The Development and Implementation of a Safety Culture Survey for High-Performing Aviation Organizations

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12. Abstract

A positive safety culture requires an intentional approach and periodic assessment to determine where things stand and where improvements can be made. To fulfill requirements of the Aircraft Certification, Safety, and Accountability Act (ACSAA, §132(c)), the FAA developed and deployed a novel survey to help assess safety culture in the regulatory environment. The survey was developed in substantial part by leveraging insights from both the scientific literature and existing regulatory frameworks of safety culture. The survey measures the ten core traits set forth in the Harmonized Safety Culture Model developed by the International Atomic Energy Agency. As designed, the survey covers important aspects of any safety-critical workplace, including individual and leader commitment to safety, just and reporting culture, competing pressures, resource allocation, problem identification and resolution, workload and work planning, and others. This report provides (a) an overview of the safety culture survey development and design; (b) a study examining safety culture perceptions within a large participating FAA line of business; and (c) a brief discussion of survey administration best practices and follow-up. The value of the survey is that it provides a comprehensive assessment of safety culture perceptions in regulatory organizations; however, its utility is only fully realized when used judiciously and when the results are acted upon as part of a larger strategy for managing safety culture change.

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List of Abbreviations

Acronym	Abbreviation Explained
ACSAA	Aircraft Certification, Safety, and Accountability Act
AVS	Aviation Safety
CAA	Civil Aviation Authority
CAMI	Civil Aerospace Medical Institute
FAA	Federal Aviation Administration
FEVS	Federal Employee Viewpoint Survey
IAEA	International Atomic Energy Agency
ICAO	International Civil Aviation Organization
INSAG	International Nuclear Safety Advisory Group
LOB	Line of Business
M-SCAIT	Maintenance Safety Culture Assessment and Improvement Toolkit
NASA	National Aeronautics and Space Administration
National Academies	National Academies of Engineering, Science, and Medicine
NIOSH	National Institute for Occupational Safety and Health
NOSACQ-50	Nordic Occupational Safety Climate Questionnaire
NRC	Nuclear Regulatory Commission
SCMT	Safety Culture Measurement Toolkit
SHo-Me	Safety Health of Aviation Maintenance Engineering (Tool)
SME	Subject Matter Expert
SMICG	Safety Management International Collaboration Group
TRB	Transportation Research Board
WellBQ	Worker Well-Being Questionnaire

Introduction

> "Safety culture is arguably the single most important influence on the management of safety. If an organization has instituted all the safety management requirements but does not have a positive safety culture, it is likely to underperform" (International Civil Aviation Organization [ICAO], 2018; p. 3-1).

The FAA defines safety culture as "…the shared values, actions, and behaviors that demonstrate a commitment to safety over competing goals and demands" (Department of Transportation Safety Council; see Morrow & Coplen, 2017). A positive safety culture requires shared responsibility across individuals and leaders, demonstrating a clear commitment to safety. Further, a positive safety culture is characterized by a questioning attitude and a respectful work environment where trust, honesty, and open communication are fostered. Creating this environment for raising safety concerns empowers problem identification and resolution, where safety issues are identified, evaluated, and properly resolved. As safety concerns are addressed, organizations with a positive safety culture will continuously learn and share the lessons learned, promoting decision-making that prioritizes safety. Finally, there should be a support infrastructure in place, including communications and work planning that mutually emphasize safety.

A positive safety culture requires an intentional approach and periodic assessment to determine where things stand and where improvements can be made. It also requires frameworks to enable positive safety culture behaviors and continuous actions, informed by periodic assessments, to strengthen and improve.

The need for safety culture assessment became visible with the passage of the Aircraft Certification, Safety, and Accountability Act (ACSAA, §132(c); as part of the Consolidated Appropriations Act of 2021, 2020), which requires the Federal Aviation Administration (FAA) to conduct safety culture assessments of all Aviation Safety (AVS) employees annually through 2031. This requirement is reflected in the FAA's strategic planning; initiating a safety culture campaign is one of the initiatives supporting the Safety pillar in FAA's Flight Plan 21 (2022).

To fulfill ACSAA requirements, the FAA developed and deployed a novel survey to help assess safety culture in the regulatory environment. The survey was designed to balance the goals of scientific robustness with the need for generalizability and ease of use across the FAA. This was achieved by taking a collaborative approach to the project, where researchers and FAA-level safety culture community of practice representatives worked together to define and develop the survey. To test its efficacy, the survey was deployed to one large FAA line of business (LOB).

This report provides (a) an overview of the safety culture survey development and design; (b) a study examining safety culture perceptions within a large participating FAA LOB; and (c) a brief discussion of survey administration best practices and follow-up. This report describes four phases of research:

1. Documenting stakeholder priorities and assessment requirements
2. Survey development
3. Survey deployment to a large FAA LOB
4. Documenting lessons learned and recommended practices for administering and acting on the safety culture survey

Phase 1: Documenting Stakeholder Priorities and Assessment Requirements

The researchers hosted brainstorming sessions to identify stakeholder priorities and requirements for a successful safety culture assessment. The brainstorming session participants included leadership and other stakeholders from the FAA-level safety culture community of practice, with diverse representation invited from all FAA LOBs.

The stakeholders prioritized the development of a comprehensive safety culture assessment that could (a) quickly and independently gather a snapshot of the workforce perceptions of the safety culture at a given timeframe,[1] (b) monitor safety culture over time, and (c) track the effectiveness of safety culture promotion and improvement actions. Specific requirements of the safety culture survey include:

- Generalizable for use across the FAA
- Scientifically robust (i.e., assess a known framework of safety culture traits, measuring and leveraging multiple indicators)
- Anonymous aggregate results
- Collaborative with labor partners

Stakeholders agreed that the assessment should consist of a survey because it provides a systematic and inclusive approach to assessment, such that all employees have an opportunity to share their perspectives. Results can be compared readily across demographic variables of interest, such as department, location, or job role (National Academies of Science, Engineering, and Medicine [National Academies], 2016); this helps identify culture silos that may require targeted improvements.

Stakeholders prioritized that the survey should be both comprehensive and quick to administer (i.e., use pulse survey methodology). The LOB and stakeholder groups mutually agreed that the survey must assess all ten traits of a positive safety culture across all members of the LOB's workforce, but the amount of time needed to answer the survey could be shortened during administration by asking each respondent to answer only a randomly selected fraction of the question items needed to fully assess each safety culture trait.

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[1] Snapshots of workforce perceptions at a given timeframe are often referred to as measures of safety climate. The terms safety culture and safety climate are often used interchangeably, though there are some academic differences. Safety culture refers to the more enduring behaviors, norms, and assumptions in the organization, whereas safety climate is a more temporal, dynamic construct (Wiegmann et al., 2002).

Phase 2: Survey Development

The survey was designed as an a priori (planned) measurement of a safety culture based on an existing, well-used framework (i.e., the *Harmonized Safety Culture Model*, described below). It assesses internationally recognized traits of a positive safety culture (Appendix A), along with supplemental modules that can help address specific work unit needs (Appendix B). The researchers developed this survey to be used in its entirety, but to meet the dual needs of assessing the ten safety culture traits while maintaining brevity, a pulse survey methodology can be adopted where respondents complete a randomly selected subset of question items per safety culture trait.

Framework of Positive Safety Culture Traits

The survey was developed in substantial part by leveraging insights from both the scientific literature (see Key et al., 2023) and existing regulatory frameworks of safety culture. The survey measures the ten core traits set forth in the *Harmonized Safety Culture Model* developed by the International Atomic Energy Agency (IAEA, 2020). The model represents an evolution of assessments dating to 1992 when the International Nuclear Safety Advisory Group (INSAG) identified human factors as having contributed to the 1986 Chernobyl nuclear disaster and noted, among other findings, *a general lack of safety culture* (1992).

The Harmonized Safety Culture Model consists of ten traits:[2]

- **Individual Responsibility.** "All individuals are personally accountable for safety."
- **Questioning Attitude.** "Individuals remain vigilant for assumptions, anomalies, conditions, behaviors or activities that can adversely impact safety and then appropriately voice those concerns."
- **Communication.** "Communications support a focus on safety."
- **Leader Responsibility.** "Leaders demonstrate a commitment to safety in their decisions and behaviors. Leaders are role models for safety."
- **Decision-Making.** "Decisions are systematic, rigorous, thorough, and prudent."
- **Respectful Work Environment.** "Trust and respect permeate the organization."
- **Continuous Learning.** "Learning is highly valued."
- **Problem Identification and Resolution.** "Issues potentially impacting safety are systematically identified, fully evaluated, and promptly resolved according to their significance."
- **Environment for Raising Concerns.** "Personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination."
- **Work Planning.** "The process of planning and controlling work activities is implemented so that safety is maintained."

Nine of the traits were recommended by the Transportation Research Board (TRB; IAEA, 2020; National Academies, 2022); an additional trait captures the priority of safety in decision-making.

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[2] Quotes are reproduced from IAEA (2020).

These ten core traits are further characterized and organized by the IAEA into *attributes* of a positive safety culture.

Item Selection

A panel of four researchers (i.e., the authors) specializing in human factors research, each with a minimum of three years of expertise on the topic of safety culture, convened to develop the survey. The researchers have previously developed safety culture assessments for use in other aviation environments (i.e., regulatory organizations, certificate holders).

To start the development process, the researchers identified available survey instruments relevant to safety climate/culture. The selection criteria for instruments to review were that they must be (a) published, with the constituent question items publicly available, and (b) developed for and/or used by a governance organization. This search yielded the following survey instruments of safety climate/culture:

- Civil Aviation Authority (CAA), Safety Health of Aviation Maintenance Engineering (SHo-Me) Tool (CAA, 2003).
- EUROCONTROL, Safety Culture Measurement Toolkit (SCMT) for European Air Navigation Service Providers (Gordon & Kirwan, 2004; Mearns et al., 2013).
- FAA, 2020 AVS Safety Culture Assessment (MITRE, 2020).
- FAA, Maintenance Safety Culture Assessment and Improvement Toolkit (M-SCAIT) (Key et al., 2023).
- FAA, *[2022 AVS] Safety Culture Assessment* (Human Synergistics; Cooke et al., Unpublished Manuscript).
- Office of Personnel Management (n.d.), 2022 Office of Personnel Management Federal Employee Viewpoint Survey results [FEVS].
- IAEA, Safety Culture Perception Questionnaire for License Holders (IAEA, 2017).
- National Aeronautics and Space Administration (NASA), *Safety Culture Survey (SCS;* NASA, 2015).
- Nuclear Regulatory Commission (NRC), *Safety Culture and Climate Survey* (NRC, 2006, 2009, 2016).
- National Institute for Occupational Safety and Health (NIOSH), *Worker Well-Being Questionnaire (WellBQ;* Chari et al., 2022).
- Nordic Occupational Safety Climate Questionnaire (NOSACQ-50; Kines et al., 2011).
- Safety Management International Collaboration Group (SMICG), *Industry Safety Culture Evaluation Tool* (SMICG, 2019).
- Transport Canada, *Score Your Safety Culture* (Transport Canada, n.d.).

A set of items evaluating the effectiveness of voluntary reporting programs was included without modifications from a previous safety culture assessment to allow year-on-year comparison (Cooke et al., unpublished manuscript).

Cumulatively, these instruments totaled over 700 items for review. Each researcher independently rated each item for relevance. Specifically, each researcher reviewed each item

and categorized them into one of the ten IAEA traits. The researchers then ranked each item by how closely it aligned with the IAEA attributes. The researchers found that the attributes overlapped, resulting in some items being classified in a secondary attribute as well. In lieu of sampling-based inter-rater reliability methods, researcher consensus for the attribute categorization of each item was reached through discussion. Many items were found not to align well with any attributes, reducing the list to approximately 300 items.

Item Validation

Next, the question items were reviewed by stakeholders to ensure their operational readiness. An iterative two-step evaluation was performed to confirm the content and face validity of the selected items;[3] consequently, the number of items in the final survey instrument was reduced.

Content Validity

A separate and independent group of safety culture subject matter experts (SMEs) evaluated the content validity of question items. SMEs held Ph.D.s in psychology or human factors, each of whom has previously led research studies assessing safety culture. SMEs rated the extent to which each of the items measured the IAEA's attribute; the definitions of each attribute were provided to the SMEs in the rating exercise. More specifically, the SMEs were asked to "Please rate the extent to which each item measures the attribute", using a rating scale of 0 to 100 in 10-pt increments. Items were not retained if the average agreement that the item measured the attribute was less than 70 of 100. The SMEs were also provided the opportunity to suggest item wording changes or request additional items to measure the attributes. This process reduced the count from 300 items to 146 items.

Face Validity

Representatives were sampled from an agency-level community of practice on safety culture to assess the face validity of each question item. Notably, one of the aims of the community of practice is to develop methods to measure and monitor safety culture across FAA LOBs. The representatives evaluated the face validity of each item to ensure that they were worded appropriately and could be answered by individuals within their respective work units. More specifically, representatives were asked to "Please rate whether employees in your work group (i.e., routing code) can comprehend and answer each item", using a rating scale of 0 ('Not at all') to 10 ('Definitely'). Items were not retained if the average agreement that the item was understandable was less than 7 of 10. This process reduced the count from 146 items to 75 items.

Final Safety Culture Survey

The researchers scoped the survey instrument by retaining items that (a) were consistently the highest-rated across the aforementioned stages of survey development and (b) were necessary and sufficient to measure a given attribute according to SME standards. Minor wording changes

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[3] Content validity is the degree to which the question items measure the intended construct (in this case, safety culture). Face validity is the degree to which the items are perceived to measure the intended construct. Both are important to evaluate during survey development.

were made to items as needed to address feedback obtained throughout the development process and to enhance comprehension. The complete and final list of 75 safety culture question items administered in the survey can be found in Appendix A.

Phase 3: Survey Deployment to a Large FAA Line of Business

In order to fulfill the Congressional direction set forth in ACSAA and FAA's strategic plans, the survey was deployed to a large FAA LOB. This survey administration is in addition to the LOB's history of commitment to fostering a positive safety culture. As a demonstration of the LOB's commitment to safety culture, recent actions have included the implementation of a voluntary reporting program (2021), the completion of a baseline safety culture assessment (2022), and the completion of a targeted safety culture assessment (2023).

Survey Administration

Given the documented priorities described in Phase 1, it was determined that the survey administration should only adopt the elements of a pulse approach that allowed the quick gathering of employee perceptions while ensuring the comprehensive assessment of all ten traits of a positive safety culture. This was achieved by inviting the entire workforce to complete the survey over a period of one month. All question items were asked, but each respondent completed a random subset of items to reduce the time expenditure per person. It was estimated that respondents could complete this survey within ten minutes, achieving one of the stakeholders' goals. The resulting dataset contained responses for all survey question items, with each item representing the views of a fraction of respondents. Specifically, each member of the LOB's workforce received a survey that contained 32 question items:

- *Safety Culture Perceptions* consisted of two question items per safety culture trait. Agreement was rated using a 5-point Likert scale plus an "NA/Don't know" option.
- *Demographics* (3 items) included staff office, job role, and years of service. Response options were customized to the participating LOB.
- *Usability* (8 items) probed the appropriateness of survey content and length and whether the results could be used to affect meaningful change. Agreement was rated using a 5-point Likert scale plus an "NA/Don't know" option.
- *Comments* (1 item) in response to the prompt: "Please share any final thoughts about the safety culture in your work environment". This offered participants an opportunity to voice their opinions, raise concerns, and share general feedback in an open-ended text entry box.

Survey Logistics

The survey's question items were coordinated and approved by the LOB's leadership and collective bargaining units. Leadership promoted the survey through email messages encouraging voluntary participation by all members of the workforce (a) one week before the four-week survey administration period opened and (b) a final reminder the week the survey period closed. Weekly reminder emails ($n = 4$) were also sent by the survey distributor to invitees who had not yet completed the survey.

The survey was administered using the Qualtrics[4] FedRamp platform. Each Federal employee who had been employed by the LOB for one year or longer ($N = 7{,}734$) received a unique Qualtrics link to participate, and the survey was open for a total of four weeks (concluding in winter 2023). Technical support was provided via email and over the phone. No incentives were offered for participation.

Confidentiality Assurances

The survey was reviewed and approved by the FAA Civil Aerospace Medical Institute's (CAMI) Institutional Review Board under approval number 202335 and followed all pertinent ethical principles set forth in the Belmont Report.[5]

The invitation identified the survey's confidentiality assurances. Specifically, participants were informed that participation is voluntary; responses are confidential and are provided in aggregate form only; and that no one at the FAA has access to individual responses.

To protect the confidentiality of the participants, an anonymous online link was provided, and the survey itself did not collect any personally identifiable information. A third-party FAA research contractor collected survey responses for de-identification, analysis, and reporting. Responses were retrieved from Qualtrics and stored on a server maintained by the FAA but accessible only by a third-party contractor, Cherokee Federal. Only aggregated results with no personally identifiable information were provided by Cherokee Federal to the FAA. Only de-identified and aggregated data (i.e., where $n \geq 8$) were included in research reports, presentations/briefings, or released to the FAA.

An executive summary of the survey results was delivered to the FAA, with the option to request supplemental data analyses and/or briefings. This report was intended to empower management to evaluate the nature of their safety culture, identify areas in need of improvement, and assess changes arising from improvement efforts.

Survey Results

The survey was started by 2,983 respondents, although some only submitted partial responses. Responses were retained for analysis if the respondent (a) accepted the invitation to participate and (b) completed two question items for at least one safety culture trait. The final sample retained for analysis included 2,879 members of the workforce, representing a 37.2% response rate. The median time to complete the survey was 7.6 minutes.[6]

Sample Representativeness

To ensure the representativeness of the sample, the sample data were compared to the LOB's workforce plan, which provides population data by staff office. Representative participation is

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[4] http://www.qualtrics.com

[5] National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research (1979).

[6] Response times reported as total time to completion from the start of the survey to the end.

critical because research has shown that respondents from different workgroups may have different perceptions of safety culture.[7]

Some responses are omitted because (a) respondents chose not to self-identify or (b) a data collection error occurred,[8] whereby the staff office was not clearly identifiable. Results are solely based on self-reporting. To maintain confidentiality, responses were not verified against other sources, such as employment records.

A breakdown of response rates by staff office is provided in Table 1. This response rate pattern is as expected, given the relative distribution of employees across the staff office.

Table 1
Participation Response Rates by Staff Office

Staff Office	Proportion of Received Responses (%)	Proportion of Total LOB Workforce (%)
[A]	64.3%	68.1%
[B]	17.7%	20.0%
[C]	6.2%	5.5%
[D]	5.8%	1.0%
[E]	2.2%	1.2%
[F]	1.8%	1.7%
[G]	0.7%	0.6%
[H]	0.6%	1.2%
[I]	0.6%	0.7%

The distribution of job roles is also as expected. Most respondents reported that they filled non-Manager roles (n = 2,269); in comparison, 495 respondents reported filling Manager roles (n =282 Front-Line Manager, n = 161 Middle Manager, n = 52 Senior Manager). Some respondents (n = 115) declined to provide their staff office.

The survey respondents reported a range of years of service within their staff office, representing diverse viewpoints and experiences (Figure 1). Just over half of respondents (50.2%) reported having 10 or more years of service.

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[7] For reviews, see Zohar (2010, 2014), Zohar and Hofmann (2012), and Zohar and Luria (2003, 2005).

[8] One small staff office was unintentionally omitted from the list of options and was immediately added per respondent feedback the morning following the survey launch.

Figure 1
Respondent Years of Service
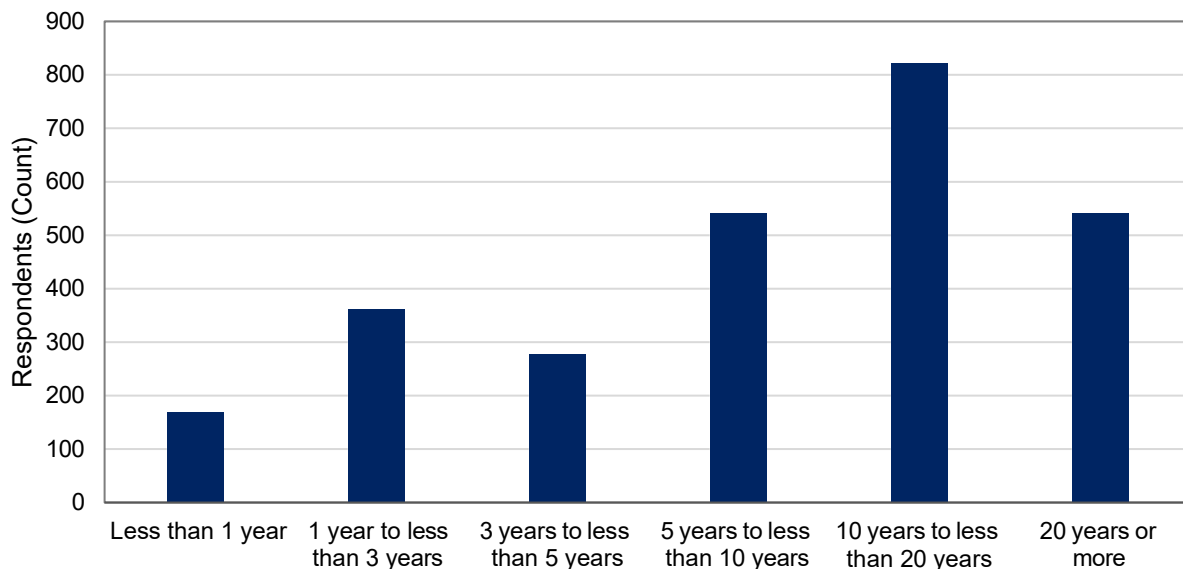
Survey Usability Ratings

Overall, respondents rated usability favorably, as shown in Table 2. Respondents agreed the time required to complete the survey is appropriate for the value of the data collected, the survey contains important items to assess an organization's safety culture, it is user-friendly, and the survey is recommended for future use.

Table 2
Survey Usability Items

Question Item	M	SD
The time required to complete this survey is appropriate for the value of the data collected.	4.12	0.79
The survey contains important items to assess an organization's safety culture.	3.68	1.11
The survey is user-friendly.	4.33	0.67
I would recommend this survey for future use.	3.71	1.16
The survey results will be used to identify areas in need of improvement.	3.22	1.46
Managers will make meaningful improvements based on the survey results.	2.67	1.61
I thought there was too much inconsistency in the survey.*	1.47	1.14
I found the survey unnecessarily complex.*	1.09	1.02

Note. Responses were provided on a 5-point Likert scale that increased from "strongly disagree" to "strongly agree" with an additional NA/Don't Know option. Items marked with an asterisk (*) are reverse-worded so that lower agreement ratings indicate more favorable perceptions of usability.

These results illustrate the effectiveness of incorporating elements of a pulse methodology on a population of this size — administering a random subset of items per respondent and then aggregating the results from all respondents. Notably, the results also highlight the need for improved awareness about how leadership will use the survey results to affect meaningful change.

Phase 4: Documenting Lessons Learned and Recommended Practices

As illustrated in Phase 3, the survey is a useful tool for capturing employee perceptions of safety culture traits within regulatory contexts, and the pulse methodology employed was successful in documenting the perceptions of the LOB's workforce. When administered judiciously, this survey can help form a foundational understanding of any aviation agency's safety culture and areas in need of transformation. In summary, "The process of designing, implementing, administering, and reporting back the data from an organizational survey is as important, if not more important, than the actual results that are generated" (p. 63, Burke et al., 1996). However, because judicious administration and action from surveys can be challenging, this section documents lessons learned during survey deployment and recommended practices for administering and acting on the survey results.

Survey Administration

Recommended practices for administering the survey include:

- ***Finalize survey content.*** It is recommended that the entire set of safety culture questions be administered in Year 1 in order to set a baseline for the safety culture. Supplemental topics can be added as appropriate (see Appendix B).

  Because small wording changes can have unpredictable effects on responses (see Converse and Presser, 1986), it is important that the question items be administered without wording changes. Differences in question item wording between organizations or between successive survey administrations may cause respondents to answer them differently, potentially resulting in misleading conclusions to be drawn.

- ***Conduct a beta-test.*** Prior to launching the survey, trial responses can be submitted by testers (e.g., 10% of the total respondents) to ensure the survey is functioning as intended and that the items are understandable to the respondents. Check that the downloaded data are provided in a format that can be used, that the data appear to be complete with respondents answering all questions, and that the survey takes the desired amount of time to complete.

- ***Choose between an anonymous and unique survey link.*** An anonymous link may produce higher response rates and encourage free sharing; on the other hand, this precludes the ability to send reminders while allowing for the potential of ballot-stuffing (i.e., the submission of multiple responses by a single respondent, usually in an effort to skew the results). A unique link per person allows follow-up reminders to be sent only to those who have not yet completed the survey; however, the final dataset will have identifiable information, which must be protected.

- ***Invite a representative sample of respondents.*** Diverse, representative participation is critical because research has shown that employees from different workgroups will likely have different perceptions of safety culture (for reviews, see Zohar, 2010, 2014; Zohar & Hofmann, 2012).

  Demographic differences may be observed, highlighting the importance of gathering a diverse, representative sample of respondents. Research has found differences in safety

culture across (a) national culture and job/professional culture (Zohar & Hoffman, 2012), (b) job roles, e.g., leaders have more positive perceptions than the workforce (Singer et al., 2003; Zohar, 2010), and (c) those of the same job role who work for different units or supervisors, potentially due to differences in leadership characteristics (Zohar, 2014; Zohar & Luria, 2003). In particular, research has shown that differences may exist between management/administrative and employee perceptions. Greater variation signals more divergence in perceptions, allowing more room to align future behaviors to reflect the desired culture (National Academies, 2016).

- **Protect respondent anonymity.** Caution is necessary to protect respondent anonymity. It is generally recognized that reporting results for work units with fewer than seven respondents can reveal individual identities (Macey, 1996). Written comments also require attention to maintain anonymity; consider only reporting if there are 20 to 50 comments. Even then, the comments must also be de-identified and cleaned (e.g., to remove names or other personally identifiable information, improper language, off-topic comments). For pulse survey methodologies, the smaller number of respondents may necessitate limiting reporting to higher levels in the organization's structure so that anonymity is maintained. Reporting larger work units can also reduce the risk of sampling error, as the sampling margin of error for pulse survey methodologies can be as high as ±15 percentage points (which is considered nonrepresentative; Colihan & Waclawski, 2006).

- **Utilize a communications campaign** to raise awareness about the assessment, build interest, and instruct respondents on how to participate. At a minimum, the invitation should explain the following: (a) the survey purpose and how the results will be used, (b) the voluntary nature of the survey, (c) protections for anonymity or confidentiality and desire for genuine feedback, (d) how long the survey will remain open for response, (e) the anticipated time it will take to complete the survey, and (f) a designated point of contact so respondents know who to reach out to for assistance.

- **Give employees time to participate.** Consider leaving the survey open for 2-4 weeks minimum, with an optional extension to achieve the desired response rate. Employees are more likely to complete a survey quickly if they are informed and encouraged in advance to participate. Setting aside time for completing the survey can also help achieve the desired response rate.

- **Send regular reminders.** After the survey 'goes live,' it can be helpful to send regular reminders about participating (e.g., weekly). Often, these reminders will produce a spike in responses.

Survey Follow-Up

A positive safety culture is not an end goal. Safety culture must be fostered, and members of leadership and the workforce alike must maintain vigilance to help identify where improvements can be made within the organization. Because of the fluid nature of safety culture, regular assessments are needed to help inform decision-making and improvement programs. The following future directions not only provide suggestions for examining the survey results but also emphasize that the survey results are but one source of information that the organization has

among many upon which to support and foster a positive safety culture. Recommended practices for survey follow-up include:

- **Perform demographic breakouts to support comparisons.** To increase the utility of survey response results, demographic breakouts can help leadership and other stakeholders identify cultural silos and differences in perceptions across LOBs. For instance, responses can be examined by making comparisons across staff offices, years of service, and job role (i.e., level of management). These comparison analyses can provide leadership and stakeholders with the ability to make targeted improvement efforts designed to address the sometimes-divergent perceptions of different groups within a single organization.

- **Analyze open-text feedback to raise contextual awareness.** Open-textbox comments can be analyzed to increase the utility of survey response results. For example, comments provided by respondents can be thematically organized to corroborate and emphasize the issues identified in the survey. The comments can provide important context and interpretive guidance to help make sense of the survey response results and inform discussions on the state of an organization's safety culture overall.

- **Bolster survey findings with other indicators.** These additional indicators can be used to verify and corroborate survey results, and they can help ensure that any safety culture improvements are well-targeted and based upon a thorough understanding of the safety culture strengths and opportunities (National Academies, 2016; Transportation Research Board, 2022). Additional data sources may include employee reports of safety concerns, audit findings (including missed audits or inadequate response to reported concerns), observations of normal operations (including tolerance for routine errors and failures in carrying out or complying with procedures and policies), and accident/incident/injury data (National Academies, 2016; Transportation Research Board, 2022). These metrics tend to be more objective than survey results and are an important component of a synergistic, comprehensive assessment of safety culture.

- **Share the results.** The more broadly the results are disseminated, the more useful the information is likely to become, and the more likely respondents will feel that taking the survey was worthwhile (Sorra et al., 2019; p. 26). Interpreting and acting on the results will require engagement from all stakeholders working together to identify what aspects of the workplace and safety culture need improvement.

- **Develop and implement an action plan.** Safety culture change is an iterative process of continuous improvement that requires awareness and dedication to safety goals (Ward et al., 2010). Real change requires the development and implementation of an action plan. The action plan should be evidence-based (based on the results), targeted and appropriately scoped, measurable, and co-developed by representatives from all stakeholder groups so there is mutual buy-in and support for the change efforts that will follow. The action plan should also be well-communicated; proactively communicating the action plan for change has multiple benefits, including improving employee engagement and buy-in and reducing resistance to change (Blackburn et al., 2011).

  An action plan should address those findings that are consistent across years, along with any new emerging opportunities. Remember, an action plan need not focus on only

one area at a time; in fact, some actions could improve multiple dimensions of safety culture simultaneously. For example, work to enhance communication could enhance (a) understanding of the reasons for decisions and (b) perceptions that final decision-makers prioritize safety over competing demands.

- ***Periodically re-assess safety culture.*** To track progress over time, it can be helpful to examine how the results compare across years, paying particular attention to the areas of overlap. After a pre-determined timeline of implementing the action plan, re-assess safety culture using the same methods used in the baseline. It would be beneficial to reassess safety culture annually or biennially because there is some evidence that culture change is slow and that actual improvements to safety culture may lag up to two years after the improvement action begins (Bergman et al., 2014; Neal & Griffin, 2006). Surveying more frequently may induce survey fatigue (i.e., reduce enthusiasm for participation) and increase the difficulties associated with communication and acting upon the results. However, for specific behavioral changes, reassessment could occur more frequently.

  Even if the reassessment shows no improvement (or even a decrease) in safety culture perceptions, never give up! Continue any in-progress efforts because the safety culture may actually decrease if the plan is stopped prematurely or not followed correctly. For example, employees may distrust leadership, provide insincere feedback, and have a lowered commitment to safety.[9]

  Finally, recognize that safety culture assessment isn't a "one-time thing"; it is a journey with no finish line. The results should be compared to a target/goal — which should be set by leadership and continually benchmarked against to track progress over time. A positive safety culture is something to continuously work toward. It takes time, effort, and commitment to growth.

Discussion

This survey leverages insights from both the scientific literature (200+ peer-reviewed sources; Key et al., 2023) and governance organization frameworks for culture management. The survey was closely adapted from a framework of safety culture dimensions, which has been successfully applied to the measurement of safety culture in the energy sector for over 20 years (*Harmonized Safety Culture Model*; IAEA, 2020).

As designed, the survey covers important aspects of any safety-critical workplace, including individual and leader commitment to safety, just and reporting culture, competing pressures, resource allocation, problem identification and resolution, workload and work planning, and others.

Unlike other assessments of organizational culture that only provide high-level aggregated feedback, this survey can be used to make comparisons across LOBs or staff offices, find culture silos, and identify areas of opportunity for safety culture improvement. This level of feedback ensures that the survey results are actionable and can be used to affect targeted and

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[9] As discussed by Taylor and Patankar (2001).

meaningful change. It has successfully undergone initial tests in the regulatory aviation environment and is ready for large-scale application.

To achieve the brief 'pulse' of safety culture requested by stakeholders, the survey was presented with only two randomly selected questions for each of the ten traits per respondent (plus usability and basic demographic items). It is noteworthy that the methodology deployed here deviates from what is typically considered to be a pulse survey. Generally speaking, pulse surveys are targeted, short (e.g., 20 items or less), and brief (e.g., require less than 10 minutes to complete). To achieve this, the typical pulse survey is limited in content (e.g., focused on 1-2 topic areas) and/or sampling (i.e., only administered to targeted samples, such as only managers or only new hires), thereby reducing the effort needed by each member of the workforce to complete. However, just as taking a pulse does not give a full picture of human health, a pulse survey may not give a full picture of the topic(s) or populations of interest (Colihan & Waclawski, 2006).

The methodology deployed here avoids the limitations of the typical pulse survey by providing a comprehensive assessment of all positive safety culture traits across a representative sample of the workforce, albeit with the tradeoff of not capturing all respondents' views of all survey items. Though this methodology choice limits the ability to conduct statistical validation of the survey (as described below), the dataset collected still provides a valuable, comprehensive snapshot of safety culture perceptions in the LOB to inform leadership action planning.

Limitations and Future Directions

This effort represents the first administration of a novel survey. During its administration, the researchers noted areas where future assessments can be improved. For example, an improved response rate could bolster confidence in the findings for assessments conducted in future years. In the current effort, 37% of those invited responded. This response rate is comparable to ~40% of the U.S. Office of Personnel Management (OPM) workforce who responded to the Federal Employee Viewpoint Survey (FEVS) in recent years (U.S. Department of Transportation, 2024). However, other Federal agencies conducting safety culture surveys have achieved higher response rates (e.g., the Department of Energy, which has achieved higher response rates at times near the IAEA's target of 70%; see Carnes & Rich, 2020), providing a target to strive toward.

Achieving a sufficient response rate can be complicated by the organizational size and structure. In smaller organizations, pulse methodology may exacerbate challenges with survey margins of error and protection of anonymity, so caution is warranted (Colihan & Waclawski, 2006). Notably, staff office sizes vary greatly across the FAA, and the perceptions of particularly small workgroups may not be well represented in the survey results. Future efforts should strive to better represent the views of the entire workforce.

It is important to remember that employee surveys, no matter how high the response rate, are comprised of voluntary responses and, therefore, may not represent the views of the entire workforce. To more fully represent the safety culture, survey results should be verified with other indicators. Recall that the IAEA model represents a framework of safety culture traits but is agnostic about which assessment method(s) are most appropriate to fully capture organizational safety culture against each attribute. During data analysis, the researchers developed the

hypothesis that some of the safety culture attributes may be more difficult than others for members of the workforce to answer via survey questions. Evidence of this can be found in the survey findings. Certain safety culture attributes (i.e., those measuring organizational processes for safety management such as Problem Identification and Resolution) received upwards of 20% neutral responses and/or greater than 10% NA/Don't Know responses. This response pattern could be interpreted to mean that (a) the items did not apply to respondents and/or (b) that respondents were reluctant to answer truthfully. These neutral and NA/Don't Know responses merit deeper exploration, potentially through other assessment methods such as one-on-one interviews, listening sessions/focus groups, or safety stand-downs to better understand the pattern of responses. This finding could indicate that some attributes might be better addressed through other forms of assessment. Alternatively, this finding could indicate that revisions are needed to the survey items for these traits/attributes to better capture perceptions of these areas. This could be investigated via factor analysis or other statistical methods of identifying redundant or uninformative items.

A remaining question is whether the survey is sensitive to contextual factors, such as changes in leadership, technology, and current events, that may influence perceptions in time. For context, the LOB was experiencing reorganization and leadership changes during the survey administration, including effects resulting from Congressional budgetary actions — which may have affected the workforce's perceptions. Further efforts are needed to better identify and understand these contextual factors and ensure that the survey is sufficiently sensitive yet generalizable across aviation contexts.

Finally, statistical analyses validating the survey could not be conducted due to the methodology that the LOB leadership and stakeholders agreed to deploy. Although adopting elements of a pulse survey reduced the time commitment needed from each respondent, this resulted in an incomplete set of results because not all question items were answered by all respondents. This limits the statistical options for confirming factor structure, identifying relationships across traits/attributes, and removing uninformative items. It is strongly recommended that the next administration of the survey asks each respondent to answer the full complement of safety culture question items so that statistical validation of the survey can be performed. Such a validation effort would bolster confidence that the traits of a positive safety culture are assessed comprehensively, thereby providing decision-makers with sufficient information from which to build action plans.

Conclusions

In developing this survey assessment, the FAA recognized the need to balance the goals of scientific robustness with the need for it to be generalizable for use across the FAA. This was achieved by taking a collaborative approach to the project, where researchers and the FAA-level safety culture community of practice worked together to develop the survey. To test its efficacy, the survey was deployed within one large FAA LOB. The results illustrate the value of stakeholder engagement when developing assessment tools, as the resulting product has several advantages:

- Provides an a priori (planned) measurement of a safety culture framework.
- Provides a targeted look at strengths and opportunities.

- Allows for comparisons to be made across work units, detecting cultural silos and local processes and perceptions.
- Detects trends and deeper characterization of safety culture not as evident in more organizationally oriented survey assessments of culture norms.

The value of the survey is that it provides a comprehensive assessment of safety culture perceptions in regulatory organizations; however, its utility is only fully realized when used judiciously and when the results are acted upon as part of a larger strategy for managing safety culture change. In their seminal textbook chapter on the role of surveys in transforming culture, Wagner and Spencer (1996) stated, "surveys should be only one part of a total toolkit of interventions. The use of that toolkit should be driven by a well-articulated business rationale for changing the organization's culture and guided by an integrated change agenda that is based on a systemic view of organizations" (p. 67). These authors underscore that surveys are not a one-stop-shop for culture change but instead serve as a tool for assessing where transformation is needed and monitoring the effectiveness of any resulting change efforts.

Continued use of this survey would empower the monitoring of cultural strengths and opportunities and allow for tracking the effectiveness of improvement efforts across time. It is helpful to remember that the survey was designed to assess the state of safety culture in the fulfillment of Congressional direction (ACSAA §132(c) as part of the Consolidated Appropriations Act of 2021, 2020) and the FAA's strategic plans (FAA, 2022). Continued assessment is needed, as changes in management, work group, and technology are likely to influence safety culture perceptions moving forward. Like any aspect of organizational culture, safety culture is fluid, and the actions to improve it will require commitment from the FAA's stakeholders and workforce that extends beyond the reach of any legislation.

It is important to note that the need for a positive safety culture is not unique to aviation; the ten traits measured in this survey were originally developed for the energy sector, with items, in turn, sourced from safety-critical industries like healthcare and construction. It is reasonable to hypothesize that the survey would be applicable to those industries with minor revisions. We look forward to shaping collective, interdependent thinking about the strategic priorities and behaviors to support high-performing regulatory organizations within and beyond aviation.

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Appendix A. Safety Culture Survey

The survey measures the ten traits set forth in the *Harmonized Safety Culture Model* developed by the International Atomic Energy Agency (IAEA, 2020). The model represents an evolution of assessments dating to 1992 when the International Nuclear Safety Advisory Group (INSAG) identified human factors as having contributed to the 1986 Chernobyl nuclear disaster, and noted, among other findings, *a general lack of safety culture* (1992).

The *Harmonized Safety Culture Model* consists of ten traits, including Individual Responsibility, Questioning Attitude, Communication, Leader Responsibility, Decision-Making, Respectful Work Environment, Continuous Learning, Problem Identification and Resolution, Environment for Raising Concerns, and Work Planning.

These ten traits are further characterized and organized by the IAEA into *attributes* of a positive safety culture. Supplemental modules to assess other topics relevant to safety culture beyond the ten traits are provided in Appendix B.

Although the survey can be administered in full, the survey was administered to the workforce by presenting a random subset of items (i.e., two items per safety culture trait) to each respondent. Because this "pulse" form of the survey presented each respondent with fewer question items, less time was needed for completion.

Because small wording changes can have important effects (see Converse & Presser, 1986), the evidence presented in this report cannot be used to make claims about the effectiveness of modified question items. Instead, the authors recommend administering question items as provided and without modification.

Survey Introduction Page

Respondents were provided with an introduction to the survey's purpose, confidentiality assurances, voluntary nature (i.e., of the data collection in general), provisions of duty time or other incentives to complete the survey, and contact information for support or questions. Language for the survey included:

> The purpose of this survey is for [Organization] to engage its workforce in assessing factors that contribute to a positive safety culture. Your participation will allow us to identify concerns and highlight areas of opportunity where we can best focus our safety culture efforts.
>
> The Civil Aerospace Medical Institute (CAMI) Aerospace Human Factors Research Division (AAM-500) is administering this survey on behalf of [Organization] with the assistance of a third-party contractor, Cherokee Nation 3S. **To ensure confidentiality of all responses, results will be provided to** [Organization] **in aggregate form only.** No one at the FAA will have access to your individual responses.
>
> Participation in the survey is completely voluntary and may be completed during duty time. If you choose to participate, please ensure you have at least 10 minutes to complete this survey. Voluntary participants shall be afforded sufficient duty time to complete the survey.
>
> If you agree to participate in this survey, please click Next to begin.

It is also generally recommended that key terms or organizations should also be defined. Language for the survey included:

Please use these definitions when completing the survey:

- [Organization]. Organization administering the survey.
- **Leaders**. Includes supervisors and managers, up to and including Senior Managers who manage a staff office.
- **Individuals**. Includes all individuals with whom you work closely.

Question Items

It is generally recommended that respondents are instructed to base their responses on their own experiences in the work environment. The responses may be provided on an agreement scale anchored with the labels "Strongly disagree", "Disagree," "Slightly disagree", "Slightly agree," "Agree," "Strongly agree," and "NA/Don't know." Higher scores reflect more positive perceptions. Note, all "NA/Don't know" responses should be excluded for score averaging.

Communication

"Communications support a focus on safety" (IAEA, 2020).

Question Item	IAEA Attribute	Source
Information is effectively communicated across teams.	Free flow of information	IAEA (2017).
An effective communication flow exists up, down, and across the chain of command (or equivalent).	Free flow of information	M-SCAIT (Key et al., 2023).
[Organization] communicates transparently with oversight, audit, regulatory organizations, and the public.	Transparency	Drafted per IAEA (2020).
The overriding priority of safety is communicated clearly by leaders.	Expectations	IAEA (2017).
Leaders adequately communicate the reasons for decisions.	Reasons for Decisions	NRC (International Survey Research, 2006).
When decisions are made that are contrary to professional recommendations, leaders communicate effectively why the decision was made.	Reasons for Decisions	NRC (Willis Towers Watson, 2020).
The information individuals need to do the job is readily available.	Workplace Communication	NRC (Willis Towers Watson, 2016).

Individual Responsibility

"All individuals are personally accountable for safety" (IAEA, 2020).

Question Item	IAEA Attribute	Source
Individuals adhere to established standards.	Adherence	Drafted per IAEA (2020).
Safety is a responsibility shared throughout [Organization]'s structure.	Ownership	EUROCONTROL (Mearns et al., 2013).
Commitment to safety is evident in the behaviors and work practices of individuals.	Ownership	Drafted per IAEA (2020).
Individuals work together effectively within and across work units to achieve goals.	Collaboration	IAEA (2017).

Questioning Attitude

"Individuals remain vigilant for assumptions, anomalies, conditions, behaviors or activities that can adversely impact safety and then appropriately voice those concerns" (IAEA, 2020).

Question Item	IAEA Attribute	Source
Individuals understand the unique risks associated with aviation, including advanced technology.	Recognize Unique Risks	Drafted per IAEA (2020).
Individuals strive to avoid complacency.	Avoid Complacency	Drafted per IAEA (2020).
Individuals feel free to stop work when uncertain.	Question Uncertainty	IAEA (2017).
Individuals feel free to ask questions about any issue.	Recognize and Question Assumptions	IAEA (2017).
It is acceptable to challenge the way things are done.	Recognize and Question Assumptions	M-SCAIT (Key et al., 2023).

Leader Responsibility

"Leaders demonstrate a commitment to safety in their decisions and behaviors. Leaders are role models for safety" (IAEA, 2020).

Question Item	IAEA Attribute	Source
Leaders' strategic plans reflect safety as the overriding priority.	Strategic Alignment	IAEA (2017).
Leaders place safety before production.	Strategic Alignment	NOSACQ-50 (Kines et al., 2011).
Leaders regularly demonstrate their commitment to safety.	Leader Behavior	SHo-Me (CAA, 2003).
Leaders demonstrate they value safety by "walking the talk".	Leader Behavior	NASA (2015).[10]
Leaders encourage employees to participate in resolving issues which affect safety.	Employee Engagement	Drafted per IAEA (2020).
Individuals are involved in contributing to the design, implementation, and measurement of safety related changes.	Employee Engagement	EUROCONTROL (Gordon & Kirwan, 2004).
Individuals have sufficient resources (e.g., people, materials, budget) to get the job done safely.	Resources	NASA (2015).
Leaders are visibly present in work environments (including virtual environments) and maintain awareness of work progress.	Field Presence	IAEA (2017).
Individuals are recognized for safety conscious behaviors.	Rewards and Sanctions	IAEA (2017).
Individuals are held to the same standards of ethical behavior.	Rewards and Sanctions	NRC (Willis Towers Watson, 2016).
Changes to the organization, systems, and procedures are properly assessed for safety risk.	Change Management	Drafted per IAEA (2020).
Roles and responsibilities are clearly defined by leaders.	Authorities, Roles, and Responsibilities	IAEA (2017).

[10] National Aeronautics and Space Administration.

Decision-Making

"Decisions are systematic, rigorous, thorough, and prudent" (IAEA, 2020).

Question Item	IAEA Attribute	Source
Individuals' decisions reflect safety as the overriding priority.	Systematic Approach	IAEA (2017).
Final decision makers prioritize safety over competing demands (e.g., politics, industry pressure).	Systematic Approach	Cooke et al. (Unpublished Manuscript).
Individuals take a conservative approach to decision-making, where safety is prioritized over competing demands.	Conservative Approach	Drafted per IAEA (2020).
Authority and responsibility for decisions is specific and well defined.	Clear Responsibility	Drafted per IAEA (2020).
Individuals understand the decision making responsibility of their job roles.	Clear Responsibility	Drafted per SME recommendation.
[Organization]'s risk based decision-making process allows individuals to be flexible under unforeseen situations.	Resilience	Drafted per SME recommendation.

Respectful Work Environment

"Trust and respect permeate the organization" (IAEA, 2020).

Question Item	IAEA Attribute	Source
Individuals are treated with respect in [Organization], regardless of their job.	Respect is Evident	NRC (Willis Towers Watson, 2016).
[Organization] would support individuals if they had a safety concern.	Opinions are Valued	EUROCONTROL (Mearns et al., 2013).
Individuals are encouraged to ask questions, voice concerns, and provide suggestions.	Opinions are Valued	Drafted per IAEA (2020).
Differing opinions are solicited and respected.	Opinions are Valued	Drafted per IAEA (2020).
In my work unit, individuals are encouraged to report safety concerns to the safety reporting program.	Opinions are Valued	Drafted per Cooke et al. (Unpublished Manuscript).
There is a high level of trust among work units.	Trust is Cultivated	IAEA (2017).
Openness and honesty are fostered throughout [Organization].	Trust is Cultivated	Drafted per IAEA (2020).
Conflicts are resolved in a timely manner.	Conflicts are Resolved	Drafted per IAEA (2020).
Our work facilities are conducive to the safe performance of our duties.	Facilities Reflect Respect	Drafted per M-SCAIT (Key et al., 2023).

Continuous Learning

"Learning is highly valued" (IAEA, 2020).

Question Item	IAEA Attribute	Source
Safety-related events or discussions are viewed as an opportunity to learn and make improvements.	Constant Examination	Cooke et al. (Unpublished Manuscript).
There is a genuine focus on continuous improvement.	Constant Examination	M-SCAIT (Key et al., 2023).
[Organization] uses information from past experiences to improve safety.	Learning from Experience	NASA (2015).
[Organization] openly shares lessons learned.	Learning from Experience	IAEA (2017).
The results of this survey will be used to make [Organization] a better place to work.	Learning from Experience	FEVS (Office of Personnel Management, n.d.).
[Organization] provides effective training.	Training	Drafted per SME recommendation.
Safety decision makers maintain the knowledge, skills, qualifications, and recency of experience necessary to make appropriate safety-related decisions.	Training	Drafted per Cooke et al. (Unpublished Manuscript).
[Organization] encourages knowledge transfer across employees (e.g., through mentorship, on the job training).	Training	Drafted per SME recommendation.
[Organization] ensures that leadership skills are developed systematically.	Leadership Development	IAEA (2017).
[Organization] adopts safety practices that have been used effectively in other industries.	Benchmarking	Drafted per SME recommendation.

Problem Identification and Resolution

"Issues potentially impacting safety are systematically identified, fully evaluated, and promptly resolved according to their significance" (IAEA, 2020).

Question Item	IAEA Attribute	Source
[Organization] places a high value on self-reporting of safety issues.	Identification	Drafted per SME recommendation.
Reported safety issues are investigated thoroughly.	Evaluation	NRC (Willis Towers Watson, 2016).
Safety issues are investigated in a timely manner.	Evaluation	Drafted per SME recommendation.
Existing safety reporting programs and systems adequately capture safety concerns.	Evaluation	MITRE (Unpublished Manuscript).
Safety issues are investigated to find underlying causes, rather than to place blame.	Evaluation	Drafted per SME recommendation.
Reported safety issues are resolved appropriately.	Resolution	NRC (Willis Towers Watson, 2016).
The effectiveness of corrective actions is assessed.	Resolution	IAEA (2017).
Appropriate action is taken when safety concerns are reported.	Resolution	Drafted per MITRE (Unpublished Manuscript).
Lessons learned are shared with individuals.	Resolution	Drafted per SME recommendation.
[Organization] analyzes safety issues to identify possible patterns, trends, and causal factors.	Trending	Drafted per IAEA (2020).

Environment for Raising Concerns

"Personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination" (IAEA, 2020).

Question Item	IAEA Attribute	Source
Individuals can report safety issues without fear of negative consequences.	Supportive Policies are Implemented	Drafted per M-SCAIT (Key et al., 2023).
In my work unit, employees do not face negative consequences for reporting safety concerns/incidents.	Supportive Policies are Implemented	Drafted per MITRE (Unpublished Manuscript).
In my work unit, employees who report safety concerns to the safety reporting program are treated in a just and fair manner.	Supportive Policies are Implemented	Cooke et al. (Unpublished Manuscript).
I am aware of existing safety reporting programs and systems and when to use them.	Confidentiality is Possible	MITRE (Unpublished Manuscript).
I feel comfortable reporting a safety concern/incident to the safety reporting program.	Confidentiality is Possible	Cooke et al. (Unpublished Manuscript).
I feel comfortable reporting a safety concern/incident to my manager.	Confidentiality is Possible	Cooke et al. (Unpublished Manuscript).
Individuals receive timely feedback on how their safety concerns are being addressed.	Confidentiality is Possible	Drafted per SME recommendation.

Work Planning

"The process of planning and controlling work activities is implemented so that safety is maintained" (IAEA, 2020).

Question Item	IAEA Attribute	Source
There is a systematic approach for managing work activities such that safety is emphasized.	Work Management	Drafted per IAEA (2020).
Work is planned and conducted such that safety margins are preserved.	Safety Margins	Drafted per IAEA (2020).
It is easy to identify where documentation (e.g., policies, procedures) has been revised.	Documentation and Procedures	SHo-Me (CAA, 2003).
Documentation (e.g., policies, procedures) reflects safety as the overriding priority.	Documentation and Procedures	IAEA (2017).
Deadlines appropriately match the level of effort required to complete tasks.	Work Management	Cooke et al. (Unpublished Manuscript).

Open-ended Feedback

Open-ended text entry fields can be included at the end of the survey, offering respondents an opportunity to voice their opinions, raise concerns, and share general feedback.

Question Item	Source
Please share any final thoughts about the safety culture in your work environment.	Drafted per SME recommendation.

Demographics

Includes items such as service office, job role, and years of service within the organization. Response options should be tailored to the participating organization.

Question Item	Source
In which Service or Office do you work?[11]	MITRE (Unpublished Manuscript).
What is your level?[12]	MITRE (Unpublished Manuscript).
How long have you worked for [Organization]?	MITRE (Unpublished Manuscript).

Survey Usability

Includes perceptions of the survey's content, length, and potential for the results to affect meaningful change.

Question Item	Source
The time required to complete this survey is appropriate for the value of the data collected.	M-SCAIT (Key et al., 2023).
The survey contains important items to assess an organization's safety culture.	M-SCAIT (Key et al., 2023).
The survey is user-friendly.	M-SCAIT (Key et al., 2023).
I would recommend this survey for future use.	Drafted per M-SCAIT (Key et al., 2023).
The survey results will be used to identify areas in need of improvement.	Drafted per M-SCAIT (Key et al., 2023).
Managers will make meaningful improvements based on the survey results.	M-SCAIT (Key et al., 2023).
I thought there was too much inconsistency in the survey.*	M-SCAIT (Key et al., 2023).
I found the survey unnecessarily complex.*	M-SCAIT (Key et al., 2023).

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[11] Sample response options include all Service or Organizations within the participating organization, including FAA routing codes as appropriate.

[12] Sample response options include "Non-Manager," "Front-Line Manager," "Middle Manager," and "Senior Manager."

Appendix B. Supplemental Modules

The supplemental modules provided have been scientifically researched, and each has been shown to have a relationship with safety culture. Supplemental modules probe specific topics important to each unit of the organization. Research shows the inclusion of such topics provides richer diagnostic information about specific concerns of interest and can augment the utility of the survey assessment results (Jiang et al., 2019; Zohar, 2014). However, care must be taken when choosing these items, as not all topics apply to all work units. It may be beneficial to work together with stakeholders who can assist with identifying important topics and selecting appropriate supplemental modules.

Supplemental Module Question Items

It is generally recommended that respondents are instructed to base their responses on their own experiences in the work environment. The responses may be provided on an agreement scale anchored with the labels "Strongly disagree", "Disagree," "Slightly disagree", "Slightly agree," "Agree," "Strongly agree," and "NA/Don't know." Higher scores reflect more positive perceptions. Note, all "NA/Don't know" responses should be excluded for score averaging.

Engagement

The level of enthusiasm and dedication an employee feels toward their job. This outcome has one of the strongest relationships to a positive safety culture (Nahrgang et al., 2011) and has specifically been linked to organizational culture within the context of governance organizations (Arleth, 2019).

Question Item	Source
I would recommend [Organization] as a good place to work.	NRC (International Survey Research, 2006).
I am proud to be associated with [Organization].	NRC (International Survey Research, 2006).
My work gives me a sense of personal accomplishment.	NRC (Willis Towers Watson, 2016).
The work I do is meaningful to me.	NIOSH WellBQ (Chari et al., 2021).[13]

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[13] Worker Well-Being Questionnaire.

Job Satisfaction

The level of job satisfaction, along with employee intent to leave their current organization.

Question Item	Source
I find my job rewarding.	M-SCAIT (Key et al., 2023).
The morale in my work unit is high.	M-SCAIT (Key et al., 2023).
I often think about quitting my job.*	M-SCAIT (Key et al., 2023).

Pressure and Workload

"The extent to which the workload overwhelms one's ability to perform safely" (Christian et al., 2009). Scheduling and time pressure, pressure to take shortcuts, and role overload (potentially due to inadequate staffing) contribute to increased work pressure, which, in turn, contributes to employee strain, burnout, and, ultimately, safety-related outcomes (Christian et al., 2009; Nahrgang et al., 2011).

Question Item	Source
There is pressure to quickly complete assigned tasks at the cost of safety.*	M-SCAIT (Key et al., 2023).
There is sufficient staffing to achieve allocated tasks on time.	M-SCAIT (Key et al., 2023).

Performance

Unit-level performance on the job. A positive safety culture has been linked to improved safety performance across safety-critical industries and within aviation (Christian et al., 2009; Sexton & Klinect, 2001).

Question Item	Source
My work unit works efficiently.	M-SCAIT (Key et al., 2023).
My work unit consistently meets its objectives.	M-SCAIT (Key et al., 2023).

Well-Being

Employees' recent well-being mentally, physically, and overall. The job demands and resources that underlie safety culture can directly affect well-being, making it an important contributor to measure (Nahrgang et al., 2011).

Question Item	Source
The nature of the work environment negatively impacts my mental well-being (e.g., stress, depression, anxiety, and problems with emotions).*	NIOSH WellBQ (Chari et al., 2021).
The nature of the work environment negatively impacts my physical well-being (e.g., physical illness and injury).*	NIOSH WellBQ (Chari et al., 2021).
I feel stressed at work.*	M-SCAIT (Key et al., 2023).

Underperformance

The extent to which underperformance is dealt with effectively. Failure to correct underperformance can lead to co-working employee strain and burnout, ultimately impacting safety-related outcomes (Nahrgang et al., 2011).

Question Item	Source
Underperformance is dealt with effectively.	M-SCAIT (Key et al., 2023).
Inexperienced staff are promoted/appointed too quickly into leadership roles.*	M-SCAIT (Key et al., 2023).

Personal Growth

Opportunities for development and growth in the organization. When employees perceive there is room for growth, they are more engaged and participative in safety (Crawford et al., 2010).

Question Item	Source
[Organization] is doing a good job of retaining its most talented people.	NRC (International Survey Research, 2006).
[Organization] is doing a good job of developing its people to their full potential.	NRC (Towers Perrin ISR, 2009).

Autonomy

The degree to which employees believe they have the freedom to make their own work-related decisions and are trusted to do their job. Autonomy is a job resource that improves employee engagement and safety-related outcomes (Nahrgang et al., 2011).

Question Item	Source
Individuals are micromanaged.*	M-SCAIT (Key et al., 2023).