

Considerations on control processes in aeronautical organizations in the context of improving safety and efficiency

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Abstract: *In modern aeronautical systems, one of the biggest challenges for the management structures is to maintain the control at all levels. Operational safety and efficiency impose the need to control all the associated risks and hazards; thus, in order to achieve organizational performance, a very important aspect is to establish and develop a strong organization with respect to operations and objectives. Nevertheless, performance cannot be achieved without control; the continuous technological development and the environmental variabilities have a great impact on the organizational management processes. Organizations are very complex and they will continue to expand due to the increasing demands of flight operations. The capacity to adapt, considering the permanent transformations in the society, represents a continuous process that needs to be carefully carried in order to diminish or eliminate the errors that may occur due to organizational factors. Controlling each operational step from the beginning represents the premises for obtaining stability and performance.*

Key Words: *Safety rules, control processes, management control system, organizational control*

1. INTRODUCTION

In the second half of twentieth century, the confidence in air transport has increased, as it is a fast and efficient means over short, medium and long distances; safety has improved, the volume of civil aviation has increased and demands are on the rise. The social and economic benefits of the aviation are substantial, while the adjacent costs are significant and steadily rising. The safety state of operations in commercial aviation has an impressive development throughout history. This performance is remarkable, given the industry worldwide growth, the implementation of new technologies, deregulation/liberalization/privatization and the global economic context. Among others, this development is the result of continuous joint and common agreed efforts by those involved in the aeronautical environment throughout years: shareholders, board of directors, engine and aircraft manufacturers, airlines, governmental and regulatory structures [1].

Maintaining and improving the performance level is a difficult and continuous process. Most of the improvements regarding the safety from different aeronautical sectors are the joint efforts concentrated on well-known and defined problems that have led to innovative technological solutions. The development of communication, navigation, air surveillance and weather conditions equipment helps various aeronautical organizations to be more aware and careful about operational risk and to avoid them or to manage them more effectively.

At the same time, new challenges arise. The structure of the latest generation of aircrafts is made of composite materials which need different procedures during the maintenance and the inspection processes as opposed to past generations aircrafts. The development of long range large aircrafts imposed new standards regarding the performance and the reliability standpoint.

The success of an organization is to achieve the established objectives in the context of challenges and economic situation at a given time; the most important element is the human resources that need to know and master the modern methods and procedures and the modes of operation of the technological assets. They should also be aware of their involvement, the quality of work and responsibilities at group, team and management level [2]. In our present days, the control has become an essential element in organizations; throughout time, studies and lessons learned followed by actions in terms of organizational development have improved the control in aeronautical systems. Aviation has become a complex system in which the error margin is very low; studies and events (incidents or accidents) have shown that without a strong management system, personnel involvement – well-defined culture -, safety processes, continuously adapting to new demands, desire for improvement, financial investments - all of them subject to control in every operational state – an aeronautical organization cannot achieve operational performances.

This article aims to present considerations on control processes given the social and organizational aeronautical environment; in order to achieve a high performance level of safety and efficiency, observing the differences between commercial airlines in context of operational evolution, is important in identifying flaws in the existing systems, that hinder the achievement of established objectives.

2. IMPLICATIONS OF ELABORATING SAFETY RULES

Safety rules are elaborated and implemented by organizational authorities who are responsible for the safety state within organizations. These aspects result in the possibility of reducing machines or human error – and a way to diminish human error is by using the organizational control and by recommending certain attitudes and behaviors in the context of safety rules. These rules represent a resource for those with safety prerogatives at organizational level (for example: training and technology). Elaborating new rules can be tempting. In the context of safety regulatory responsibilities, the organizations can make two mistakes: they can be very restrictive or superficial. It is not difficult to imagine that most regulators try to avoid the second mistake, considering that the lack of safety represents a life-threatening aspect. In essence, it is tempting to create and implement new rules in response to safety problems; this incentive is the result of the desire to find a fast solution to a complex problem. In the case of an incident or accident, there may be public pressure on managers or on other organizational members with safety related positions to take immediate actions – elaborating and implementing new rules/restrictions represents an easy and quick measure [3].

The idea that accidents are a gap within a regulatory system which needs to be established is common. Morris et al (1999) [4] demonstrated that decision-makers have a tendency to blame human errors and not technological system failures in the event of accidents when they have to give an answer like “if this then the accident would not have happened”.

Given that organizations that operate with high risks do not function independently in society and are subject to a system of rules and regulations, there is external pressure to develop new rules. If an accident occurs and there is a regulation that should have prevented it, the person who has not complied with the established set of rules is responsible of the outcome; if there are no regulatory aspects in that particular matter, then the responsibility lies with the staff assigned to this regulatory sector.

Drafting rules in writing represents an imbalance for formal control [5]. Schulz (1998) [6] concluded that rules do not create infinite rules – the process of developing new rules is slowing down due to the existing rules. Even so, many very detailed rules, are a problem for the organization because they can slow down the internal organization processes and implicitly diminish organizational control.

Safety system implies a management in which the basic idea is that prevention measures of incidents and accidents should be initiated at the early stages of system development and should be maintained through the entire cycle. Experience helped those who managed this aspect of safety systems to find some conclusions. One of them is related to the fact that the newly designed systems will always have undetected problems, no matter how well-defined the safety systems are. This is why a safety program should be used throughout the entire life-cycle of the systems to ensure that those elements of risk are identified whenever they occur and proper corrective actions are taken with respect to the given situation.

From the way the concept of safety system is defined it is easy to understand that the main element is the system with large features and associated attributes. This implies the need to know each element in the system; how the system works system analysis tools, life cycle and development processes.

Proactive and preventive safety processes can be effectively implemented if it is attempted/intended to achieve the safety goals at all stages of the life cycle of the system by using appropriate tools.

The safety objectives content should be correlated with technological and management progress.

3. CONTROL AT ORGANIZATIONAL LEVEL

Organizational control theory [5], [7], [8], [10] refers to how an organization influences the purpose of accomplishing the established objectives. Ouchi's (1979) [9] model is the prevailing element used in empiric studies regarding organizational control [7], [10], [11], [12], [13]. He proposed a model for choosing the control methods for managers, which shapes the context decision: task programmability (the ability to specify the necessary steps) and outcome measurability (the ability to measure the output).

In Figure 1, if a task is very well understood (cells 3 and 4), the appropriate behaviors can be specified to obtain the desired results – the information needed to perform the tasks can be found in the rules [9]; behavioral control (e.g. processes, work phases, role specification, monitoring) specifies the proper steps to follow.

In specialized literature there are different opinions on the form which can be taken by the behavior. Weick et al. (2005) [14] highlights the importance of context in which actions

are developing and suggests a process that can model the behavior when uncertainty and ambiguity prevails. If the outputs are easy to measure (cells 2 and 4), then the output can be monitored and the output control can be used to obtain the planned results. According to Ouchi, where it is possible to control the output or behavior, the mode chosen should be the one that provides lower costs.

If tasks setting and output measurement is low (cell 1), then clan control is the recommended one. The clan control refers to the regulation of planning objectives, behaviors, evaluation and consequences management by a group of individuals which are sharing similar objectives, norms and values [9], [15], [16]. Clan control can be at profession level, organizational level or work group levels [9], [15], [16] and usually the purpose is to solve a problem in joint manner, participatory decision making, sharing information in open and honest manner and respecting promises [17], [18].

It is well known that using multiple control methods is more efficient than using only one. Most of studies regarding control theory emphasize individual control modes and ignore the effects of interaction between control modes [19], [20]. Liu et al. (2010) [19] and Tiwana (2010) [20] have develop a performance model for the effects of control modes explicitly specifying the interaction between those modes.

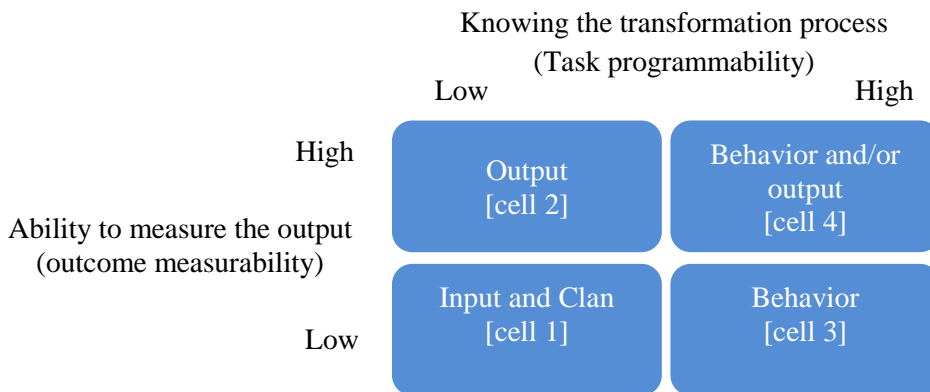


Fig. 1 Choosing the control mode depending of existing context [21]

The characterization of an organization in the context of control typology has the role of describing an essential and universal aspect of the organization - an aspect of the organizational environment that each member of the organization must accept and adapt to. The organization implies control. A social organization represents an orderly arrangement of the amount of individual social interactions. Control processes are helping to shape attitudes so that they can be in line with rational plan of the organization. Organization require a certain level of compliance as well as integration of a large number of activities. The control function has to ensure compliance with organizational requirements and the accomplishment of the most important established objectives. The coordination and organization of all interest and diffuse potential behavior of members represent largely a control function; many problems of organization and individual adjustments occur in this situation.

The control is inevitably correlated with the organization, with far greater implications. It implies all aspects of social life that are of particular importance to all people. The main problems are choices and freedom at individual level, correlated with those related to will and prosperity. It is not about what is going on inside the organization, but also about organization's relationship with other structures/systems. It analyzes issues related to democratic or authoritarian managerial style, centralized or decentralized system, general or

closed monitoring, trade unions, administrative councils and others. Control and compliance issues in organizations contribute to serious dilemmas. Organizations provide order – a necessary condition for people to produce massively and operate safely. Abundance and security create opportunities and choices/decision – a prerequisite for human freedom. Moreover, responsibility for creating and supporting order tends to be distributed unevenly within organizations. Most of the time, there are a small number of people who decide on the order that many people have to comply with, but no matter how the order is created, it is necessary for everyone or almost everyone to comply with the organizational norms.

The control has been defined in many ways over time and is associated with several terms. Generally, it refers to a process by which a person or group of people or an organization deliberately determines or affects what will be done by another person, group or organization.

The control, of course, can have a micro-level effect, such as a specific person to a subordinate, how to act in a certain circumstance, or at a macro level, more generally, as it happens at the organizational level by determining policies or internal actions.

The control can be reciprocal, individuals in a group having in some extent control over the activity of others; or it can be unilateral, an individual controlling and others being controlled. Assigning power to a person depends on his or her position to exercise control; authority is about the right to exercise control.

If by liberty we refer to the extent at which an individual determines his behavior, being controlled can be perceived, in general terms, as opposed to freedom. The more an individual's behavior is determined by others (that is, being controlled), the less the individual is free to determine his own way of action.

The system control management aims to motivate and guide managers to ensure that organizational goals are met. This is done by rewarding and promoting people in accordance with well-established criteria. Most of the times, it is built to help achieve the highest goal congruence level, where people pursue their personal goals that lead to the organizational goal. There is no extensive scientific research on how to achieve control systems that results in the objectives congruence; moreover, it is not very clear how formal and informal elements work within the control processes.

The challenge is to identify requirements that allow formal and informal control systems to achieve goal congruence.

Organizational integrity, integrated into formal and informal objectivity concepts, has an important role; formal objectivity is related to how control system management is built (formal control elements), and informal objectivity in the concrete manner in which managers are operating the system (informal control elements).

The main purpose of the management control system is to achieve the congruence of objectives. This type of systems acts as means of distributing resources and responsibilities, in accordance with certain criteria through planning, monitoring, evaluation and reward. Complementary to this initial objective of achieving goal congruence is the principle of using the system control management to reduce uncertainty.

Objectives congruence as the primary objective of the management control system is not inconsistent with the use of control means to reduce uncertainty, because, even if a system is used for that purpose, it must reach a certain level of coordination between the interests of the system's operating personnel and the interests of the organization, thus allowing interest alignment [22]. These authors define the organizational interest's alignment as "the extent to which members of the organization are motivated to behave and act in accordance with the organizational goals" [22].

4. MANAGEMENT CONTROL SYSTEM AND THE RESULTING IMPLICATIONS

The ultimate goal of management control systems is to shape people so that they can contribute to organizational goal.

The specialized literature on organizational integrity has investigated the objectivity of informal rules that create strong perceptions of objectivity, thus providing a better way for achieving the set of organizational goals [23], [24], [25].

In 1980 Otley and Berry [26] argued in their work that organizational control is a neglected subject. Currently, the topic has omissions in many ways, despite ongoing technological development. In the same article, Otley and Berry quoted Tennenbaum (1968) [27] who said that an organization without a certain form of control was impossible – an obvious aspect. Managerial tasks are designed to ensure goal setting, performance monitoring, performance evaluation rewards and penalties; all these tasks are part of the management control process. An important part of managerial activities are related to the management control.

A formal control system can be defined as a management control structure (for example: responsibility structure, defined and adapted to organizations characteristics) and a management control process through which goals and strategies are settled and which models the annual budget for each responsibility center; the performance is measured and evaluated, rewards and punishments are at the decision of each responsibility center [28].

The formal control systems are suited with cyber systems, where there are more certainties than uncertainties. In high uncertainty environments, where change is continuous, such as the aeronautical environment, a formal control system may become ineffective. Therefore, informal structures are needed to influence the control processes.

It is difficult to identify the organizations that have only formal control systems, because they usually also have an informal dimension. The best example in this context is the coercive bureaucratic organizations [29], such as those in the public sector, where rules are strictly followed. Even then, there is a certain level of discretion and arbitrariness. These systems are usually inflexible, so unjust elements do not arise in the form of arbitrage, but in the form of unjust rules that can be difficult to change.

When a control system is formalized, both formal and informal control means can be used. A formal system cannot be managed only by using formal control methods; managers, when operating the system, use specific informal control elements and exercise a level of subjectivity. Therefore, in most control systems, informal control methods are intertwined with formal control methods.

Regardless of the nature or form of control there is a characteristics number of elements specific to an effective control system. The control systems can have both positive and negative effects. It is important that they are designed in a constructive and beneficial manner.

For a control system to make sense it has to be understood by those involved in the operations. The purpose of the control system and the information it provides has to be very comprehensible to those who act on the results. The level of sophistication of a control system must be in direct relation to the nature and the technical competence of the members. The information needs to be presented in a simple form; if it is not understood, there is a very high chance that it will not be taken into account and the potential of a control system cannot be very clear. The control must comply with the organization's structure and be related to decision-makers in charge of performance. Information should be given to

managers who are responsible for well-defined areas of activity and who are able to use the information in order to assess the level of success in achieving the objectives. Information should allow managers to control their area of responsibility and must be presented in a form that highlights when corrective action is required.

An effective control system should report deviations from the standard performance level as fast as possible. It is desirable for possible deviations to be identified before they occur. It is important that the deviations from the initial plan to be timely reported so that corrective actions can remedy the situation in an adequate timeframe and consistent manner; for example, the information that the budget can be overcome or cannot be reached must be shared with the managers in a timely manner in order to enable them to make decisions in this regard, thus avoiding last moment drastic situations/actions/limitations.

The control system should draw attention to important critical activities that influence the success of the organization.

A high number of unnecessary control methods and unimportant activities are a problem from the economic and timeframe point of view; they may have a demoralizing effect on the organization's staff and may lead to the loss of sight of other key point in the control process. Certain control elements are more important than others.

The control must be carefully maintained in key area and crucial activities to the organization's success.

To be effective, the control system must be flexible, based on information uninfluenced by the modification of various factors not related to the purpose of the control system. In addition to identifying deviations from the planned performance standard, the control system must be sufficiently complex to indicate the means by which performance can be improved.

The control can highlight a number of problematic areas that require corrective action. The management structures should investigate these possibilities and determine appropriate corrective actions to manage the cause of the deviation and to solve the identified problems [30]. At the same time, control systems must be subject to continuous analysis to ensure that they are effective and appropriate in the context of the results they produce.

It does not have to be expensive or very elaborate, but it should satisfy all the features presented above.

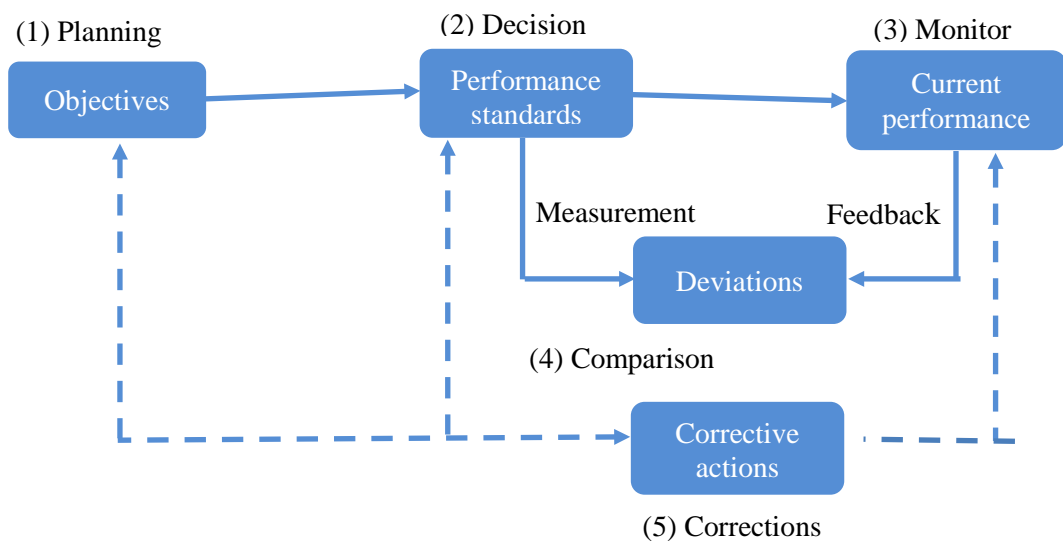


Fig. 2 Five steps for organizational control [31]

5. CONCLUSIONS

There is not a mathematical system that can accurately model a real physical system; uncertainty will always be present. The uncertainty refers to the fact that we cannot precisely predict what will be the output of a real physical system even if we know the input very well, so we are uncertain about the system. The uncertainty is based on two aspects: ignorance or unpredictable inputs (noises, perturbations and others) and unpredictable dynamics.

A model should provide a prediction on the input-output response so that it can be used to perform the control over the system and be reliable for operation – which is not possible. An engineer should take risks. There are things that cannot be eliminated, but they can be more flexible with the use of appropriate modeling, analysis and techniques in the design structure.

The role of an engineer is not just about constructing control systems or implementing elements that, for example, provide feedback about an existing system. An engineer should also be involved in choosing and configuring hardware platforms for overall system performance. For this reason, it is important that a theory of feedback not only leads to good structures, when possible, but also to indicate directly and unambiguously when performance objectives are not met.

The performance can be achieved if all the organizational aspects are under control. The aeronautical organization is composed of a sum of subsystems, which must be under control during the operational phases; without internal control and optimization of subsystems the external variables (social, economic, technological) may affect the functionality of a subsystem, implicitly the operation of the entire system. Without control is very hard to maintain an acceptable safety level. The control processes aim to optimize the system's operation; the control must be imposed by the organization's management structures – decision making structures – and these structures must be very well organized, stable, cooperable and performance-oriented.

Because of aeronautical system properties and characteristics, commercial airlines must prioritize the control processes in all operational phases. Neglecting one organizational aspect can cause a chain reaction that may influence the entire organizational process in a negative way; the internal operational algorithms can have flaws and the premises for hazardous events are higher. Every aeronautical system should implement a set of control processes according to their operational characteristics and organizational objectives in order to achieve a high level of safety and efficiency throughout the entire operational spectrum.

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