darunter versteht. und ähm .. wenn so etwas da drin steht dann ist das eigentlich ein Freipass für gesunden Menschenverstand. Aber es ist halt dann der Controller der dann entscheidet, er muss letztendlich die Verantwortung dafür übernehmen 00:16:07

E: für mich zeigt das, wen er das so schreibt, dass wir zuviel und auch nicht die richtigen Regeln haben. Das es überreguliert ist. Das man nur arbeiten kann indem du Regeln brichst.

Dann stimmt einfach etwas nicht. Und wenn das so deutlich formuliert wird dann sowieso 00:16:05

R: das ist einfach seine subjektive eigene Meinung, das kann man schon so akzeptieren 00:16:34

R: also ich finde er hat schon recht 00:16:38

E: eben, das finden wir ja alle 00:16:38

Ma: dann können wir einfach in Zukunft sagen: der Thomas Novotny hat gesagt das..00:16:18

(Pause) 00:16:23

S: Gemäß meiner Umfrage haben 45 % von allen Befragten angegeben das ATC im allgemeinen und ihre Arbeitgeber im speziellen überreguliert ist und was das so produzieren kann da hat einer oder eine etwas interessantes geschrieben: Überregulierung kann ein falsches Bild von der Sicherheitslage geben. Würdet ihr dem zustimmen oder eher nicht. 00:17:12

R: Wenn etwas gut und sicher ist muss man nicht so viele Regeln aufstellen. Wenn man alles bis in letzte Detail regulieren muss dann eh.. (0.5) ist irgendetwas nicht ganz sauber 00:17:15

M: dann stimmt etwas an der Basis nicht. 00:17:15

R: dann hat es Risiken und Gefahren überall, die man regulieren muss, dass man das überhaupt aufschreiben muss *(v.a. die leute regulieren?) 00:17:12*

S: ok 00:18:19

R: wenn über all steht die und die und die Regel gilt, dann muss ja das unheimlich heikel unheimlich sensible sein. 00:18:02

N: für mich drückt diese Überreglementierung vor allem ein Misstrauen vom Management an die Fluglotsen aus. Das sie wie Marek gesagt hat alles abgesichert haben wollen, und wir als Lotsen dann nicht kommen können und sagen wir haben es nicht besser gewusst. 00:18:06

N: also früher als ich angefangen habe, hat...s ( ) 00:18:09

S: ja aber hat es den das früher gegeben, dass Fluglotsen gekommen sind und gesagt haben, ja also ich kann hier die Verantwortung nicht übernehmen weil pfffhh, ich habe es ja nicht besser gewusst= 00:18:35

N: =nein, nein, das glaube ich nicht 00:18:35

S: es ist ja nicht so oder? Also mein Empfinden geht in die Richtung das sich Fluglotsen sehr wohl bewusst sind was ihre Verantwortung ist und diese auch tragen 00:18:24

N: das hat vielleicht auch noch etwas mit Überlingen zu tun 00:18:24

M: das ist halt schon noch in den Köpfen 00:18:24

N: ich weiß einfach nur noch das früher als wir angefangen haben da gab es doch nicht so viele Regeln, schon gewisse 00:18:27

Ma: da hast du das Manual gehabt 00:18:27

N: und eine Weisung war eine Seite und ganz klar und einfach beschrieben und dann alle 2 Monate mal eine wenn überhaupt 00:18:23

N: heute kriegst du ja jeden 3 oder 4 Tag eine 10 seitige Weisung, also ist doch das wirklich einfach dass 00:18:26

S: das habe ich gar noch nicht gezählt, da müsste ich mal schauen wie viele Weisungen wir in den letzten 2 Jahren gekriegt haben 00:18:26

M: das finde ich extrem.. 00:18:28

S: Irgend jemand hat noch ein spezielles englisches Sprichwort aufgeschrieben: ‚Rules are for the adherence of fools and the guidance of wise men'. Gilt das in der ATC auch? 00:18:33

N: ja ich glaube schon. Ein Stück weit, so wie wir vorher gesagt haben, wenn es sein muss und es nicht mehr anders geht dann bricht man die Regel halt 00:19:03

N: das macht jeder Lotse 00:19:03

Ma: letztlich ist auch so das die vielen Regulationen die geordneten Arbeitsabläufe garantieren. Sie geben Stabilität ins System. Du weist was du zu erwarten hast. Es hat alles schon seinen Grund. Man will ja so viele Flieger wie möglich durch das System lassen und deshalb muss man halt alles standardisieren und irgendwo zu Papier bringen. 00:20:13

E: das schon aber dann gibt es wiederum viele Regeln die dich einschränken und entgegen dem efficiency Prinzip sind (Minga 150) da hat man doch das Gefühl das behindert meine Arbeit doch mehr als das es hilft (.) den verkehr richtig zu regeln, und es gibt verschiedene Regeln natürlich, das was du sagst ist natürlich die positive Seite davon, dass man zusieht das alle so in die gleiche Richtung arbeiten aber es gibt auch sehr viele Regeln die dich einschränken 00:20:08

N: ja, vor allem im Sektorübergreifenden Bereich ist es wichtig Regeln zu befolgen aber in deinem eigen Luftraum dort wo du zuständig bist solltest du eigentlich schon machen dürfen wie du es für richtig hältst. Jetzt wäre es interessant jemanden von App/Twr dabei zu haben, die haben ja noch ganz andere Vorschriften. 00:20:11

Various: Regeln App/Twr, Spielraum, Individualismus, Dep sehr eng, stakeholder, Kanton, Unique, Lärmbüro etc. Bazl eigentlich keine Aufgabe der Fluglotsen mehr 00:20:08

S: Wie würde man den ein bisschen mehr 'Spielraum' in Vorschriften rein bringen? Wie bringt man so etwas hin mit einer Dienstweisung eine Zwischenlösung die zwar vorschreibt was grundlegend verlangt wird aber dennoch genügend Freiheit lässt je nach Situation anders zu reagieren ohne gleich die Regel zu brechen? 00:20:28

R: das ist eigentlich ein Widerspruch 00:20:11

S: ja aber du kannst ja nicht jede Situation genau detailgetreu Vorskizieren. 00:20:10

R: dann gibt's keine Regeln mehr 00:20:10

Ma: Ich glaube es würde etwas helfen wenn du den legal bindenden Charakter von der Weisung wegnehmen würdest. Man müsste einen Rechtsraum definieren und als Fluglotse darf ich mich darin bewegen und innerhalb skyguide organisieren wir unsere Arbeit via Dienstweisungen aber sie sind legal und im einzelnen wortlaut nicht bindet. Das heißt man kann als ATCO nach besten Gewissen und Wissen arbeiten, man hat guidelines nach denen wir uns verpflichten zu arbeiten und man soll nur davon abweichen wenn die unmittelbare safety tangiert wird aber das ist in einem geschützten legalen Raum. Dann nimmt man nämlich der Dienstweisung das starre weg und sie werden ein bisschen mehr dehnbar und somit erreicht man etwas mehr Spielraum. Die Tatsache das wir beim erarbeiten einer neuer Dienstweisung zum teil zu dritt eine halbe stunde über den gebrauch von should oder shall streiten, das ist doch völlig absurd 00:20:07

S: man kann ja in einer Dienstweisung sowieso nie alles bis in letzte detail beschreiben weil sich ja der Kontext die Umgebung ständig wandelt 00:20:29

E: Eine Lösung für mich wäre wenn mir die Leitung mehr den Rücken decken würde, so im Stil von: arbeitet ihr wir halten den legalen Aspekt von euch fern, quasi, das fehlt es ist sogar so das man versucht die ganze Verantwortung auf uns zu schaufeln, man kann vor Gericht gezogen werden wenn du dich nicht an die SO hältst, da hat Marek sicher recht mit seiner Idee diesen Aspekt heraus zu nehmen. So wie es jetzt ist, ist es enorm bindend und dann denkt natürlich auch jeder nur für sich 'cover your ass' und weil du auch nicht gedeckt wirst. aber du hast mir ein Stichwort geliefert mit CBs. Plötzlich merkt man es funktioniert einwandfrei wen die CBs da sind und man sich nicht mehr an die Regeln hält. Es geht so flexible und gut wenn es sich mal eingespielt hat. 00:20:08

E: Das ist ja eigentlich der Beweis dass...= 00:20:16

N:= es weniger bräuchte 00:20:16

E: ja, das es mit weniger Regeln besser funktionieren würde 00:20:16

S: ja das ist spannend. 00:20:16

S: und was ist mit Training? Was denkt ihr, wenn man eine allgemeinere Weisung schreiben würde und dann mit Training die Feinarbeit, quasi die Durchführung in verschiedenen Situationen trainieren würde? 00:20:32

N: kann mir grad keine Situation vorstellen wo das was bringen würde 00:20:34 00:26:54

V: Basel / 180 / überflüssige Regel / idiotische Überreglementierung 00:29:33

E: was hier noch dazukommt ist das unser Luftraum immer komplizierter wurde 00:29:35
Nur schon die Intersektions wir haben ja hunderte von Intersektions die es früher nicht gab, das ganze System wird immer noch komplexer, aufgebauschter. 00:29:57

R: da sollte mal jemand großzügig aufräumen, alle unnötigen Intersektions, das ganze

Manuel ist ein einziges Flickwerk, da müsst man mal neu anfangen und zwar strukturiert und organisiert. 00:29:39

E: wegen jedem kleinen Vorfall gibt es einen neue Regeln 00:29:54

V: flyby/Hdg / etc 00:30:23

S: Wie könnte man unsere Arbeit auch anders organisieren? Im Moment wird alles in SO's reingepackt, neue Verfahren, administratives, technisches, Verhaltensregeln und so fort. Habt ihr irgendwelche Ideen/Ansätze wie man unsere Arbeit auf eine andere Art regeln könnte? 00:31:36

N: Ein Anfang wäre das Manual auszumisten. Dieses Flickwerk neu zu strukturieren und sich grundlegend Gedanken zu machen was muss da rein, was nicht. Es fängt ja schon bei den Stiften an, wenn man ihnen genauere Angaben machen könnte was gilt und was nicht wäre es für sie auch einfacher. Jetzt pickt einfach jeder sich raus was ihm gerade passt. die Einheit fehlt. 00:30:40

R: ich finde wichtige das die SO ihren legalen Charakter verliert und nicht alles beinhalten muss, was zwar die Richter und das Management befriedigt aber praktisch völlig unbenutzbar ist. Abcklickerrei. keine Juristerei00:30:24

Ma: Anzahl SO reduzieren, administrative Sachen gehören nicht in eine bindene Vorschrift. Nur Verfahrensanpassungen. Diese Menge ist nicht mehr verarbeitbar. 00:33:46

E: Mich stört auch das alles auf Englisch sein muss. Man versteht ja nicht mal auf deutsch alles. 00:33:38

S: und Kulturaspekte? Wie sollen wir das organisieren? 00:34:11

E: Geht nur wenn jeder seine Vorbildfunktion wahr nimmt und es vorlebt. (Antibeispiel: DL) 00:33:29

Ma: Der ATCO kann doch am Besten beurteilen wie viel er momentan zu tun hat und wie er sich verhalten soll. Es ist ein verantwortungsvoller Job und wer ihn verantwortungsvoll wahrnimmt braucht keine Verhaltensregeln. Dort gibt es halt verschiedene Menschen. 00:33:45

M: Disziplinarische Probleme mit einer verschwindenden Minderheit lassen sich sowieso nicht via Regeln für alle regeln. 00:33:49

E: Aber genau das ist die Tendenz. Für alles und jedes gibt es eine Vorschrift, dass ist es genau was uns zur Überregulierung führt. 00:33:27

N: solche Veränderungen in einer Gruppe funktionieren nur wenn man gemeinsam darüber diskutiert. Probleme anspricht nicht verdrängt, bewusst machen was Verhalten auslösen kann. 00:33:24

S: was können wir im Nachhinein tun? Stellt euch vor wir kriegen eine neue sehr unpraktikable Vorschrift. Wo und wie können wir versuchen sie zu ändern damit wir sie nicht immer brechen müssen? 00:33:27

N: Verfahrensgruppe. 00:33:40

Ma: Habe die Hoffnung, dass das Pendel von alleine wieder zurück schwingt. Wir sind so überreguliert so unglaublich stark reglementiert, dass muss ja wieder zurück gehen. 00:34:12

S: das hängt aber auch an der Ausbildung? Je nach dem was für Leute man sucht und kriegt, kann man sie auch entsprechend schulen damit sie die Verantwortung auch ohne gecklicke tragen. 00:33:20

S: an der Survey gaben 6% an, dass sie noch nie eine Regel brechen mussten 00:33:21

Danke etc. 39:19:00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