Using data to assess performance of safety management

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USING DATA TO ASSESS PERFORMANCE OF SAFETY MANAGEMENT

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The investigation of serious incidents and accidents has been a mandatory safety assurance method. The value of such investigations in learning from the past and improving the safety features of our systems is undebatable. Serious incidents and accidents are investigated by independent agencies/authorities, and they are typically supported by all stakeholders involved or affected who devote resources such as time, staff, equipment, facilities, and expertise.

However, when it comes to incidents that organizations investigate internally, the principle of independence and the expectation for adequate resources might not be guaranteed. This might occur partially because internal safety investigators report to managers of various organizational levels, and they are not always positioned in the safety department/office that reports directly to senior management.

That an internal investigation team is composed of employees and experts serving in positions other than safety-related ones is not unusual. Hence, internal safety investigators might face challenges in observing internal or external investigation standards and guidelines and ensuring that the outcomes of their investigations are of high quality and effective. Furthermore, the support of internal investigations, utilization of respective reports, and response to those might indicate the importance that management assigns to internal investigations and reflect the level of safety management's maturity within the organization.

This article presents the main parts of a study conducted at a large aviation organization and demonstrates how quantitative and qualitative data related to internal safety investigations can be used to assess safety management's role, the speed of safety communication, the timeliness of safety investigation processes and realization of safety recommendations, and the extent of convergence between safety management and investigation teams.

The results of the study suggested an interfering role of the safety department into operations, severe delays of internal safety investigations, timely implementation of recommendations, quick dissemination of investigation reports to employees, and a low ratio of investigation team recommendations included in the final safety investigation reports. The findings were discussed with safety staff of the organization who attributed them to nonscalable safety investigation procedures, ineffective resource management, lack of consistent and bidirectional communication, lack of investigators' awareness about the overall organizational context, and a weak commitment of operating departments to the realization of safety recommendations.

Overall, the specific research demonstrated an alternative way of exploiting available data from safety investigation processes and reports in the context of an internal performance-based evaluation of safety management.

Expectations from safety management

Senior management is responsible for defining safety policies and procedures, allocating the resources required to accomplish safety activities, adapting best industry practices, and incorporating regulations of state and international authorities and bodies. In a clearly scoped and mature safety management system, safety personnel should not interfere with operational decisions and remedial actions; the principal duty of department managers is to implement solutions for safety deficiencies. Individuals responsible for affected functional areas must be directly involved in the decision-making process and assigned with the responsibility and accountability for implementing appropriate corrective actions. As such, functional directors are actively involved in safety management and operationalize their safety responsibilities in their area.

Safety investigations make up a fundamental safety management practice, and their contribution to safety assurance are highly valuable. The distinct role of safety investigations in safety management stems from the potential to uncover causal and contributing factors and present the aftermaths derived from analyses of factual data. High-quality investigations, in terms of depth, clarity, punctuality, and objectivity, along with management support in realizing remedial actions, decisively affect an organization's safety culture.

Resources allocated to investigations determine their extent and depth; as recognized, available resources will curtail some safety investigations. Nonetheless, the formulation of safety recommendations is the ultimate goal of safety investigations. Specific requirements must be set for safety recommendations: they must be addressed to the most proper operational or management level that holds the authority to make the necessary changes; the suggestions must address objectives instead of specific actions to meet objectives; and the recommendations must be developed following a dialogue among the involved parties to avoid unexpected and undesirable denial and resistance to their

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implementation.

Also, safety communication is an inextricable part of a well-operated safety management scheme. Transport Canada combined good communication and effective training with increased probability of a successful safety management. Under this requirement, all organizational levels and functions must be aware of the strengths and weaknesses that affect operational activities. Information must not be restricted to safety topics; in a mature organizational culture, employees need to be knowledgeable about total organizational performance and benchmarking results.

Inclusive electronic databases should allow employees to retrieve information about industry and international standards, organizational plans and their incarnation progress, operational procedures, quality-assurance findings, and remedial actions. Specifically, in the context of safety investigations, the goal is to keep organizational memories alive, circulate aftermaths, and increase risk awareness so that similar negative events can be avoided.

Research methodology

The study was conducted at an aviation organization (AO) and explored how it could use data from safety investigation processes and reports to develop relevant safety management performance metrics in addition to measuring incident rates and frequencies of contributing/causal factors. The AO's hierarchical structure includes senior management, where the safety department resides; three middle-management sectors, each supported by a safety department; and air operations, maintenance, logistics, and ground support units, each reporting to a section and running a safety office.

The data used includes the AO's safety investigation progress records, investigation team reports submitted to the AO's safety department, final investigation reports released after processing investigation team reports, and recommendation logs. The data already existed within the organization but had not been previously used to assess aspects of its safety management. The sample was provided by the AO's safety department and covered reports and records of 810 safety events that occurred between 2004 and 2014 during flights or on the ground.

Following the analysis of the datasets, the results were communicated to seven safety professionals within the AO, and individual interviews were scheduled to discuss and explain the findings. The aim was to combine perspectives from safety professionals with various roles in the AO. All interviewees were experienced safety investigators, and four of them had safety management-related positions at the time of the interviews. The metrics employed to evaluate aspects of safety management and the results of the quantitative and qualitative analysis are jointly described in the following sections; the reader can refer to the full article for further details.

Investigation Phase	Maximum Duration Foreseen (days)	Actual Average Duration (days)	Deviation Between Actual and Maximum Duration
Operating Unit (completion of investigation team tasks and first commentary)	50	119	+138%
Middle-Management Sector (second commentary)	20	50	+150%
Senior Management Directorates (third commentary)	20	15	-25%
Safety Department (publication of final safety investigation report)	60	60	0%
Total Process Time	170	432	+154%

Table I Duration of Safety Investigation Phases

Metric 1: Duration of safety investigation phases

Description

This metric regarded the time elapsed among the several phases of safety investigations. A considerable deviation from the foreseen deadlines could be attributed to mismanagement or lack of resources in the investigation process or unrealistic expectations. According to the AO's safety investigation procedures:

- The investigation team should submit its report no later than 50 days after the event's occurrence, accompanied by comments from the operating unit involved and/or affected by the event. The combination of the report and comments constitutes the draft investigation folder.
- Afterwards, the sector that the operational unit reports to should comment on the investigation folder in 20 days. This additional commentary should become part of the draft investigation folder.
- Next, within 20 days senior directorates addressed during the safety investigation should add comments to the investigation folder. Directorates' comments should also supplement the investigation folder.
- After all commentary is collected, the safety department should publish the final investigation report in 60 days.
- Taking into account the timeline referred above, along with an allowance of 20 days for secretarial procedures, the safety department should issue the official report no later than 170 days after the date that the safety event occurred.

Results

As Table I shows, the organization under study experienced severe delays in its investigation phases at the operating unit and middle-management sectors. All

interviewees attributed those findings to ineffective resource management at the aforementioned organizational levels. Although investigation team members should be released from their normal duties during each safety investigation, this was not practiced by the managers of the operating units. At the middle-management sector, the delays were linked to understaffing and the requirement to accomplish a variety of activities in addition to coordinating the commentary of safety investigation folders. Safety staff of the operating unit and safety investigators claimed that the safety investigation procedures applied across the whole AO were not scalable and flexible enough to account for the variety of special conditions in each section and operating unit.

Metric 2: Timeliness of communication of final investigation reports

Description

The specific metric regarded the time required for communicating the final investigation report to end users at operating units and departments. The AO distributed the reports in hard copy format and imposed documentation controls to avoid publicizing the investigation reports and the negative implications on individuals and the organization as a whole. Although the AO had not set a specific timeframe for the communication of final investigation reports, such a metric was considered as indicative of safety management performance.

Results

In average, each report was communicated to the end users of operating units in 11 days; taking into account secretarial procedures, communication of final safety investigation reports to the end users did not show important delays. The AO's safety personnel stated that the organization recognized the merit of effective and timely communication of investigation reports across all organizational levels to prevent unwanted events through the aftermaths formulated in such reports.

Metric 3: Number and resemblance of recommendations

Description

This metric regarded two measurements: first, the difference between the number of recommendations stated in the investigation team reports and the ones included in the final reports; second, the number of common recommendations between investigation teams and the safety department. According to the AO's procedures, the recommendations generated by the investigation teams were not binding and were subject to changes, additions, etc., based on the comments received by the sectors and senior directorates and a final evaluation by the safety department. The AO provided safety investigation training to staff members who had been already trained as safety officers and implemented the risk-assessment process of the organization as part of their duties.

According to the AO's safety investigation procedures, investigation teams were expected to formulate recommendations after evaluating various options, their possible effects on operability, side effects to other organizational functions, associated costs, etc. This particular metric indicated the distance between the investigation teams and the AO's safety department in terms of number and resemblance of recommendations. A significant distance could be attributed to flaws in information sharing among investigation teams and the safety department. This could imply ineffective communication across the organization.

Results

The final investigation reports included 48% more recommendations than those formulated by the investigation teams. Also, only 61% of the recommendations proposed by the investigation teams were stated in the final reports. During discussions on this topic, the AO's safety staff pointed out that safety investigators had put much effort in their tasks and were highly concerned about the quality and completeness of their reports. However, investigators were not cognizant of the "big" picture of the organization in terms of complexity and resource constraints.

Moreover, investigators were not able to estimate costs when they were designing recommendations, and they were not aware of any other planned corrective actions that possibly were overlapping with the remedies proposed by the teams. The interviewees further noted the findings in the incomplete information investigators had obtained regarding the organization's plans, initiatives, constraints, etc. This, in turn, was ascribed to the lack of a central data storage system where such information could be stored and retrieved. Additionally, the safety department had not communicated to the investigators the reasons for the differences between what the investigation teams had suggested and what management adopted, because the AO lacks relevant procedures.

Metric 4: Type of recommendations

Description

Taking into consideration that standards propose a supportive role of safety managers and officers in developing remedial measures, each safety recommendation was classified as "assignment," "action," or "reminder," as explained below. The frequency of each recommendation type would indicate to what extent the AO's safety department had been supportive or interfering in operational managers' duties concerning generating and implementing corrective actions.

Assignment

The recommendation stated the objective to be achieved, meaning "what" should be fixed. This type of recommendations indicated a supportive role of the safety department because the latter did not restrict managers in the way they would tackle the problems revealed during safety investigations.

Action

The recommendation stated specific methods to address a deficiency, thus minimizing the degree freedom managers had to devise solutions. This indicated an interfering role of the safety department.

Reminder

The recommendation referred to an existing rule/procedure that was not followed by the employees, and its reinforcement was suggested. In this case, the role of the safety department was perceived as supportive since it did not introduce an action (e.g., how the reinforcement will be achieved).

Results

The safety department published about 39% action, 22% assignment, and 39% reminder recommendations. Safety staff of the safety department claimed that although the AO's procedures described

the distinct roles of several functions in the safety investigation process and generated recommendations, results from monitoring the corrective actions showed that those roles had not been practiced. Operating units and/or middle-management sectors had delayed, or even unilaterally rejected, corrective actions without providing relevant feedback to the safety department. Consequently, the safety department was concerned that the deficiencies revealed through investigations would not be timely or addressed at all, and subsequently in many cases the specific department had undertaken the role of managers.

The rest of the interviewees acknowledged that safety recommendations were frequently strict and did not give flexibility to operating units and middle-management levels to implement the remedies. These interviewees added that sometimes the action recommendations did not match the special conditions, resources, and other factors of the various operating units, thus occasionally increasing the implementation time and possibly the quality of the corrective actions. The frequency of reminder recommendation types in final investigation reports was perceived by the AO's safety personnel as positive. They claimed that it was not necessary to overwhelm other organizational functions by publishing additional directives regarding reinforcement of established procedures and rules.

Metric 5: Timeliness of implementing recommendations

Description

This metric regarded the time gap between delivery deadlines of recommendations and dates of their actual implementation in total and per-recommendation type. This metric would indicate potential delays in implementing corrective actions and trigger an exploration of underlying reasons.

Results

Managers implemented recommendations one month after the publication of the final safety investigation reports. The recommendations' delivery deadline defined in those reports had a median value of zero. Statistical tests showed that assignment-type recommendations needed more time for implementation, followed by the action and reminder types. The same order was calculated for the time allotted by the safety department for the realization of each recommendation type.

The AO's safety staff anticipated the aforementioned results, which suggested that safety department requested almost immediate implementation of recommendations. The interviewees argued that most of the action-type recommendations regarded easy-to-implement changes (e.g., subtle amendment of procedures) and that reminder-type measures required by default a short implementation time. Since action and reminder recommendations made up 78% of the total number of recommendations published by the AO, the short average implementation time revealed by the particular metric was expected.

On the other hand, assignment recommendations usually referred to the introduction of new technology or technical modifications, extensive changes to procedures, and further research for deficiencies identified during safety investigations. Such recommendations required detailed planning and research and consequently increased time for their delivery. However, they made up about one-fifth of all recommendations, and they did not significantly affect the results of the specific metric.

The overall picture

The analysis of data in combination with the discussions held with the organization's staff revealed both positive and negative performance of the safety management aspects considered in the study. The significant delays in safety investigations were attributed by the AO staff to ineffective resource management and investigation procedures, which led to a gap between AO expectations and actual deliverables. Although a timely and adequate allocation of resources will benefit organizations in terms of depth and speed of investigations, it seems that the specific organization did not realized the extent to which such resources were not always available or committed to investigations. Hence, it was not always feasible for the AO to derive lessons from safety investigations in a timely manner.

The fact that 48% more recommendations were stated in the final reports compared to the number of remedies stated in the investigation team reports—and that only 61% of the latter were adopted—indicated a dissociation among the safety department and investigators. Although the AO was expecting investigators to be aware of the wider organizational context when they were formulating recommendations, the quantitative and qualitative differences in generating safety recommendations were attributed to the lack of consistent information sharing between senior/middle management and investigators.

Moreover, the lack of a central information system did not support investigators' awareness of the overall organizational context and led to proposing remedies that were not completely aligned with the plans, constraints and other conditions of the AO. In addition, it seems that, even under the lack of such a central system, a bidirectional communication between the safety department and investigators could have alleviated over time the discrepancy regarding the quantity and quality of safety recommendations. Thus, the organization missed the opportunity to minimize the aforementioned gap over time.

On the positive side, the quick dissemination of safety investigation reports to the end-user level and the timely implementation of safety recommendations were attributed to the appreciation of communication of such information across the organization and the importance given to the efforts for preventing future accidents and incidents. It seems that the AO successfully estimated the time planned and the resources allocated to the implementation of remedies. However, the metric of timely implementation of safety recommendations does not account for the quality and effectiveness of the remedial actions, which were not possible to evaluate through the analysis of investigation reports and records.

The relatively high percentage of action-type recommendations indicates that the AO's safety department played an interfering role in the responsibilities of other departments. This was the result of managers' inadequate commitment to the realization of assignment-type recommendations in the past. This, in turn, resulted in important delays in the implementation of remedies and increasingly forced the safety department to formulate safety recommendations based on what should be performed instead of what should be achieved. Such an approach literally violated the scope of the recommendations referred to in the standards; the AO's staff

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attributed the aforesaid evolving practice of the safety department to the lack of a productive dialogue across the various organizational levels.

Conclusion

The study described in this paper demonstrated the potential for using data from safety investigation records and reports to assess the performance of various safety management aspects and to monitor event rates and frequencies of contributing and causal factors. The findings from the analysis of such data triggered respective discussions, through which positive and negative areas of safety management performance were identified.

Each organization might record different data in regard to safety investigations, so the implementation of the whole set of metrics presented in this study may not be always feasible. However, organizations can follow the method of this study to develop metrics depending on the data they maintain in relation to safety investigation reports and processes and use those to improve their safety management. The quality of safety recommendations and the depth of investigations are examples of aspects that can also be evaluated depending on the resources and type of data available. Nonetheless, it is of paramount importance that the results of such metrics be followed up with interviews and/or questionnaires to interpret figures and inform decisions. ◆

HELICOPTER ACCIDENT TRENDS IN EIGHT ISASI COUNTRIES

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Nevertheless, the fatal accidents that continue to occur often involve age-old issues, such as a high rate of VFR flying at night, flying VFR into weather, and inadequate preflight planning, including go/no-go decisions. LOC and CFIT accidents continue to account for a substantial majority of accidents, and each is strongly influenced by night flying and by weather. Other common issues include pilot performance (at least in accident flights), dispatch, and other issues in larger organizations, including a failure to establish, follow, and monitor good SOPs.

However, accident rates differ significantly by category of helicopter. These rates are influenced by differences in basic capabilities, but perhaps more by differences in who is flying the equipment, the mixture of missions in each category, differences in instrumentations, etc. Each country likely needs to adapt any concerted safety effort to reflect its own fleet mix; one size may not fit all.

Recommendations focused on the need for more thorough preflight planning and training as a starting point for reducing accidents in night VFR and in IMC. Training and better preflight are standard recommendations in any safety study, but they are difficult to do effectively. It must be repeated and sustained, and this can be costly and time consuming.

We also have recommended that more organizations adopt nonpunitive reporting programs and more use of meaningful data monitoring. These approaches may be more difficult options when addressing private pilots and small organizations, and even in larger organizations they require staff that can understand and analyze the information. Again, this is not free.

However, we also have recommended multiple technological interventions that can further improve helicopter safety, particularly by reducing LOC and CFIT accidents. They include but are not limited to greater use of TAWS and night-vision goggles, more use of onboard weather detection systems, three-axis autopilots, greater attention to helipad design, and more. Cost is the most common barrier to broader application of these technologies. ◆