The art of balance: A study of conflicting goals in a change intensive system

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Abstract. This paper describes some of the processes involved in balancing conflicting goals (e.g. between safety and operation) in a change-intensive environment. The objective has been to explore whether the balance between safety and production in a system becomes more complicated when changes, caused by either external or internal drivers, play a major part of the context in which the system operates. Loss of oversight over consequences becomes a prevalent challenge, and changes made at macro-level of the system might have unintended consequences on micro-level of the system and vice versa. The paper is based on data collected in the Norwegian civil aviation transport system. We have used two different frames, downwards and upwards resilience, to conceptualise processes of balancing safety and production in a change intensive complex socio-technical system such as aviation. Results show that there is a lack of commitment to downward resilience at a macro level of the Norwegian aviation transport system, mainly due to the tension that lies in the two-edged objective of being both safe and community-serving. The prioritization of regional policy (community-serving) and an unwillingness to develop distinct goal rules for balancing safe and community-serving air transport place downwards pressure on the aviation system. Despite deficiencies in the downward resilience, upward resilience traits at the micro level of the aviation system seem to counterbalance the picture by characteristics such as a clear commitment to safety, sacrificing decisions, and establishing resource buffers to handle safety in critical situations.

1 INTRODUCTION

The Norwegian civil aviation transport system has during the last decade been exposed to several externally and internally motivated changes. Changes may come in forms of

new EU legislation and regulations, deregulation, new business structures (e.g. merges, restructuring, relocation), and new technology. An increased focus on efficiency and cost reduction has been observed, resulting in questions whether the pressure has negative effects on the prioritization of safety (H¯yland & Aase 2008, Aase et al 2008). Historically, conflicting goals have shown to be part of the causal explanations of several serious aviation accidents in Norway. Analysis of accident investigation reports has revealed that in the Skagerrak accident (1989, 55 fatalities), pressure to uphold flight program due to a critical company economy was part of the accident picture. In the Namsos accident (1993, 6 fatalities), the investigation board recommended that the airline company's board of directors and top management clarified their principles for safety priority versus regularity, timeliness, and economy (Tj¯rhom & Aase 2008).

In this paper we seek to explore how processes of balancing conflicting goals are handled in today's aviation system, and whether balance between safety and production in a system becomes more complicated when changes, caused by either external or internal drivers, play a major part of the context in which the system operates.

2 METHODOLOGY

The study presented in this paper is part of a research program on safety and changes in the Norwegian aviation transport system conducted by a research group at the University of Stavanger. The paper is based on results presented in previous publications from the research program (H¯yland et al 2008, H¯yland & Aase 2008, Pettersen 2006, Pettersen & Aase 2008, Hauland et al 2007, Tj¯rhom & Aase 2007, 2008), and belonging data material. The publications are based on data covering a broad range of topics concerning the possible influence of changes on safety in the socio-technical aviation system. No supplementary data collection has taken place designed to cover the topic of conflicting goals more specifically.

The studies that this paper is based on covers empirical data from three cases to represent different levels of the aviation system:

- *The legislation/regulation case* consists of 26 interviews with inspectors, advisors and managers in the Civil Aviation Authority and 12 with employees in the Ministry of Transport and Communications. The object of this study was to describe safety policies, perceptions of safety, safety practices and changes.
- *The air traffic control/airport operation* case contains a study of five airports with 126 informants (interviews), aimed at diagnosing the safety culture as a means for improvement. The case also includes qualitative free text data concerning changes and safety aspects from a questionnaire survey, with 231 respondents (managers, planners, engineers, air traffic controllers).
- *The maintenance case* was carried out as an exploratory study of a line maintenance department, with participant observation, 15 interviews and a number of informal discussions. The goal was to gain insight into how safety is created and maintained through work practices at an individual/group level. The case also includes free text data from the described questionnaire survey, with 283 respondents within maintenance (managers, planners, engineers, aviation technicians).

Data is collected in the period between mid 2004 and mid 2007. Data analysis in this study was conducted by searching the empirical material and the previous publications for issues covering the topic of goal conflicts and for empirical examples in data material on processes of balancing safety and production.

3 THE ART OF BALANCE

According to Reason (1990) "*all organisations have to allocate resources to two distinct goals: production and safety*". In his opinion these goals are agreeable in the long term, but in a short time perspective with lack of resources production seems to take precedence over safety. These problems are reinforced by the difficulties with measuring safety. Gaba (2000) points to the fact that signals of safety are weaker than signals of production, and refers to the asymmetry regards to measuring these two goals. Safety comes in short because of lack of good measurement indicators, and it is problematic to state the relationship between resources and gains regarding safety. Organisations and systems are then dependent upon defining safety as precisely and operational as possible, besides being keen-sighted regarding changes that may impact the understanding of safety. In other words, one has to draw a picture, or make a model of the state of the art regarding safety and the ability to handle uncertainties by using sacrificing decisions (Woods 2006) in which goals of safety and production are weighted against each other, and against local work situated contexts.

In a system perspective decisions made at macro-level might have impact on micro-level and reverse (Dekker 2006). The operator's opportunity to act resilient depends upon the organisational context that frames the operational work, as well as resilience in the upper layers of the system reverberating acts and operations in the lower layers of the system. In this paper, downwards and upwards resilience are used as conceptual frames to describe this macro-micro level interface.

4 TRACES OF BALANCING IN THE NORWEGIAN AVIATION SYSTEM

Even thought there exists a range of incentives in our society to make sure commercial aviation operates safely (e.g. public opinion, passenger lists, lawsuits), the importance of highlighting the balance between safety and production goals is still prevalent (Perrow 1999). In a change intensive environment with coexisting and conflicting pressures from macro and micro level actors, managers may set their priority on cost optimization without having good aviation safety indicators to warn when safety margins erode.

4.1 Downward resilience?

Downward resilience (Woods 2006) reflects how overall directions and technical solutions prepare for, either bad or efficiently, resilience work. Lack of infrastructure or procedures to handle the safety or a lack of supervising goals might signal a lack of interests in the safety issues. It then becomes infeasible to discuss concepts of trade-offs

between goals, sacrificing judgement (Woods 2006), and commitment (Flin 2006), without having a goal structure that makes it possible to state safety and production efficiency as equal.

When looking at downward resilience in the Norwegian aviation transport system it became innate to point to the written words. At the web site we can read following: "The Ministry of Transportation is responsible for the framework condition in the Aviation transport in Norway". This statement is vague and then left over to the Civil Aviation Authority to take the safety responsibility regards to controlling and supervise the actors in the system. In the legislation/regulation case the most prominent goal conflict was related to the vision of the Civil Aviation Authority (CAA). The vision stated that the CAA should be an active initiator for safe **and** community-serving aviation services. The vision itself produces conflicts between "safe" and "community-serving" because safety goals are not defined.

In the Norwegian Aviation transport system this challenge with goal conflict might be even more prevalent because the political system in Norway are transitory consisting of a lot of small political parties that make coalitions. In practise this transitoriness means that one can every fourth year get new politics. One employee in the Ministry of Transportation, unit for aviation, said about changes in government;

> *"the departments change some colour, quite a lot of the attitudes changes, but from day to day are the jobs in consideration the same."*
>
> *And another:*
>
> *"New government? Then we have to fling oneself into the government's declaration"*
>
> *And a third :*
>
> *"It happens often that we during an elucidation of a case be aware of the fact that this is against the political decisions. It is important to us to be tidy."*

Caused by political changes there might be a change in goals, i.e. is one of the political parties in Norway especially focused on regional policy, with following implication that this party when the get the government abandoned the plans about close down some of the short take-off and landing ports in Norway that not gratify demands for airports within EU and international body of rules.

Grote suggests "rules management as a source for loose coupling in high-risk systems" (Grote 2008:91). Rules can have a function as glue within the organisation, the glue that makes the working operations consistent even when one has to adapt to unfamiliar events (Grote 2004). If rules should be resources for actions, not determinants for action, (Grote 2008), we have to; distinguish between different specification levels of rules. The differentiation can be made between; Goal rules, process rules and action rules (Hale & Swuste 1998), these three types of rules could be viewed as following an axis where goal rules are most strategic of the three and action rules are most detailed. The rules will become normative and show a direction in situation that calls for trade-offs between economy and safety.

The lack of some distinct goal rules worked out by the Ministry made an inherent tension between safety and community serving. The lack of clear safety statements from the ministry will then let the way open for other parts of the system to strive for

productivity in precedence of safety. Managers and owners will always striving for reaching new goals regards to production efficiency and thereby became less engaged in safety goals.

These vision stated by the Civil Aviation Authority was perceived as conflicting, on of the inspector says;

> *"Our goal is (both) to be community serving and contribute to an increased safety level within aviation; I am not agreeing with that (double-edged), in my opinion our job should be to say NO! But it is a lot of difficult decisions regards to exemptions which are our task."*

Because it is the CAA that have the technical competence it became their task to decide whether the exemption needed for operation is strengthening the resilience or not. In lack of an overall defined trade-off, the decision for exemption or not became a struggle between professional consideration and politics in force. This possible struggle shows the vulnerability regards to the employees in CAA`s commitment to safety or not. And point back to the role of the Ministry of Transportation to show commitment to safety. As one of the employees in CAA said;

> *"We are the government's instrument for (both) safe and community serving aviation. Viewing resilience as interrelated system vice, it became important to know the Ministry of Transportation opinion about commitment to safety".*

None of the stated visions from The Ministry of Transportation or the Civil Aviation Authority can serve as goal rules that gives the organisation a common direction in trade-offs between safety and production. Both of the vision lack the dimension of giving tools for trade-offs between safety and security. The decision makers be in short of directions the give them the power to make sacrificing judgements. Without any clear defined overall safety goals we might say that there at lack of articulated safety commitment from the upper layer of the Norwegian Aviation System. It became difficult to state that the system has an inherent downward resilience; the upper layer has shown to little volition to make a sacrificing judgement between safety and production.

4.2 Upward resilience?

When it comes to decisions made at the micro level we can se that these make out often influence the resilience of the system as such. It is at this level in the system that the concrete operations find place. When modelling resilience one have to take into consideration the constant pressure on maintaining margins in the production process in a safe manner. The operations that are going on will never be a blueprint of the designated operations (Snook 2000, McDonald 2006, Pettersen & Aase 2008). There seems to appearance a wakening understanding of the gap between design, procedures and rules and the work that is really going on in the front line. This gap can be described by alternations of situations that call for new ways of handling the operations. When the situations that calls for flexibility appears the operators and manager often has to make trade-offs between conflicting goals (McDonald 2006). These decisions might be difficult to take because of the inability to have a comprehensive picture of what kind of influence a decision on one level of the system might have on other parts of the system. The operator in front-line will not be able to know the fully consequence of a chosen

deviance from prescribed rules. Their trade-offs are made by their contextual frame from their point of view in the organization (Dekker 2006). Repeatedly deviation from prescribed design may over time become a new rule which means that the design and the real operations became really unequal. An accumulation of such drift from deviation all over the system made the system opaque and it became difficult to know for sure if the decisions made regards to trade-offs really are sacrificing judgements.

In the airport operation case goal conflicts were related to prioritizing between efficient traffic handling and safety. Differences between airports were revealed where some handled the possible conflicts by choosing safe work practices, by addressing the conflict upwards in the hierarchical system, and by providing necessary resources for safe operations. Other airports experienced that efficient traffic handling was prioritized before safe operations, resulting in procedure violations (H¯yland et.al 2008).

This case shows clearly that when the operators experience commitment to safety by their managers, they dare to make sacrificing decisions, as they do at the airport where they feel such commitment. The opposite is the case at the airports where the operators experience lack of commitment from their management, and thereby tend to give efficiency precedence before safety.

In the maintenance case, the technicians report that formal descriptions of work are just a part of their knowledge base. In addition to the written procedures they have to elaborate problem solving procedures. These problem solving procedures are used when the situations calls for flexibility. The standard operating procedures are static tools which need to be justified to keep the system resilient. The problem solving procedures are "embedded in the heads and hands of the practitioners" (Pettersen 2006). The technicians reported about intuitive feelings that give guidance to their judgements. Their intuitive feelings are based upon years with experience that offer them comprehensiveness to view their part of production in an appropriate safety manner. In the technicians opinion there has been a change in their freedom to choose safety in precedence of efficiency. Data tells us that technicians experienced conflicting goals related to keeping the aircraft safe from technical faults and the same time getting the aircraft operational within the time limit of its planned schedule. A lot of technicians report about experienced increase in focus on demands for productivity as follows:

> *"Economy gets precedence for safety", "there is an odd mixture of safety and profit", "general demands on improved efficiency" and a "considerable weakening in the trust in the central management caused by their throughout focus on economy".*

All of these statements are mentioned by technician's experience when they were asked about perception of changing safety experience, or to say it with Woods (2006) changing frames for making sacrificial judgements. The experienced conflict regards to their opportunity to make (in their view) good trade-offs was often resolved by the technicians themselves by creating time spaces ("delays due to technical reasons") for making sure the airplane was technically airworthy (Pettersen & Aase 2008). In the trade-off between punctuality and safety, we found that the operating technicians were commitment to sacrificing decision. Because of their ownership to the technical competence they were in charge of being committed to safety and thereby making sacrificing decisions. Their perception of an increased focus on production is a challenge

when it comes to their commitment to make a good job in a safe manner. In lack of the framework for sacrificing judgement made by clear overall common safety goals that create downward resilience, the technicians have made their own buffer "due to technical reason". In power of their technical competence the operator at lower levels

5 CONCLUSION

Based on our data we state that there is a lack of commitment to downward resilience at a macro level of the Norwegian aviation transport system, mainly due to the tension that lies in the two-edged objective of being both safe **and** community-serving. The prioritization of regional policy (community-serving) and an unwillingness to develop distinct goal rules for balancing safe and community-serving air transport place downwards pressure on the aviation system. Despite deficiencies in the downward resilience, upward resilience traits at the micro level of the aviation system seem to counterbalance the picture by characteristics such as a clear commitment to safety, sacrificing decisions, and establishing resource buffers to handle safety in critical situations. Employees at airports make sacrificing decisions by consulting management and establishing buffers of resources available for safety critical situations. Technicians within maintenance create safe practices by searching for knowledge and experience throughout the organisation and create safety spaces that may involve using statements such as "delay due to technical reason".

The tension between downward and upward resilience in the aviation system that we have studied is balanced by a strong professionalism throughout the system that functions as a buffer and make safety goals prevalent to production goals. To uphold this art of balancing it is in our opinion crucial to develop strong but flexible goal rules at a macro level to demonstrate a commitment to safety that micro level actors find trustworthy.

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