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Performance Assessment Methods to Evaluate Discretionary ATC Safety Standards

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The US Federal Aviation Administration (FAA) established the Air Traffic Safety Oversight Service (AOV) in 2005. Its mission is to provide independent oversight of the US air traffic service provider, Air Traffic Organization (ATO). AOV monitors ATO compliance with safety standards and safety management systems (SMS) including the ATO's policies, procedures, and practices. AOV based its surveillance activities on systematic auditing methods to monitor ATO compliance with required safety controls. However, audits could only be used to monitor required safety controls having objective (strong) evidence of performance available. AOV lacked methods to monitor discretionary (weak) safety controls or safety controls without objective evidence of performance (weak). By adapting data collection methods from other domains of human performance assessment, we developed methods for monitoring discretionary controls and all controls without objective evidence of performance. The systematic assessment method complements AOV's audit process so that more extensive oversight activities can be conducted. 150

The US Federal Aviation Administration (FAA) is responsible for civil aviation safety and provides for the safe and efficient use of the national airspace. The FAA established the Air Traffic Safety Oversight Service (AOV) in 2005 to be responsible for independent oversight of the US air traffic service provider, the Air Traffic Organization (ATO). To accomplish its mission AOV monitors ATO compliance with safety standards and safety management systems (SMS) including the ATO's safety controls executed through its policies, procedures, and practices. These are documented in ATO orders and other guidance documents and are accepted controls for known system hazards or potential hazards. SMS dictates continuous improvement and feedback. To support this, AOV regularly and systematically conducts surveillance of the ATO's performance by collecting safety-related data.

Air traffic control (ATC) is a highly proceduralized environment. Initially, AOV modeled its oversight activities after the FAA's regulation of the aviation industry (e.g., commercial passenger carriers) and airmen (i.e., pilots). It developed its procedures and materials for conducting compliance audits based on those from other regulatory organizations, such as the US General Accounting Office (GAO) and the various Offices of Inspectors General (OIGs). Ensuring acceptable performance is the responsibility of the ATO. Although the controls provided herein as examples use the performance of an air traffic controller, safety

controls are in place for performance at all levels of the ATO organization. AOV monitors the ATO's execution of this responsibility at all organizational levels.

To accomplish this, AOV uses systematic auditing methods to monitor ATO compliance with required safety controls. Audit results identify potential safety impacts of ATO policies, procedures, practices, and any changes proposed to them. Required controls are signaled by direct words like "must" and "will" such as, *Ground control must notify local control when a departing aircraft has been taxied to a runway other than one previously designated as active.*

AOV needed methods to conduct oversight of discretionary controls. Discretionary controls are easily identified because they are signaled by words like "may," "should," and "can" that give the performer more than one option in the situation. An example of a discretionary control is *Once the pilot informs you action is being taken to resolve the situation, you may discontinue the issuance of further alerts.*

Moreover, performance of both required and optional controls is sometimes modified by explanations with words like "timely" and "controller judgment." AOV needed unbiased methods to collect and report subjective performance data.

In sum, while AOV had the methodology for oversight of ATO's required safety controls, audit methods permitted only monitoring of compliance for required safety controls and only those with objective evidence of performance. AOV lacked methods to monitor (1) discretionary safety controls and (2) all safety controls where evidence of performance was subjective.

Method

Based on our general experience in research methods and in conducting requirements audits, we identified ATO directive documents containing the types of controls and performance that we could use to develop a basic assessment methodology.

Control Types

Using FAA Order 7110.65 *Air Traffic Control* as the example ATO directive for this activity, we examined how safety controls were written. We identified two types of safety controls in the ATO document:

(1) those required to be performed (these we labeled "strong" - as in strongly written so as to be mandatory) and

(2) those performed at one's discretion (these we labeled "weak" - as in weakly written so as to be optional).

Data Types

We identified two types of data to reflect performance: (1) objective evidence that a control was performed (e.g., Yes, it was completed; No, it was not completed) or (2) subjective evidence (e.g., Was it timely? Was good judgment used?).

To organize subjective data, descriptive survey methods were adopted to construct response scales, etc. (e.g., Babbie, 2007; Brace, 2004; Kumar, 1999). Similar to constructing a census when the count and distribution of a population is of interest, appropriate data collection instruments can collect frequencies and variability of performance.

These scales are constructed by the assessment team to reduce likelihood of a biased response tool. Data patterns can then be reported without the risk of interjecting personal opinion or judgmental bias during data collection. For example, "time" amounts can be measured without also decreeing a judgment about whether a response was "timely" or not.

Results

Methods for the two types of controls (strong control, weak control) were listed individually in the row and column labels. The methods for the two types of controls (strong, weak) were then crossed with methods for the two data types (strong data, weak data). Each cell then has an assigned (1) control type and (2) data collection method (Yes/No/NA or scaled). The fourth (cell A1) represents the existing compliance audit methodology. The resulting four quadrants and their associated methods in Table 1 define three new oversight methods shown. Cells A2, B1, and B2 give instructions for the type of control and data to be assessed. The matrix provides a tool to help assessment teams build their materials to conduct an assessment and suggested methods to report the results.

Table 1.
Matrix of Methods

		START HERE > The safety control of interest is …	
		A: STRONG CONTROL Compliant performance is mandatory or prohibited (e.g., must, must not) • Use checklist questions restating the requirement(s) for compliance.	**B: WEAK CONTROL** Performance is optional (e.g., may, need not). • Use survey items pre-defined by AOV to describe outcomes.
Then > Id data type.	**1: STRONG DATA** are clear objective, countable, measurable • Use methods for objective data (i.e., Yes, No) • Report results using count and percent. • May also include data range and distribution. (STRONG Evidence)	**A1: Conduct an AUDIT** Compliant performance is mandatory or prohibited. • **Materials**: Use checklist questions using requirement(s) to be audited. • **Data Collection**: Use methods for objective data (i.e., Yes, No; was/wasn't done, etc.). • **Results**: Report count, percent, range, and distribution.	**B1: Conduct an ASSESSMENT** Compliant performance is optional or described in vague terms. • **Materials**: Use survey items pre-defined by AOV to describe outcomes. • **Data Collection**: Use methods for objective data (i.e., Yes, No; was/wasn't done, etc.) • **Results**: Report count, percent, range and distribution.
	2: WEAK DATA are unclear subjective ambiguous, vague, unobservable • Use methods for unclear data (i.e., see AOV Job Aid for pre-defining variables and data). • Report results using count, percent, range, and distribution. (WEAK Evidence)	**A2: Conduct an ASSESSMENT** Compliant performance is defined as mandatory or prohibited. • **Materials**: Use checklist questions using requirement being assessed. • **Data Collection**: Use methods for unclear data with AOV pre-defined variables. • **Results**: Report count, percent, range and distribution.	**B2: Conduct an ASSESSMENT** Compliant performance is defined as optional or in vague terms. • **Materials**: Use survey items pre-defined by AOV to describe outcomes. • **Data Collection**: Use methods for unclear data with AOV pre-defined variables. • **Results**: Report count, percent, range and distribution.

Conclusions

By identifying two types of controls and adapting data collection methods from other domains of human performance assessment, we developed methods for monitoring discretionary controls and all controls without objective evidence of performance. The systematic assessment method complements AOV's audit process so that more extensive oversight activities can be conducted. Results of assessments may be useful to identify controls which need to be (a) strengthened, (b) added when a gap in hazard control is identified, or (c) removed because they add an unnecessary complication to the safe provision of ATC services. Distributions of times and performance variance (for example) across the same situations can lead to productive discussions about safety and risk in the provision of services.

References

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Kumar, R. 1999. *Research Methodology*. Thousand Oaks, CA: Sage.