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Safety Culture Assessment by FAA Aviation Safety Inspectors

Kylie K. Worthington[1]
Robert Gay[2]
Peter T. Hu[3]
Inchul Choi[3]
David J. Schroeder[3]

[1] Flight Deck Human Factors Research Laboratory, AAM-510
Civil Aerospace Medical Institute
Federal Aviation Administration
Oklahoma City, OK 73125

[2] Flight Standards, Office of Safety Standards
SMS Program Office, AFS-910

[3] Cherokee Nation 3S
Oklahoma City, OK 73125

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16. Abstract

The recent Department of Transportation (DOT) Office of Inspector General (OIG) report identified concerns regarding the Federal Aviation Administration's (FAA) safety oversight of an air carrier, including a lack of guidance for how inspectors should evaluate and oversee safety culture (OIG, 2020). To help address these concerns, FAA conducted a three-phase program of research designed to support assessment of safety culture by the FAA's Aviation Safety Inspector (ASI) workforce. In Phase 1, researchers reviewed current practices, identified opportunities for improving safety culture oversight, and provided recommendations for safety culture assessment. In Phase 2, researchers developed and tested a new safety culture assessment approach that is poised for future integration into the Safety Assurance System (SAS). Notably, Response Details for all seven Safety Attributes in SAS were revised and expanded to help better-document potential safety culture concerns that may arise during ASI surveillance. In Phase 3, researchers aligned the Proposed Response Details to help ensure that certificate holders (CHs) would be assessed against the same standard used in its other safety culture efforts. In particular, the Proposed Response Details were mapped to the International Atomic Energy Agency's (IAEA) Harmonized Safety Culture Model (IAEA, 2020).

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Keywords: safety culture, culture assessment, Data Collection Tool, Response Details, Aviation Safety Inspector, Safety Assurance System

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List of Abbreviations

Abbreviation	Definition
AAA	Analysis, Assessment, and Action
ASAP	Aviation Safety Action Plan
ASI	Aviation Safety Inspector
C-DCT	Customized DCT
CASS	Continuing Analysis and Surveillance System
CEPO	Certificating and Evaluation Program Office
CH	Certificate Holder
CHAT	Certificate Holder Assessment Tool
CMO	Certificate Management Office
COS	Continued Operational Safety
CPM	Certification Project Manager
DCT	Data Collection Tool
DOT	Department of Transportation
ED DCT	Element Design DCT
EP DCT	Element Performance DCT
FAA	Federal Aviation Administration
FSDO	Flight Standards District Office
GA	General Aviation
IAEA	International Atomic Energy Agency
ICAO	International Civil Aviation Organization
IFO	International Field Office
National Academies	National Academies of Science, Engineering, and Medicine
OIG	Office of Inspector General
PI	Principal Inspector
RBDM	Risk-Based Decision Making
RPAT	Risk Profile Assessment Tool
SAS	Safety Assurance System
SME	Subject Matter Expert
SMICG	Safety Management International Collaboration Group

SMS	Safety Management System
SP	Safety Performance [DCT]
VDRP	Voluntary Disclosure Reporting Program

Executive Summary

Background and Purpose

The recent Department of Transportation (DOT) Office of Inspector General (OIG) report identified concerns regarding the Federal Aviation Administration's (FAA) safety oversight of an air carrier, including a lack of guidance for how inspectors should evaluate and oversee safety culture (OIG, 2020).

To help address these concerns, FAA conducted a three-phase program of research designed to support assessment of safety culture by the FAA's Aviation Safety Inspector (ASI) workforce. In Phase 1, researchers reviewed current practices, identified opportunities for improving safety culture oversight, and provided recommendations for safety culture assessment. In Phase 2, researchers developed and tested a new safety culture assessment approach that is poised for future integration into the Safety Assurance System (SAS). Notably, Response Details for all seven Safety Attributes in SAS were revised and expanded to help better-document potential safety culture concerns that may arise during ASI surveillance. In Phase 3, researchers aligned the Proposed Response Details to help ensure that certificate holders (CHs) would be assessed against the same standard used in its other safety culture efforts. In particular, the Proposed Response Details were mapped to the International Atomic Energy Agency's (IAEA) *Harmonized Safety Culture Model* (IAEA, 2020).

Key Findings: Phase One

Brainstorming sessions with subject matter experts (SMEs) and stakeholders documented potential assessment avenues along with leadership priorities for successful safety culture assessment. The ensuing program of research centered on integrating safety culture into SAS Data Collection Tools (DCTs) and Response Details because it was deemed the most reasonable alternative to meet leadership priorities and ensure that safety culture becomes part of routine surveillance. An examination of existing SAS data (2018-2020) suggests that the Safety Attributes are a viable way of assessing safety culture. However, additional and/or revised Response Details are needed to fully capture safety culture concerns.

Key Findings: Phase Two

Before seeing the Proposed Response Details, many participants reported concerns about the CHs' culture (i.e., 7.1 on a 10-point scale; 44.3% of CHs on average). Many of the participants indicated it is important to assess safety culture (i.e., 9.0 on a 10-point scale).

The Proposed Response Details provided the opportunity for participants to select a higher number of Response Details, particularly when the scenario had a high safety culture concern (see Appendix E).

The participants rated usability favorably. Most rated the revisions as "somewhat better" or "much better" for all 7 Safety Attributes. Participants reported that the Proposed Response Details provided a simplified, plain-language way to record unfavorable responses and improve ASI understanding of not only the safety culture, but also of the Safety Management System (SMS) and the Safety Attributes.

Key Findings: Phase Three

The Proposed Response Details provide adequate coverage of the IAEA traits (i.e., 38 of 43), meaning that there is alignment in how safety culture assessment is conducted within the FAA and for CHs. These Proposed Response Details are ready for integration into SAS for operational use by ASIs (see Appendix F).

Recommendations and Future Directions

The Proposed Response Details represent only one improvement that the FAA can make to help monitor safety culture concerns. Future work is needed to improve ASI education on safety culture, guidance to score safety culture concerns, and support eventual integration into SAS. Future work should address these considerations in a programmatic way, with the aim of improving safety culture assessment by the ASI workforce. Next steps may include:

- Develop and formalize ASI training course for safety culture assessment.
- Conduct periodic assessments to evaluate effectiveness.
- Improve the ability for ASIs to factor safety culture into oversight decisions.
- Consider alternative ways to integrate safety culture more fully into SAS.

The Proposed Response Details provide guidance and direction to support data collection on some (but perhaps not all) critical elements of a CHs safety culture. They are intended to integrate within the oversight philosophy, methods/tools, and resources currently employed by the FAA, and ultimately empower the workforce to conduct safety culture assessment as part of routine surveillance and oversight. This research project demonstrates the value of cross-office collaboration and partnership. The deliverables include not only an assessment of safety culture for ASIs to use when surveilling CHs, but also a roadmap to guide end-user testing for future SAS changes. The integration of these findings will enhance the ability of the ASI workforce to assess CHs' safety culture and related concerns.

Background and 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 Federal Aviation Administration (FAA) defines safety culture as the shared values, actions, and behaviors that demonstrate a commitment to safety over competing goals and demands. Safety culture is an intangible but critical concept underlying safety management (Akselsson et al., 2009; Office of Inspector General [OIG], 2020; Piers et al., 2009). Researchers have documented that a positive safety culture not only helps the Safety Management System (SMS) work more effectively (French & Steel, 2017; Piers et al., 2009), but also provides the basis for continuously improving the SMS itself (Akselsson et al., 2009).

Despite the recognition that safety culture is critical for effective safety management, there is a paucity of operational guidance about how the FAA's Aviation Safety Inspector (ASI) workforce should assess and record safety culture. In a recent report, the Department of Transportation (DOT) OIG (2020) identified concerns regarding the FAA's safety oversight of an air carrier. The report found that "FAA has not provided inspectors with guidance on how to review risk assessments or how to evaluate and oversee safety culture." (p. 5).

OIG (2020) further reported that 61% of interviewed FAA oversight staff ($n = 28$; $N = 46$), including senior level managers, raised concerns about the carrier's safety culture, with comments like, "The safety culture…consists of using 'diversion, distraction, and power' to get what the company wants" and "It's not a positive culture…. Arrogance gets the best of them." FAA management stated they could not consider safety culture-related concerns in the approval process because the carrier *otherwise met the technical requirements.* Thus, the OIG report illustrates that the lack of a standardized process for incorporating safety culture into oversight and risk mitigation, has resulted in inadequate risk management by the FAA. To address these deficiencies, OIG made 11 recommendations, the last being, "develop and implement inspector guidance on how to evaluate air carrier safety culture and how it should be factored into oversight decisions" (OIG, 2020, p. 19).

To fulfill the OIG's recommendations, the FAA developed, tested, and finalized a new safety culture assessment method for use by the ASI workforce. The assessment was designed to balance the goals of scientific robustness with the need for it to be easy to use

by the ASI workforce. This was achieved by taking a collaborative approach to the project, where researchers and Flight Standards representatives worked together to develop, test, and refine the assessment.

The goal of this phased research effort is to ensure safety culture assessment becomes part of routine surveillance that is integrated with the oversight philosophy, methods, tools, and resources employed by the FAA. Phase 1 was a review of current practices that informed actions for the subsequent research. Phase 2 developed and tested new tools to help support safety culture assessment. Phase 3 finalized the new tools, with the goal of eventually integrating safety culture assessment into the FAA oversight framework.

Phase 1: Review of Current ASI Safety Culture Assessment Methods

The purpose of Phase 1 was to review the current practices and recommendations for improving safety culture assessment by FAA ASIs. This began with an inquiry into the current state (i.e., training, tools) of safety culture assessment as performed by the FAA to help inform potential avenues for improvement. Questions included:

- What are the criteria and metrics for successful safety culture assessment by the ASI workforce?
- What are the potential avenues for safety culture assessment by the ASI workforce?
- Do the current surveillance and oversight tools, such as the Safety Assurance System (SAS), adequately assess and record information about safety culture?

To discover and identify actionable and reasonable methods to assess safety culture of Certificate Holders (CHs), the researchers hosted brainstorming sessions to identify (a) leadership priorities for a successful assessment approach and (b) reasonable alternatives for safety culture assessment. The brainstorming session participants included Flight Standards (AFS-900) leadership and stakeholders in current or former ASI roles.

Flight Standards (AFS-900) leadership indicated the following priorities for a successful safety culture assessment:

- scientifically robust
- internationally respected
- achievable by the workforce
- integrated into existing oversight systems (e.g., SAS)

- supported by policy and training

With those criteria in mind, we brainstormed with AFS-900 ASIs to explore potential avenues for assessing safety culture. Input from these ASIs into the discovery process was crucial because they are a select group of inspectors whose job role is to provide field support (including coaching/training) to the ASI workforce. They also support the development of training, policy, SAS tools, and other resources as needed. The brainstorming process generated five potential avenues of assessment (see Table 1).

Table 1
Potential Avenues for Assessing Safety Culture

Avenue for Assessment	Description and Discussion
Adopt a standalone safety culture assessment outside SAS (e.g., SMICG interview protocol).[1]	This is an internationally recognized method of safety culture assessment. However, it is unlikely to integrate well into ASI workflows. May require in-depth training and/or a special oversight group to administer. Given the resource-intensive nature of such an approach, the assessment would likely only occur periodically rather than as part of routine surveillance.
Adopt ASI-administered surveys.	Surveys are perhaps the most common safety culture assessment method (National Academies of Science, Engineering, and Medicine [National Academies], 2016). However, surveys are unlikely to integrate well into ASI workflows and within limited FAA resources. Surveys alone provide an incomplete picture of safety culture.
Develop a standalone SAS Data Collection Tool (DCT) for safety culture assessment.	This would involve development of a DCT to surveil safety culture in a given timeframe. This method may preclude the ability to record safety culture concerns during routine surveillance. Instead, the DCT may not be conducted routinely or consistently across CHs. It is also likely that the additional DCT would increase ASI workload.

[1] See Safety Management International Collaboration Group (2019).

Avenue for Assessment	Description and Discussion
Add risk factor to the SAS Certificate Holder Assessment Tool (CHAT).[2]	The CHAT should be updated reactively based on surveillance outcomes per 8900.1 Volume 10. However, there is a limited mechanism to surveil safety culture concerns today, which provides limited input to inform CHAT changes. Additionally, there is no safety culture-related risk factor in the CHAT.
Integrate into existing systems (e.g., SAS DCTs and Response Details).	SAS DCTs and Response Details is the pre-existing method for ASIs to record surveillance activities and outcomes. This could be leveraged to record safety culture concerns with seamless integration into ASI workflows and minimal impact to ASI workload (compared to a standalone DCT).

Participants at the brainstorming sessions agreed that leveraging the existing oversight tool, SAS, for safety culture assessment would; allow for easier integration into current ASI workflows, ensure safety culture is assessed routinely during oversight and surveillance, and provide the FAA with regular status updates of CHs' safety culture and observed concerns. This contrasts with the other avenues of assessment, which would result in additional effort with only periodic (i.e., annual) updates.

The ensuing program of research centered on integrating safety culture into SAS Data Collection Tools (DCTs) and Response Details as this avenue was deemed most reasonable to meet leadership priorities and ensure safety culture becomes part of routine surveillance.

SAS Overview

The current mechanism for safety culture assessment is through routine surveillance performed in SAS. As part of their job role, ASIs are assigned to complete DCTs on a fixed schedule. DCTs are "…tools designed to collect data to help the Principal Inspector (PI) / Certification Project Manager (CPM) determine if a CH or applicant follows procedures, controls, and process measurements for each element or

[2] Note, the CHAT was available before the OIG (2020) report was published, yet inspectors still reported there is no way to adequately record safety culture concerns.

system within their scope of operation" (FAA, 2022). DCTs evaluate the design of systems (Element Design [ED] Assessments), the safety performance of the accepted design (Safety Performance [SP] and Element Performance [EP] Assessments), or customized, focused inspections (Custom [C] DCT).

The goal of system safety oversight is to evaluate and validate a CH's ability to manage safety-critical processes and achieve safety objectives using the seven Safety Attributes.[3] Every SAS DCT question is mapped to an attribute. Procedures Attribute questions assess technical processes and contain regulatory and guidance references, while the remaining Safety Attribute questions assess safety management. Some DCT response options include: not observable, not applicable, favorable, isolated issues, several issues, systemic issues, etc. If an unfavorable response (e.g., isolated issues, several issues, systemic issues) is selected for the DCT question, ASIs must subsequently record Response Details corresponding to and explaining the unfavorable response. SAS tallies all unfavorable findings, associated attributes, and corresponding Response Details. These tallies provide a quick snapshot of the CH's risks and are used for risk-based decision making (RBDM) and mitigation by the PIs. Specifically, the surveillance results serve as inputs to the Analysis, Assessment, and Action (AAA), Risk Profile Assessment Tool (RPAT), and CHAT functions of SAS. These tools allow the PI to determine the level of risk and appropriate mitigation strategies for a CH. In turn, the outputs of these tools serve as inputs to annual planning meetings to prioritize the high-risk areas to surveil in the upcoming year. For more information about the SAS workflow, see FAA Order 8900.1 Volume 10.

The Safety Attributes were re-defined and revised in 2018, adding a new attribute for Safety Ownership. The objective of the new Safety Ownership attribute was to evaluate the extent to which the CH workforce (including management) communicate and demonstrate their commitment to the company's stated safety objectives. The Safety Ownership attribute was to be the first step in conducting oversight of a CH's safety culture.

Methods

We sought to determine whether there had been an increase in the use of Safety Attributes and Response Details since their revision in 2018. The team accessed and analyzed the subset of data that were available from 2018 - 2021. This included the ED

[3] The seven Safety Attributes are: Responsibility, Authority, Safety Ownership, Procedures, Controls, Interfaces, and Process Measurement.

and EP DCTs. These data are limited by (a) the exclusion of SP DCT data, (b) the uneven distribution of ED and EP DCTs completed by office types (i.e., a Certificate Management Office [CMO] may complete more), and (c) a reduction in surveillance activities due to the COVID-19 pandemic.[4]

Results

When the team tallied the frequency of unfavorable findings for each Safety Attribute in SAS (except Procedures). The results indicated an increase in attribute use between 2018 (n = 531) to 2019 (n = 736), and then the rate leveled off in 2020 (n = 714). The increase in Safety Attribute selection suggest the Safety Attributes are a viable mechanism for assessing CHs' safety management and safety culture.

Digging deeper, the researchers examined the Response Details that accompany the Safety Attributes. There is only one Response Detail choice that pertained to safety culture: *lack of safety culture.* The results of this examination revealed zero selections of this Response Detail choice in the 2018-2021 dataset; it appears that ASIs were not utilizing the (limited) means for recording safety culture concerns in SAS during that time.

Discussion

The purpose of Phase 1 was to scope, review, and inform FAA current state of safety culture assessment and recommendations for improving safety culture assessment by FAA ASIs. The research focused on SAS integration based on brainstorming feedback and leadership priorities (see Table 1). Every SAS DCT question is currently mapped to a Safety Attribute; the attributes had been revised to acknowledge safety culture (i.e., via the Safety Ownership attribute). Across EP and ED DCTs, there was an increase in Safety Attribute use between 2018 and 2020, suggesting that the use of the Safety Attributes is a viable way of assessing safety culture. However, the Response Detail choice related to safety culture was not being selected.

The Response Details, in general, were not written with safety culture as the focus and do not align with a scientific framework of safety culture assessment, which portrays safety culture on a continuum of maturity or health rather than a dichotomous presence or 'lack' of safety culture Therefore, the ability for ASIs to record and infer meaningful

[4] ED and EP DCTs are much fewer in count than SP DCTs because ED and EP DCTs drill down into a design area, and thus are only performed on an as-needed basis; SP DCTs are required on a scheduled timeframe (every 6, 12, or 24 months). SP DCT data was not available at the time of this research; therefore no analyses of this data are provided in this report.

safety culture trends and patterns in their oversight tools and database (SAS) are hindered.

The researchers proposed revisions to the Response Details to better capture safety culture. A revised set of Response Details were field-tested and reviewed by inspectors to obtain end-user feedback and to ensure that the new proposed content is both understandable and usable by the workforce. This field test was completed in Phase 2 of this research, discussed below.

Phase 2: DCT Revisions and Field Test

Phase 2 builds on the findings of Phase 1 by proposing changes that can be made to improve SAS so that ASIs can better identify and record safety culture concerns during routine surveillance.

Proposed Safety Culture Assessment Method

The research team sought to develop a flexible, science-based approach to providing ASIs with tools and guidance for safety culture assessment. Referring to the leadership priorities identified in Phase 1, this new approach was designed to be scientifically robust, but also easily utilized by the ASI workforce. This was achieved by taking a collaborative approach to the project, where researchers and Flight Standards representatives worked together to develop, test, and refine the assessment.

Response Details for all seven Safety Attributes were revised to better document potential safety culture concerns that may arise during ASI surveillance. The Response Details were modified using a scientific framework based on the Job Demands-Resources model of organizational behavior and outcomes (Bakker & Demerouti, 2007).

For example, the Safety Ownership attribute was modified. The DCT question is usually of the form: “Did the certificate holder's personnel understand their role and contribute to the safety performance of the processes?” Table 2 compares the Current and Proposed Response Details for the Safety Ownership attribute (see Appendix B for a complete list of Proposed Response Details as used in Phase 2 field testing). Implementation of these revised Response Details could empower data collection on most (but perhaps not all) critical elements of a CHs safety culture.

Table 2
Current and Proposed Response Details for the Safety Ownership Attribute

Current Response Details	Proposed Response Details
• Unaware or ~~ineffective~~ safety policies or processes • Unaware or ~~ineffective~~ safety related reporting tools • Unclear safety policy • Ineffective safety related training • Lack of safety culture • Unclear safety objectives • Other	• *Employees are* unaware of safety policies or processes. • Unclear or *ineffective* safety policy • Unclear or ineffective safety objectives • Management does not communicate/ demonstrate a commitment to safety. • *Employees are* unaware of safety related reporting tools. • Employees are unwilling to report hazards/risks/events, including unclear procedures. • Ineffective/lack of safety programs (i.e., VDRP, ASAP)[5] • Ineffective/inconsistent response to reported hazard/risk/events, event investigations, and/or corrective actions (fairness/justness) • Employees failed to perform/follow process (procedures, guidance). • Ineffective safety related training • Negative/unhealthy safety culture • Other

Note. Struck text indicates language to be removed from the Response Details; italicized text indicates new language to be added to the Response Details. The Response Details presented here were tested (see Appendix B for the full set of Proposed Response Details).

Purpose

The purpose of Phase 2 was to conduct a field test of the Proposed Response Details. During the field test, participants voluntarily used the Current and Proposed

[5] Voluntary Disclosure Reporting Program and Aviation Safety Action Plan, respectively.

Response Details to complete DCT questions for three inspection scenarios (see *Inspection Scenarios*) with a range of safety culture concerns. Participants then rated usability and provided feedback and recommendations for improvement.

The research hypotheses were:

- **Hypothesis #1:** Proposed Response Details should allow documentation of more safety culture concerns when compared to Current Response Details. In other words, participants should select a higher percentage of Proposed Response Details (than Current), with the strongest effect found for the High safety culture concern scenario. There should be no difference in selection of Current and Proposed Response Details in the Low safety culture concern scenario.
- **Hypothesis #2:** Proposed Response Details should be perceived favorably, with more favorable ratings of Proposed than Current Response Details.

Methods

Participants

Participant recruitment was coordinated with field office management. FAA Flight Standards ASIs in safety oversight roles were invited to participate, of which 47 completed informed consent. Of those, 33 completed the study.[6]

Data Confidentiality

This research was reviewed and approved by the FAA Civil Aerospace Medical Institute's Institutional Review Board (Approval No. 202220). The invitation and informed consent identified the study's confidentiality assurances. Specifically, participants were informed that participation is voluntary; and there is no linkage between their identity and their responses.

The responses were passed directly to a contractor for removal of personally identifiable information; participants were informed that only summary results would be reported so that identity is not identifiable to management or to the FAA. Participants were also informed that de-identified data may be made available to others for research-related purposes only.

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[6] $n = 1$ left the study immediately after completing informed consent; $n = 2$ left the study during the Demographics Questionnaire; $n = 3$ left the study during Scenario 1; $n = 8$ left the study during subsequent Scenarios.

Materials

Inspection Scenarios.

The scenario format was chosen because it is familiar, like the in-person training that ASIs experience. Additionally, the researchers estimated that the method would take not only less time than field work (surveillance of CHs) but would also provide a standardized set of inspection scenarios to be evaluated by all participants. Importantly, standardized scenarios would allow the establishment of a baseline of responses to each DCT.

The researchers collaborated with stakeholders to develop six inspection scenarios based on real events observed during routine surveillance (see Appendix C). For each scenario, the ASIs identified the most relevant DCT. Scenarios were developed so that (a) they were relevant for either airworthiness inspections or flight ops inspections, and (b) they represented a continuum of safety culture concern, from low to high. This methodology allowed us to test the hypothesis that the Proposed Response Details allow improved documentation of safety culture concerns, when they are present (i.e., in the high safety culture concern scenario; Hypothesis #1).

A beta test was conducted to ensure that the scenarios represented a continuum of low to high safety culture concerns. The DCT for each scenario was completed by two AFS-900 ASIs and two Ph.D.-level experts in safety culture to identify the Response Details that should be selected. Differences were resolved through inter-rater discussion until agreement was reached for the ASIs and the safety culture experts, separately. Based on these experts' ratings, the total number of Response Details per scenario was calculated. Logically, scenarios with a higher number of Response Details are higher in safety culture concern. Following this logic, scenarios were categorized as showing high, medium, and low safety culture concerns. See Appendix C for scenario text.

Scenarios with a high safety culture concern described a procedural deviation that the ASI, through a series of interviews and observations, can track back to a lack of resource allocation by the accountable executive. These scenarios describe a persistent and known issue where the accountable executive has instructed personnel to use workarounds.

Scenarios with low safety culture concern described a one-off procedural deviation that was corrected on the spot; they also specified to the reader that there were no other issues identified during the surveillance. Thus, there was no evidence of a safety culture concern.

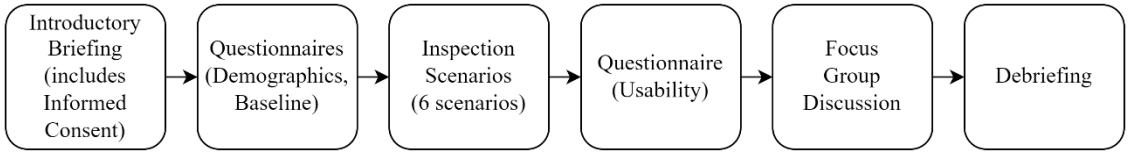
Questionnaires.

Three questionnaires were presented to participants over the course of the study: (a) demographic questionnaire, (b) baseline questionnaire, and (c) a usability questionnaire adapted from the System Usability Scale (Brooke, 1996). The questionnaires are provided in Appendix D.

Procedure

Data collection sessions followed a sequential procedure (Figure 1) that lasted no longer than 4 hours per meeting, including breaks. Sessions began with a 15-minute introductory briefing that included completion of informed consent. Participants then completed a demographics questionnaire followed by a baseline assessment.

Figure 1
Data Collection Session Procedure



Following the questionnaires, each participant reviewed and rated three of six total inspection scenarios. Participants completed one each of the High, Medium, and Low safety culture concern scenarios; the scenarios were tailored to their specialty, as reported in the demographic questionnaire. The scenarios were self-paced and took 20-45 minutes each to complete for a total of 2-3 hours. Each scenario consisted of: (a) approximately two paragraphs of descriptive text; and (b) approximately seven DCT questions provided electronically, with response options and text-entry comment fields. DCT Response Details (Current or Proposed) were randomly assigned per scenario per participant. Display logic was used to present scenarios and DCT questions relevant to each ASI's specialty (i.e., airworthiness, flight ops), with DCTs presented randomly to prevent order effects.

Next, participants were asked to complete a Usability Assessment (15 minutes) which concluded the self-paced portion of the study. The informed consent, demographic questionnaire, baseline assessment, inspection scenarios, and usability assessments were completed using an automated data collection platform (Qualtrics XM).[7]

[7] Qualtrics is FedRAMP qualified.

Results

Demographics and Baseline

The 33 participants included representatives from CMOs, Flight Standards District Offices (FSDOs), and other offices within FAA's Flight Standards organization (i.e., Certificating and Evaluation Program Office [CEPO], International Field Offices [IFOs]). Given the small number of CEPO and IFO representatives who participated, these participants were combined with the FSDO participants for analysis. Participant demographics are displayed in Table 3.

Table 3
Participant Demographics

	CMO		FSDO & Other	
	M	*SD*	*M*	*SD*
Sample Size (*n*)	18	-	15	-
Experience at FAA (years)	12.2	6.6	13.6	8.0
Experience in Current Role (years)	4.2	4.2	5.2	5.4
Certificates Overseen (count)	1.1	0.2	18.5	15.8

In the baseline survey, participants reported that they are concerned about their CHs' culture (average 7.1 on a 10-point scale; 44.3% of CHs on average), and almost all participants indicated that it is important to assess safety culture (average 9.0 on a 10-point scale).

Next, we evaluated participants' knowledge of safety culture by asking them how to identify safety culture operationally. They reported using a variety of information sources, including:

- training records
- trend analysis data
- interviews with employees at all levels of the organization
- accident/incident/injury data
- safety promotion materials (e.g., posters, bulletin boards)
- CHs' evaluations of their own culture
- Continuing Analysis and Surveillance System (CASS), audit findings

- effective coordination between departments when manuals/programs are revised
- internal evaluation programs
- provision of resources (e.g., personal protective equipment, facilities, equipment/tooling, accurate and updated manuals/work cards)
- voluntary disclosure programs; hotline complaints
- daily event occurrences, damages, etc.
- SMS manual; company manuals

Further, participants were asked to identify cues of a strong or a weak safety culture. Common responses included:

- Strong Safety Culture
    - safety as the highest priority
    - leadership commitment
    - provision of resources (e.g., facilities, equipment/tooling, staffing)
    - response to inspectors' visits and feedback
    - commitment to continuous improvement
    - well defined audit system with findings observed and appropriate action(s) taken
    - timely corrective actions and follow-up for reported events and safety issues
    - open lines of communication from management to staff and vice versa
    - positive attitude of employees
    - team players all working for same goal
    - employees are aware of and able to demonstrate their role in safety (e.g., reporting, eliminate hazards when observed)
    - strong participation in safety programs
    - personnel following their procedures
- Weak Safety Culture
    - speaking with both side of the mouth: "do the right thing - unless it costs money."
    - pressure to take shortcuts
    - resistance to change and denial of safety issues
    - audits and safety meetings that "check the box" but don't generally find and address safety issues
    - blaming and punishing employees for mistakes

- high turnover rate
- employee reluctance to report hazards or lack of trust in the organization/management
- groupthink; lack of questioning attitude
- lack of employee engagement; low morale
- lack of employee empowerment to do the right thing
- poor training

Comparison of Proposed versus Current SAS DCT Response Detail Selections

Next, participants used the Current and Proposed Response Details to assess the three scenarios. We examined their Response Detail selections quantitatively (i.e., number of selections; see Table 4) and qualitatively (i.e., selection choice, consistency of choices across participants; see Table 5).

As expected (Hypothesis #1), analyses revealed that the Proposed Response Details provided the opportunity for participants to select a comparatively larger number of Response Details when the scenario had a high level of safety culture concern. This difference was found to be statistically significant, $t(229) = 4.59$, $p < 0.001$.[8]

Table 4

Number of Response Details selected, by Scenario Level of Safety Culture Concern

	Scenario Level of Concern					
	High		Medium		Low	
Assessment	*M*	*SD*	*M*	*SD*	*M*	*SD*
Proposed Response Details	3.27	2.33	1.47	1.81	0.93	1.60
Current Response Details	2.07	1.62	1.51	1.70	1.02	1.37

It is possible that the Proposed Response Details caused inspectors to be more liberal in their selections, rather than selecting them due to the Proposed Response Details providing ability to document to safety culture concerns (when present). Thus, it is necessary to establish whether inspectors were selecting the relevant Proposed

[8] T-tests for mean number of selected Response Details in the scenarios with low or medium safety culture concern were not significant at the $p = 0.05$ level.

Response Details only when the scenario or surveillance event called for them to do so (Hypothesis #1).

To address this, the researchers examined what proportion of selected Response Details were from the Current and the Proposed sets. For each of the scenarios, the number of inspectors who selected each Response Detail was calculated. The Response Details that were selected frequently (by >40% of inspectors) are presented in Table 5; further discussion for all Response Details is provided in Appendix E.

The results in Table 5 support Hypothesis #1. When inspectors assessed the High Concern scenario, 58% of the frequently selected Response Details were from the Proposed Response Detail set (i.e., were related to safety culture concerns). Inspectors selected comparably fewer Proposed Response Details for the scenarios with Medium and Low Concern (25% and 0% selected, respectively). In summary, inspectors selected safety culture-related Response Details when relevant for the scenario, and not otherwise (thus confirming Hypothesis #1).

Table 5
Response Details Selected by >40% of Inspectors

Scenario Level of Concern	Response Detail
High	Failure to identify issues/process deficiencies in process measurements.
High	Personnel failed to follow process (procedures, guidance, etc.).
High	Personnel failed to perform task.
High	Process failed to meet desired outcome.
High	Failure to develop and maintain risk controls.
High	Failure to develop and maintain risk controls *(for new systems, revising existing systems, or developing operational procedures).**
High	Failure to follow risk controls *(i.e., because they are unclear, poorly communicated, burdensome, or tribal knowledge/group norms)*.^
High	Failure to identify hazards or ineffective risk controls.
High	Risk controls are ineffective *(i.e., fail to mitigate risk).*
High	Failure of interfaces between processes or procedures.
High	Internal communication failure(s).

Scenario Level of Concern	Response Detail
High	Internal communication failure(s) *between management and employees.*
High	Internal communication failure(s) *between multiple departments (i.e., maintenance and flight ops)*.
High	*Communication failure(s) laterally and/or up and down the chain of command (or equivalent).*
High	Failed to ensure quality performance of process.
High	Failed to provide financial resources.
High	Failed to provide sufficient *(adequate number, trained and qualified)* human resources.^
High	*Failure to communicate the importance of safety (e.g., focusing on competing goals of productivity or profit).*^
High	Failure to ensure safety of process.
High	*Equipment/tools are not adequate, available, or calibrated.*
High	Failed to ensure quality performance of process.
High	Failure to identify issues/process deficiencies in process measurements and/or procedures.
High	Failure to implement safety risk processes.
High	Ineffective planning of resources *(e.g., workload, scheduling, pressure).*^
High	Ineffective use of resources *(e.g., money, internal and external personnel, equipment/tools, training)*.*^
High	Staffing is not adequate to perform the tasks.
High	Unacceptable safety risk acceptance.
High	Failure to detect changes in the operational environment *(i.e., physical, regulatory, financial).*
High	Inadequate monitoring/*evaluations* of operations processes or systems *(e.g., repeated failures not detected).*
High	Process failed to meet desired outcome.
High	*Employees* failed to perform/follow process (procedures, guidance).

Scenario Level of Concern	Response Detail
High	*Ineffective/inconsistent response to reported hazard/risk/events, event investigations, and/or corrective actions (fairness/justness).*
High	*Ineffective/lack of safety programs (i.e., VDRP, ASAP)*.*
High	Lack of safety culture.
High	*Management does not communicate/demonstrate a commitment to safety.*^*
High	*Unclear* or ineffective safety objectives.
Medium	Personnel failed to follow process (procedures, guidance, etc.).
Medium	Personnel failed to perform task.
Medium	Process failed to meet desired outcome.
Medium	Skipped process step(s).
Medium	Failure to identify hazards or ineffective risk controls.
Medium	Risk controls are ineffective *(i.e., fail to mitigate risk).*
Medium	Internal communication failure(s).
Medium	Internal communication failure(s) *between multiple departments (i.e., maintenance and flight ops)*.
Medium	Lack of interfaces.
Medium	Inadequate monitoring of operations processes.
Medium	*Employees* failed to perform/follow process (procedures, guidance).
Medium	Unaware or ineffective safety policies or processes.
Low	Personnel failed to follow process (procedures, guidance, etc.).
Low	Ineffective planning of resources.

Note. Italicized text indicates the proposed revisions to the Response Details, as presented in the field test. Response Details that are highly related to culture are denoted with an asterisk (*). Contributing factors to noncompliance with procedures are marked with a caret (^); there is often a cultural/normative contribution to procedural noncompliance.

Usability of the Proposed Response Details

After DCT completion, participants evaluated the usability of the Proposed Response Details. The overall average for the usability items was $M = 3.87$ of 5 ($SD = 0.95$). The usability items are presented in Table 6, illustrating that participants rated usability favorably.

Table 6
Selected Usability Items

	Score	
Question Prompt	*M*	*SD*
I thought the new list was easy to use.	3.91	0.91
I think I would like to use the new list frequently.	3.97	0.98
I found the new list unnecessarily complex.*	2.33	1.16
I think that I would need the support of a technical person to be able to use the new list.*	1.97	1.02
I believe that most people would learn to use the new list quickly.	3.91	0.91
I felt confident using the new list.	4.03	0.85
I needed to learn many things before I could get going with the new list.*	2.30	1.07
I found the new list cumbersome to use.*	2.15	1.15
I thought there was too much inconsistency between what is in the new list and the real world.*	2.39	1.17
Using the new list, I was able to accomplish my assigned tasks.	4.12	0.55
I think I could become good at using the new list.	4.18	0.73
The new list correctly understood and responded to my commands.	3.88	0.82
The new list enhanced my understanding of how to assess safety culture.	3.67	1.02
I found the new list could be well-integrated into the Safety Assurance System (SAS) software.	4.15	0.80
The new list would improve my work performance (e.g., accuracy, error-free).	3.88	0.78

	Score	
Question Prompt	*M*	*SD*
The new list would increase work productivity.	3.48	0.87
The new list would make it easier to perform my task.	3.48	1.00
I feel positively toward the new list.	3.88	0.96
I intend to be a frequent user of the new list.	3.85	1.00
I feel confident finding information in the new list.	3.88	0.89
I have the necessary skills for using the new list.	4.18	0.85

Note. Responses were provided on a scale of 1 (strongly disagree) to 5 (strongly agree). Items marked with an asterisk (*) are reverse-worded, so lower agreement ratings indicate more favorable perceptions of usability.

Participants then compared the Proposed Response Details with the Current Response Details. Most participants rated the Proposed Response Details as "somewhat better" or "much better" for all seven of the Safety Attributes (see Table 7).

Table 7
Usability Comparison of the Proposed Response Details with the Current Response Details in SAS, by Safety Attribute

	Score	
Safety Attribute	*M*	*SD*
Procedure	4.00	0.79
Controls	4.30	0.73
Interfaces	4.48	0.67
Responsibility	4.48	0.57
Authority	4.58	0.75
Process Measurement	4.33	0.74
Safety Ownership	4.67	0.65

Note. Scores were responses provided on a scale of 1 (much worse) to 5 (much better).

Participants then provided open-ended feedback about the benefits and drawbacks of the Proposed Response Details. Researchers classified the comments as positive (benefit; $n = 24$), negative (drawbacks; $n = 5$) and neutral ($n = 6$).

Participants generally agreed that the revisions provided a simplified, plain-language way to record unfavorable responses and improve ASIs' understanding of safety culture, SMS, and the Safety Attributes. The reported benefits included:

- "Provides better consistency and quality to SAS databases."
    - "It helps to improve the accuracy of data."
    - "Helps inspectors more clearly identify the root cause of the failure."
- "More accurate safety culture evaluation."
- "Appears to better describe the requirements of CFR part 5, SMS."
- "Inspectors will (should) be drawn into the 7 Safety Attributes and use them more."
- "The variety with the new protocol compliments the variety of issues we see in the field."
    - "Provides more choices that may better relate to the situation."
- "Verbiage used seems to be more clear and detailed."
- "Easier to understand."
- "With time and a clearer inspector understanding of safety culture and the goals the agency is trying to achieve with the tool, will lead to better inspections."

The reported drawbacks included: may ultimately generate more work for General Aviation (GA) inspectors; number of options may be overwhelming for some.

Discussion

The researchers developed a new safety culture assessment approach that is designed for integration into SAS. Response Details for all seven Safety Attributes in SAS were revised to help ASIs during surveillance to better-document potential safety culture concerns.

Participating ASIs used the Proposed Response Details to complete DCT questions for three inspection scenarios with varying levels of safety culture concern. Participants then rated usability and provided feedback and recommendations for improvement.

At baseline, many reported concerns about the CH's culture and noted the importance of assessing safety culture. As expected, the Proposed Response Details

provided the opportunity for participants to select more Response Details, particularly when the scenario had a high safety culture concern (i.e., when there was insufficient resource allocation, traceable to the accountable executive).

Further, participants rated usability of the Proposed Response Details favorably. In general, they agreed that the Proposed Response Details provided a simplified, plain-language way to record unfavorable responses and improve inspectors' understanding of not only the safety culture, but also SMS and the Safety Attributes. The Proposed Response Details for all seven Safety Attributes were rated as "somewhat better" or "much better" than the Current Response Details.

It is an open question how these Response Detail changes would perform in operational contexts if integrated into ASI workflows. The researchers chose this scenario-based method so that participants evaluated a standardized set of culture concerns. However, analyses identified individual variation in perceptions of the scenarios. Some participants selected mostly "Not Observable" responses to DCT questions, meaning they did not interact with the Response Details. Participants attributed this to ambiguity or inadequate information in the scenarios, precluding adequate root cause analysis. Notably, surveillance of actual CHs is not limited to printed scenario text, so it is not expected that this limitation will affect the utility of the Proposed Response Details in operational environments.

Phase 3: Finalizing Safety Culture Assessment for Integration into SAS

Given the overall finding that the ASIs were able to record safety culture concerns using the Revised Response Details, the next step in the phased research approach was to finalize the Response Details for potential integration into SAS. No changes were recommended during the field test; however, the researchers noted an opportunity to synergize ASI safety culture assessment with other FAA safety culture objectives.

Concurrent to this research effort, AVS selected the International Atomic Energy Agency's (IAEA) *Harmonized Safety Culture Model* (2020), as the basis of their safety culture assessment program. To ensure that CHs are assessed against the same model, the Proposed Response Details for safety culture were aligned to this framework.

Purpose

The purpose of the alignment effort was to produce a final set of Proposed Response Details that adequately captures the IAEA safety culture traits and attributes (see Appendix F).

Method

A panel of three raters convened to align the Response Details with the IAEA attributes of a positive safety culture. The panel consisted of two senior ASIs (one maintenance and one flight ops) and one human factors researcher. All had prior experience with safety culture assessment.

The IAEA model consists of 10 traits of a positive safety culture, with each trait consisting of several attributes; the model contains 43 attributes in total (IAEA, 2020). Each rater independently categorized the Proposed Response Details into the IAEA safety culture attributes. Raters were also provided the opportunity to make wording suggestions to existing Response Details and/or to add new Response Details that may capture the IAEA attributes.

The raters recognized that it may not be possible to produce a one-to-one categorization, in part because IAEA safety culture attributes are positive features of an organization, whereas the Response Details are (inherently) negative. Thus, it would be possible that not all IAEA attributes may have a corresponding Response Detail, whereas some IAEA attributes may have multiple corresponding Response Details.

Given the exploratory nature of this alignment exercise, no constraints were placed on the raters' categorization effort. For example, there was no restriction placed on re-mapping of Response Details across attributes. The alignment was based on the raters' judgment and expertise.

Results

Researchers summed the number of IAEA attributes that had at least one Response Detail categorized with agreement from at least two raters. After the initial round of rating (i.e., when each of the three raters worked alone), inter-rater agreement was obtained for 51% (22 of 43) IAEA attributes. The three raters then convened, at which consensus was reached through discussion that resulted in final inter-rater agreement for 88% (38 of 43) IAEA attributes.[9,10] The raters and researchers interpreted

[9] Often, the same Response Detail was categorized into multiple IAEA attributes. In part, this is because some IAEA attributes are complex and multi-faceted, and there is overlap amongst the IAEA attributes.

[10] Response Details were not categorized for 5 IAEA attributes (i.e., Avoid Complacency, Question Uncertainty, Resilience, Learning from Experience, and Benchmarking). All three raters agreed that assessing these attributes of safety culture during routine surveillance would be too difficult for inspectors.

this to mean that the Proposed Response Details provide adequate coverage of the IAEA attributes, meaning that there is synergy in how safety culture assessment is conducted within the FAA and for CHs.

The raters were also mindful to ensure that after alignment with IAEA, the number of Response Details would not harm SAS usability. Notably, the alignment effort in Phase 3 did not increase the number of Proposed Response Details (see Table 8). This was achieved by removing or rewording redundant items from the Current Response Details to accommodate the addition of the new safety culture Proposed Response Details.

Table 8
Number of Proposed Response Details

	Response Details (count)		
Attribute	SAS Current	After Field Test	After IAEA Alignment
Procedures	20	16	10
Responsibility	9	9	9
Authority	9	21	18
Controls	10	8	8
Interfaces	7	6	6
Process Measurement	10	9	10
Safety Ownership	7	13	11
Total	*72*	*82*	*72*

As Table 8 illustrates, the final number of Proposed Response Details does not exceed what is currently in SAS. The Procedures attribute was streamlined by combining and/or relocating Response Details to focus inspector attention on safety management and culture rather than technical process failures. Similarly, new Response Details were added to the Authority attribute to capture leadership responsibility for safety, as culture starts at the top.

Discussion

The purpose of Phase 3 was to finalize the Proposed Response Details for potential integration into SAS. This was achieved by strategically aligning the Proposed

Response Details for safety culture to the model chosen for other FAA safety culture objectives.

Three raters reviewed the Proposed Response Details and compared them against the *Harmonized Safety Culture Model* (IAEA, 2020), while continuing to ensure that the aligned Response Details captured the major traits of a positive safety culture. Notably, inter-rater agreement was 88%, and the final number of Proposed Response Details does not exceed what is currently in SAS.

Although the changes proposed in the Phase 3 effort have not been tested operationally, the evidence suggests that the effort resulted in a final set of Response Details that are in alignment with IAEA traits of a positive safety culture and should be usable by the ASI workforce.

General Discussion

As previously discussed, the OIG report (2020) identified concerns regarding the FAA's ASI workforce's oversight of an air carrier. Perhaps most striking, 61% of FAA staff reported that they were concerned about the air carrier's safety culture. The report also provided a set of recommendations; central to the current research effort is Recommendation #11, which gives the direction to "develop and implement inspector guidance on how to evaluate air carrier safety culture and how it should be factored into oversight decisions" (OIG, 2020, p. 19).

In response, the overarching goal of the research effort was to give field inspectors a voice for assessing and recording safety culture concerns. To support the ASI workforce in overseeing safety culture, the authors scoped, developed, field tested, and aligned a new safety culture assessment methodology consisting of proposed modifications to SAS DCT Response Details.

The Three-Phase Approach

Research was organized into three Phases. In Phase 1, the researchers reviewed potential culture assessment methods and identified SAS as an area where modifications could help ASIs improve safety culture oversight. Leadership priorities for a successful safety culture assessment approach were documented, and brainstorming sessions with stakeholders and subject matter experts (SMEs) explored assessment avenues. SAS data analysis from 2018-2021 revealed that although there has been an increase in the use of Safety Attributes (including Safety Ownership, which refers specifically to culture), there is only one Response Detail relevant to safety culture.

In Phase 2, researchers worked with stakeholder groups and SMEs to propose a set of modified and new Response Details to help ASIs record safety culture concerns. These Proposed Response Details were tested in a study with ASI participants, who indicated that the Proposed Response Details demonstrated favorable usability. Notably, the study also found that participants used the appropriate Response Details when safety culture concerns were present.

In Phase 3, the researchers ensured that the Proposed Response Details aligned with other FAA efforts in assessing and fostering safety culture by mapping the Proposed Response Details to the IAEA's *Harmonized Safety Culture Model* (IAEA, 2020). The research effort resulted in a final set of Proposed Response Details that were in alignment with the *Harmonized Safety Culture Model* while maintaining the same number of Response Details for ASIs to choose.

Limitations and Future Directions

The Proposed Response Details represent only one improvement that the FAA can make to help monitor safety culture concerns. Future work is needed to improve education on safety culture, guidance to score safety culture concerns, and support eventual integration into SAS. Future work should address these considerations in a programmatic way, with the aim of improving safety culture assessment by the ASI workforce.

Improve the Ability for ASIs to Factor Safety Culture into Oversight Decisions

The Proposed Response Details provide a way for ASIs to record safety culture concerns; however, there is still a need to ensure that safety culture is factored into risk-based oversight decisions. Because oversight decisions are based on ASIs' determination of risk, ASIs need guidance for determining whether the safety culture concern is isolated or systemic. Metrics will be needed to help ASIs identify which CHs are operating at risk and need additional oversight. Future research may be needed to characterize a threshold for concern (e.g., how many Response Details must be observed, and over what timeframe); exploration should include potential interdependencies or interactions among the safety culture Response Details. ASIs will also need resources and support to work collaboratively with their CHs to mitigate any identified safety culture deficiencies.

Modify ASI Training Course for Safety Culture Assessment

One notable finding from the field study is that participating ASIs demonstrated a good understanding of safety culture characteristics and assessments (see Key et al.,

2023, for a review).[11,12] Because the participants self-selected and volunteered for the study, they may be more knowledgeable and/or motivated about safety culture than the average ASI. Nevertheless, their knowledge and understanding could serve as a foundation for an ASI training course to emphasize safety culture fundamentals. Many of these safety culture fundamentals are taught in existing training courses (e.g., FAA21000150), such as the basics of what safety culture is and the impact of safety culture on SMS effectiveness (see Appendix A). Bolstering the course curriculum with instructions to assess safety culture in SAS could ensure that ASIs have adequate understanding of safety culture to perform their oversight duties. Curriculum could include what questions to ask when performing DCTs, practice identifying culture indicators and recording in SAS, and guidance for integrating safety culture into RBDM and risk mitigation.

Conduct Periodic Assessments to Evaluate Effectiveness

For FAA to draw meaningful safety culture patterns and trends, ASIs must record the Safety Attribute data with culture in mind. As noted previously, the scenario-based field test did not involve surveillance of CHs, and as such may not have captured the nuances that can be found in operational circumstances. A post-implementation evaluation of effectiveness would provide assurance that the Response Details are performing as expected. Similarly, the researchers recommend performing an analysis on a periodic basis to monitor the use of SAS Safety Attributes and Response Details to ensure that safety culture concerns are recorded appropriately. The analysis should include SP DCT data because it is the most abundant and generalizable (given it is completed by CMO *and* FSDO inspectors).

Consider Alternative Ways to Integrate Safety Culture into SAS

The Proposed Response Details of safety culture assessment focused on recording unfavorable aspects of safety culture. This is tautological and inherent to SAS design; however, this precludes the ability to record *positive* aspects of safety culture – and

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[11] Examples of characteristics include: decision making that prioritizes safety, leadership commitment, employee involvement and safety ownership, justness, resource allocation, communication, environment for raising concerns (e.g., reporting systems), problem identification and resolution processes, continuous learning, and mutual trust and respect (Chidester, 2016; Churucca et al., 2021; Flin et al., 2000; Gillen et al., 2014; Guldenmund, 2000; IAEA, 2020; O'Connor et al., 2011).

[12] Examples if assessments include: document reviews, including company manuals, safety management processes, audit findings, training records, voluntary disclosures, accident/incident/injury rates, safety performance indicators (National Academies, 2016; see Chidester, 2016; Churucca et al., 2021; Gillen et al., 2014; Zohar, 2014).

whether a CH's safety culture is maturing along with safety management efforts (e.g., SMS implementation). The Proposed Response Details are not intended to be a one-size-fits-all solution for culture assessment, nor is it appropriate to assume they would be appropriate for culture assessment in other contexts (e.g., for use by CHs, or to measure safety culture within the FAA). Alternatives within SAS may include (a) a safety culture indicator on the Certificate Holder Assessment Tool (CHAT), (b) making a standalone safety culture DCT rather than incorporating into every DCT, or (c) providing less specific response options. Outside SAS, the other avenues for assessment include (a) standalone assessments and (b) surveys, as identified in the Phase 1 brainstorming sessions (see Table 1).

Conclusions

The Proposed Response Details herein provide guidance and direction to support data collection on some (but perhaps not all) critical elements of a CHs safety culture. They are intended to integrate within the oversight philosophy, methods/tools, and resources currently employed by the Agency, and ultimately empower the workforce to conduct safety culture assessment as part of routine surveillance and oversight. This research project demonstrates the value of cross-office collaboration and partnership. The deliverables include not only an assessment of safety culture for ASIs, but also a roadmap to guide end-user testing for future SAS changes. The integration of these findings will enhance the ability of the ASI workforce to assess CHs' safety culture and related concerns.

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Appendix A
Training Courses

The FAA trains inspectors on safety culture through two training courses. The authors reviewed the full content of each course and compiled the content pertinent to safety culture.

Course FAA21000150, Continued Operational Safety (COS) of a Safety Management System

This course, deployed in June 2018, enables ASIs to use the evolved COS tools to provide continued oversight of a CHs' SMS. Lesson 2 summarizes how SMS evolved from system safety and describes how system safety, the Safety Attributes, SAS, the DCTs, safety culture, and SMS relate to one another. Lessons 3 and 4 describe the Safety Attributes. The Safety Ownership attribute was added to increase awareness that the culture of an organization plays a major role in its management of safety. Lesson 5 is focused on the role of safety culture in an organization. It outlines components of organizational culture; outlines four organizational indicators of safety culture (i.e., organizational commitment, operations interaction, formal safety system, and informal safety system); and teaches ASIs how to recognize these indicators at a CH's organization.

Course FAA21000171, System Safety Recurrent

This course, deployed in May 2020; provides Flight Standards personnel who conduct operations under all 14 CFR parts with updated information about System Safety so that they can use a risk-based approach to their decision making that considers Safety Attributes, safety culture, and human factors to assess how the service provider is managing safety. Lesson 3 defines the Safety Attributes. Lesson 4 reviews the principles of RBDM, stating the evaluation of risk should also encompass information about the operator's safety culture and how the operator deals with human factors (e.g., does it consider human factors like stress and try to mitigate them?) Lesson 5 focuses on the importance of human factors and safety culture. It emphasizes reporting and just culture as key elements shaping safety culture and outlines how FAA supports a just regulatory culture.

Findings and Recommendations

The two training courses were implemented to guide inspectors to think about culture when performing surveillance and oversight of CHs' operations. In this way, the training content seems suitable and adequate. The training courses (a) orient inspectors to the vocabulary and key concepts surrounding safety culture, and (b) provide a brief

introduction to organizational culture indicators (i.e., organizational commitment, operations interaction, formal safety system, and informal safety system).

However, perhaps because there is not a robust safety culture assessment in SAS (see Safety Assurance System Data), the training does not teach the practical *how*. Specifically, the courses do not train inspectors to answer the questions: How to assess the health of the safety culture? How to assess and record safety culture deficiencies in SAS? How to integrate safety culture as a risk indicator for RBDM, and how to mitigate any identified safety culture deficiencies?

The authors recommend that the current training be supplemented by additional hands-on curriculum for safety culture assessment, practice identifying culture indicators and recording in SAS, and guidance for integrating safety culture into RBDM and risk mitigation.

Appendix B
Proposed Response Details

The set of Proposed Response Details **utilized during the field test** is provided below. *Note.* Struck text indicates language removed from the Response Details; italicized text indicates new language added to the Response Details.

Table 9
Current and Proposed Response Details, by Safety Attribute

Safety Attribute	Current Response Detail	Proposed Response Detail
Procedures	Unclear procedure(s). Conflicting procedure(s). Used workaround(s). Skipped process step(s). Personnel failed to follow process (procedures, guidance, etc.). Procedures/guidance not available. Procedures/guidance not current. Inconsistent procedure(s). Undocumented procedure(s). Minor typographical error(s) (i.e., record entries). Information missing. Communication failure. Personnel failed to perform task. Equipment/tools not available. Equipment/tools not adequate. Equipment/tools not calibrated. Facilities not adequate. Process failed to meet desired outcome. Process oversight failure. Other.	Unclear procedure(s). Conflicting procedure(s). Used workaround(s). Personnel failed to follow process (procedures, guidance, etc.). Procedures/guidance not available. Procedures/guidance not current. Undocumented procedure(s). Minor typographical error(s) (i.e., record entries). Information missing. Communication failure. Personnel failed to perform task. Process failed to meet desired outcome. Failure to identify issues/process deficiencies in process measurements. Other.

Safety Attribute	Current Response Detail	Proposed Response Detail
Responsibility	Failed to provide financial resources. Failed to provide sufficient human resources. Individual not clearly identified. Failure to ensure safety of process. Failure to oversee operations conducted under the certificate. Failed to ensure quality performance of process. Process oversight failure. Communication failure(s). Other.	Failed to provide financial resources. Failed to provide sufficient *(adequate number, trained and qualified)* human resources. Individual not clearly identified. Failure to ensure safety of process. Failure to oversee operations conducted under the certificate. Failed to ensure quality performance of process. Communication failure(s) *laterally and/or up and down the chain of command (or equivalent).* *Failure to communicate the importance of safety (e.g., focusing on competing goals of productivity or profit).* Other.
Authority	Process oversight failure. Unacceptable safety risk acceptance. Ineffective planning of resources. Ineffective use of resources. Ineffective control of resources. Failure to implement safety risk processes. Process owner not clearly identified. Unqualified. Other.	Failure to identify issues/process deficiencies in process measurements and/or procedures. Unacceptable safety risk acceptance. Ineffective planning of resources *(e.g., workload, scheduling, pressure).* Ineffective use of resources *(e.g., money, internal and external personnel, equipment/tools, training).* *Equipment/tools are not adequate, available, or calibrated.* Procedures are *inaccurate, unclear, or otherwise not followable.* *Staffing is not adequate to perform the tasks.* Inadequate training.

Safety Attribute	Current Response Detail	Proposed Response Detail
		Facilities not adequate. Failure to ensure adequate supervision. Failure to implement safety risk processes. Process owner not clearly identified. Unqualified to make key safety risk acceptance decisions. Failed to ensure quality performance of process. Other.
Controls	Failure to identify hazards or ineffective risk controls. Failure to develop and maintain risk controls. Failure to effectively mitigate risk before applying risk controls. Risk controls ineffective. Unclear risk controls. Failure to assess risk for a new system. Failure to assess risk when revising an existing system. Failure to assess risk when developing operational procedures. Failure to maintain records of outputs of risk control assessments. Other.	Failure to identify hazards or ineffective risk controls. Failure to develop and maintain risk controls *(for new systems, revising existing systems, or developing operational procedures).* Failure to maintain records of outputs of risk control assessments. *Failure to effectively evaluate substitute/residual risk before applying risk controls.* Failure to follow risk controls *(i.e., because they are unclear, poorly communicated, burdensome, or tribal knowledge/group norms).* Risk controls are ineffective *(i.e., fail to mitigate risk).* Other.
Interfaces	Internal communication failure(s). External communication failure(s). Lack of interfaces.	Internal communication failure(s) *within a single department.* Internal communication failure(s) *between multiple departments (i.e., maintenance and flight ops).*

Safety Attribute	Current Response Detail	Proposed Response Detail
	Inconsistent interfaces. Poor coordination between departments and employees. Failure of interfaces between processes or procedures. Other.	Internal communication failure(s) *between management and employees*. External communication failure(s) *outside the organization (i.e., with contractors, FAA).* Failure of interfaces between processes or procedures. Other.
Process Measurement	Inadequate monitoring of operations processes. Ineffective evaluations of processes or systems. Undocumented or insufficient investigations. Failure to conduct audits. Ineffective audits. Failure to detect changes in the operational environment. Personnel failed to perform/follow process (procedures, guidance, etc.). Process failed to meet desired outcome. Process oversight failure. Other.	Inadequate monitoring/*evaluations* of operations processes or systems *(e.g., repeated failures not detected).* Undocumented or insufficient investigations. Failure to conduct audits. Ineffective audits. Failure to detect changes in the operational environment *(i.e., physical, regulatory, financial).* *Failure to detect personnel not following procedures/processes.* Process failed to meet desired outcome. Other.
Safety Ownership	Unaware or ~~ineffective~~ safety policies or processes. Unaware or ~~ineffective~~ safety related reporting tools. Unclear safety policy. Ineffective safety related training. Lack of safety culture. Unclear safety objectives.	*Employees are* unaware of safety policies or processes. Unclear or *ineffective* safety policy. *Unclear* or ineffective safety objectives. *Management does not communicate/demonstrate a commitment to safety.* Employees are unaware of safety related reporting tools.

Safety Attribute	Current Response Detail	Proposed Response Detail
	Other.	*Employees are unwilling to report hazards/risks/events, including unclear procedures.* *Ineffective/lack of safety programs (i.e., VDRP, ASAP)* *Ineffective/inconsistent response to reported hazard/risk/events, event investigations, and/or corrective actions (fairness/justness)* Employees failed to perform/follow process (procedures, guidance) Ineffective safety related training. *Negative/unhealthy safety culture.* Other.

Appendix C
Example Inspection Scenarios

Scenario A – High Safety Culture Concern

Inspector Boyle is assigned SP 6.0 Operations in Ground Icing for Part 135C certificate holder, KeyAir (1PHD) / 14 CFR 135 C CH at Loveland Fort Collins Airport (FNL), Loveland Colorado. FNL is KeyAir's busiest outstation. Inspector Boyle picked a day when the weather forecast was for snow that night. He arrived at 0530 to the small passenger terminal and met the customer service representative on duty that morning. After introductions, he accompanied the customer service representative to the Beechcraft King Air C90 aircraft that was parked outside overnight. Inspector Boyle noticed a layer of wet heavy snow covering the aircraft. The customer service representative was unable to start the tractor that would tow the deicing cart to the aircraft. Frustrated, the customer service representative called his manager in Denver but there was no answer. The customer service representative reported to Inspector Boyle that he asked his supervisor, the Director of Ops (DO), for a new tractor last month. The customer service representative told Inspector Boyle that he would be working this flight alone today due to the other customer service representative having called in sick.

As the customer service representative checked the passengers in, Inspector Boyle noticed the pilots walked out to the aircraft. The Captain did the preflight walk around and the second officer tried again to start the tractor with no luck. The Captain brought a ladder to the aircraft and brushed off the snow on the leading edge and middle of the wing. The King Air's right engine was started to create cabin heat and the second officer carried the baggage to the King Air and stowed it. Inspector Boyle watched as they boarded the passengers, the cabin door closed, both engines were started, and the King Air turned and taxied away. Inspector Boyle asked the customer service representative where they were going to taxi to get deiced so he could drive over and observe. The customer service representative said the Captain told him he was just going to do a very fast taxi and blow snow off the aircraft.

Inspector Boyle then interviewed the DO. The DO took the issue to the Accountable Executive (AE) in their last safety meeting, but the AE stated that they had exceeded their budget for the fiscal year and they had no money for a new tractor. The AE stated that the DO needed to figure out a way to make the old tractor work, and the DO agreed. The AE was away at this time and was not interviewed.

*Please consider that KeyAir has an operations manual and a deicing program.

Scenario B – Low Safety Culture Concern

Inspector Smith was observing maintenance being conducted at an outstation in Green Bay for operator XXXA. Maintenance personnel were replacing a starter generator on the aircraft. Inspector Smith reviewed the maintenance manual procedures, which stated that the v-clamp for the starter generator attachment should be torqued to 85 inch pounds. Inspector Smith asked to see the torque wrench used for the v-clamp, and it was revealed that the company personnel did not have the necessary torque wrench available. They went to a maintenance facility at the airport, acquired the appropriate torque wrench, and torqued the v-clamp using the proper procedures. No other issues occurred during the rest of this inspection.

Appendix D
Phase 2 Questionnaires

Demographic Questions

Participants were asked to respond for each of the following question prompts:

1. Are you part of a:
    - FSDO
    - CMO
    - CMU
2. Please identify your job role:
    - PMI
    - POI
    - PAI
    - Assistant PMI
    - Assistant POI
    - Assistant PAI
    - Other (please specify)
3. Please indicate the number of years you have been with FAA:
    - [Dropdown menu to choose 1-50 years]
4. Please indicate the number of years you have been in your current role:
    - [Dropdown menu to choose 1-50 years]
5. Please identify the types of certificates you oversee (mark all that apply):
    - 121
    - 135
    - 145
    - Other (please specify)
6. Please indicate the number of certificates you oversee:
    - [Dropdown menu to choose 1-100 certificates]
7. Please indicate which facility location you work for:
    - [Text response]

Baseline Survey Questions

Participants were asked to respond to each of the following question prompts:

1. Are you concerned about the safety culture of the certificate holders you oversee?

    - [Rating on a 1 (not at all concerned) - 10 (extremely concerned) scale]
2. Please rate the percentage of certificate holders you oversee that have concerning safety cultures.
    - [Slider bar (visual analog scale) response, anchored with the prompts, "no certificate holders I oversee" and "all certificate holders I oversee."]
3. How important is it to assess certificate holders' safety culture?
    - [Rating on a 1 (not at all important) – 10 (extremely important) scale]
4. How is FAA currently assessing and recording safety culture concerns?
    - [Text response]
5. Please describe benefits and drawbacks (pros and cons) with the current methods for assessing safety culture in SAS.
    - [Text response]
6. What information would you gather to evaluate certificate holders' safety culture?
    - [Text response]
7. What cues/indicators can signal a strong safety culture?
    - [Text response]
8. What cues/indicators can signal a weak safety culture?
    - [Text response]

Usability Questions

Participants were asked to rate their agreement with the following statements regarding the Proposed Response Details on a 1 (strongly disagree) – 5 (strongly agree) scale:

1. I thought the new list was easy to use.
2. I think I would like to use the new list frequently.
3. I found the new list unnecessarily complex.
4. I believe that most people would learn to use the new list quickly.
5. I felt confident using the new list.
6. I needed to learn many things before I could get going with the new list.
7. I thought there was too much inconsistency between what is in the new list and the real world.
8. Using the new list, I was able to accomplish my assigned tasks.
9. I think I could become good at using the new list.
10. The new list correctly understood and responded to my commands.
11. The new list enhanced my understanding of how to assess safety culture.

12. I found the new list could be well-integrated into the Safety Assurance System software.
13. The new list would improve my work performance (e.g., accuracy, error-free).
14. The new list would increase work productivity.
15. The new list would make it easier to perform my task.
16. I feel positively toward the new list.
17. I intend to be a frequent user of the new list.
18. I feel confident finding information in the new list.
19. I have the necessary skills for using the new list.
20. Participants were asked to compare the Proposed Response Details to the current SAS:
21. Please rate how the new list of SAS Response Details for safety culture compares to the current assessment methods in SAS.
22. [Rating on a 5-point scale from “much worse” to “much better”]
23. Please describe the benefits and drawbacks (pros and cons) of using the new list of SAS Response Details to assess safety culture.
24. [Text response]
25. Please provide any recommendations to improve the new list of SAS Response Details.
26. [Text response]
27. Please provide any recommendations to improve the new list of SAS Response Details.
28. [Text response]

Appendix E
Inspector Selections of Response Details

For each Response Detail and at each Scenario level of concern, note the difference in percent selected between Current and Proposed. Note, dashes in the tables indicate where the Response Detail was not presented.

Table 10
Response Details Selected for the Procedures Safety Attribute

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
Communication failure.	11%	7%	8%	5%	11%	0%
Conflicting procedure(s).	0%	0%	0%	0%	0%	0%
Equipment/tools not adequate.	28%	-	0%	-	21%	-
Equipment/tools not available.	11%	-	0%	-	37%	-
Equipment/tools not calibrated.	50%	-	0%	-	0%	-
Facilities not adequate.	6%	33%	0%	0%	5%	0%
Failure to identify issues/process deficiencies in process measurements.	-	47%	-	14%	-	7%
Inconsistent procedure(s).	0%	-	0%	-	5%	-
Information missing.	6%	0%	0%	0%	0%	0%
Minor typographical error(s) (i.e., record entries).	0%	0%	0%	0%	0%	0%
Personnel failed to follow process	72%	80%	92%	100%	47%	43%

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
(procedures, guidance, etc.).						
Personnel failed to perform task.	39%	47%	42%	43%	5%	14%
Procedures/guidance not available.	0%	0%	8%	0%	0%	0%
Procedures/guidance not current.	6%	7%	0%	0%	0%	0%
Process failed to meet desired outcome.	44%	53%	42%	33%	5%	14%
Process oversight failure.	28%	-	33%	-	16%	-
Skipped process step(s).	11%	-	50%	-	5%	-
Unclear procedure(s).	17%	7%	0%	0%	0%	0%
Undocumented procedure(s).	0%	0%	8%	10%	5%	0%
Used workaround(s).	0%	20%	0%	24%	5%	0%

Table 11
Response Details Selected for the Controls Safety Attribute

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
Failure to assess risk for a new system.	17%	-	8%	-	0%	-
Failure to assess risk when developing operational procedures.	6%	-	8%	-	21%	-

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
Failure to assess risk when revising an existing system.	22%	-	0%	-	0%	-
Failure to develop and maintain risk controls.	50%	-	17%	-	21%	-
Failure to develop and maintain risk controls (for new systems, revising existing systems, or developing operational procedures).	-	47%	-	19%	-	0%
Failure to effectively evaluate substitute/residual risk before applying risk controls.	-	0%	-	14%	-	7%
Failure to effectively mitigate risk before applying risk controls.	28%	-	0%	-	5%	-
Failure to follow risk controls (i.e., because they are unclear, poorly communicated, burdensome, or tribal knowledge/group norms).	-	40%	-	29%	-	14%
Failure to identify hazards or ineffective risk controls.	50%	53%	50%	48%	21%	36%
Failure to maintain records of outputs of risk control assessments.	0%	7%	8%	14%	11%	0%

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
Risk controls are ineffective (i.e., fail to mitigate risk).	-	67%	-	43%	-	14%
Risk controls ineffective.	39%	-	33%	-	11%	-
Unclear risk controls.	6%	-	8%	-	0%	-

Table 12

Response Details Selected for the Interface Safety Attribute

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
External communication failure(s).	0%	-	8%	-	0%	-
External communication failure(s) outside the organization (i.e., with contractors, FAA).	-	7%	-	5%	-	0%
Failure of interfaces between processes or procedures.	6%	60%	33%	24%	11%	21%
Inconsistent interfaces.	6%	-	33%	-	5%	-
Internal communication failure(s).	61%	-	58%	-	16%	-
Internal communication failure(s) between management and employees.	-	80%	-	14%	-	7%

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
Internal communication failure(s) between multiple departments (i.e., maintenance and flight ops).	-	53%	-	48%	-	14%
Internal communication failure(s) within a single department.	-	13%	-	19%	-	7%
Lack of interfaces.	11%	-	42%	-	5%	-
Poor coordination between departments and employees.	61%	-	25%	-	26%	-

Table 13

Response Details Selected for the Responsibility Safety Attribute

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
Communication failure(s).	28%	-	25%	-	5%	-
Communication failure(s) laterally and/or up and down the chain of command (or equivalent).	-	53%	-	5%	-	14%
Failed to ensure quality performance of process.	50%	53%	17%	19%	5%	14%
Failed to provide financial resources.	94%	93%	8%	10%	11%	7%

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
Failed to provide sufficient (adequate number, trained and qualified) human resources.	-	47%	-	10%	-	0%
Failed to provide sufficient human resources.	44%	-	0%	-	0%	-
Failure to communicate the importance of safety (e.g., focusing on competing goals of productivity or profit).	-	60%	-	14%	-	7%
Failure to ensure safety of process.	39%	67%	25%	19%	21%	14%
Failure to oversee operations conducted under the certificate.	11%	33%	8%	10%	11%	14%
Individual not clearly identified.	0%	0%	0%	5%	5%	0%
Process oversight failure.	28%	-	33%	-	16%	-

Table 14
Response Details Selected for the Authority Safety Attribute

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
Equipment/tools are not adequate, available, or calibrated.	-	60%	-	10%	-	29%
Facilities not adequate.	6%	33%	0%	0%	5%	0%
Failed to ensure quality performance of process.	50%	53%	17%	19%	5%	14%
Failure to ensure adequate supervision.	-	20%	-	10%	-	14%
Failure to identify issues/process deficiencies in process measurements and/or procedures.	-	47%	-	19%	-	21%
Failure to implement safety risk processes.	17%	40%	8%	14%	16%	7%
Inadequate training.	-	7%	-	19%	-	7%
Ineffective control of resources.	28%	-	8%	-	5%	-
Ineffective planning of resources.	39%	-	0%	-	42%	-
Ineffective planning of resources (e.g., workload, scheduling, pressure).	-	47%	-	10%	-	7%
Ineffective use of resources.	11%	-	0%	-	0%	-
Ineffective use of resources (e.g., money, internal and external	-	53%	-	5%	-	14%

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
personnel, equipment/tools, training).						
Procedures are inaccurate, unclear, or otherwise not followable.	-	20%	-	5%	-	0%
Process oversight failure.	28%	#N/A	33%	-	16%	-
Process owner not clearly identified.	6%	7%	8%	10%	5%	0%
Staffing is not adequate to perform the tasks.	-	47%	-	10%	-	0%
Unacceptable safety risk acceptance.	67%	60%	17%	24%	16%	7%
Unqualified.	6%	-	0%	-	0%	-
Unqualified to make key safety risk acceptance decisions.	-	7%	-	10%	-	0%

Table 15

Response Details Selected for the Process Measurement Safety Attribute

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
Failure to conduct audits.	11%	27%	8%	10%	16%	7%
Failure to detect changes in the	17%	-	0%	-	0%	-

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
operational environment.						
Failure to detect changes in the operational environment (i.e., physical, regulatory, financial).	-	47%	-	5%	-	0%
Failure to detect personnel not following procedures/processes.	-	33%	-	33%	-	14%
Inadequate monitoring of operations processes.	22%	-	58%	-	21%	-
Inadequate monitoring/evaluations of operations processes or systems (e.g., repeated failures not detected).	-	40%	-	38%	-	21%
Ineffective audits.	11%	20%	8%	5%	5%	14%
Ineffective evaluations of processes or systems.	17%	-	8%	-	11%	-
Personnel failed to perform/follow process (procedures, guidance, etc.).	11%	-	25%	-	16%	-
Process failed to meet desired outcome.	44%	53%	42%	33%	5%	14%
Process oversight failure.	28%	-	33%	-	16%	-

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
Undocumented or insufficient investigations.	11%	7%	8%	5%	5%	0%

Table 16

Response Details Selected for the Safety Ownership Safety Attribute

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
Employees are unaware of safety policies or processes.	-	20%	-	10%	-	14%
Employees are unaware of safety related reporting tools.	-	33%	-	5%	-	14%
Employees are unwilling to report hazards/risks/events, including unclear procedures.	-	13%	-	14%	-	21%
Employees failed to perform/follow process (procedures, guidance).	-	60%	-	52%	-	29%
Ineffective safety related training.	11%	33%	0%	14%	11%	7%
Ineffective/ inconsistent response to reported hazard/risk/events,	-	47%	-	0%	-	7%

	Inspectors Selecting Response Detail for Scenario (%)					
	High Concern		Medium Concern		Low Concern	
Response Detail	Current	Proposed	Current	Proposed	Current	Proposed
event investigations, and/or corrective actions (fairness/justness).						
Ineffective/lack of safety programs (i.e., VDRP, ASAP).	-	53%	-	5%	-	0%
Lack of safety culture.	56%	-	17%	-	21%	-
Management does not communicate/demonstrate a commitment to safety.	-	87%	-	19%	-	21%
Negative/unhealthy safety culture.	-	33%	-	14%	-	14%
Unaware or ineffective safety policies or processes.	11%	-	50%	-	26%	-
Unaware or ineffective safety related reporting tools.	11%	-	8%	-	26%	-
Unclear or ineffective safety objectives.	-	40%	-	10%	-	21%
Unclear or ineffective safety policy.	-	33%	-	10%	-	14%
Unclear safety objectives.	6%	-	8%	-	5%	-
Unclear safety policy.	6%	-	0%	-	5%	-

Appendix F
Finalized Response Details

Black text denotes Current Response Details. Italicized text denotes Proposed Response Details. Response Details that are highly related to culture are denoted with an asterisk (*). Contributing factors to noncompliance with procedures are marked with a caret (^); there is often a cultural/normative contribution to procedural noncompliance.

Table 17
Procedures Attribute Comparison

DCT example question: Did the certificate holder meet its regulatory and guidance requirements for ____ Process?

Current Response Details	Proposed Response Details
• Unclear procedure(s). • Conflicting procedure(s). • Used workaround(s). • Skipped process step(s). • Personnel failed to follow process (procedures, guidance, etc.). • Procedures/guidance not available. • Procedures/guidance not current. • Inconsistent procedure(s). • Undocumented procedure(s). • Minor typographical error(s) (i.e., record entries). • Information missing. • Communication failure. • Personnel failed to perform task. • Equipment/tools not available. • Equipment/tools not adequate. • Equipment/tools not calibrated. • Facilities not adequate. • Process failed to meet desired outcome. • Process oversight failure.	• *Procedures/guidance are not current, inaccurate, unclear, conflicting, or otherwise not followable.^* • Personnel failed to follow process (procedures, guidance, etc.). • Procedures/guidance not available. • Undocumented procedure(s). • Minor typographical error(s) (i.e., record entries). • Information missing. • Communication failure. • Personnel failed to perform task. • Process failed to meet desired outcome. • Other.

Current Response Details	Proposed Response Details
• Other.	

Table 18
Responsibility Attribute Comparison

DCT example question: Were financial and human resources provided to ensure the safety and quality performance for the ____ processes?

Current Response Details	Proposed Response Details
• Failed to provide financial resources. • Failed to provide sufficient human resources. • Individual not clearly identified. • Failure to ensure safety of process. • Failure to oversee operations conducted under the certificate. • Failed to ensure quality performance of process. • Process oversight failure. • Communication failure(s). • Other.	• *Failure to communicate the importance of safety (e.g., focusing on competing goals of productivity or profit).* *^ • Failed to provide sufficient *(adequate number, trained and qualified)* human resources.^ • Failed to provide financial resources. • Individual not clearly identified. • Failure to ensure safety of process. • Failure to oversee operations conducted under the certificate. • Failed to ensure quality performance of process. • Communication failure(s) *laterally and/or up and down the chain of command (or equivalent).* • Other.

Table 19
Authority Attribute Comparison

DCT example question: Did the person with authority over the certificate holder's ____ process effectively plan, direct, control, or change procedures, and make key determinations, including safety risk acceptance decisions?

Current Response Details	Proposed Response Details
• Process oversight failure. • Unacceptable safety risk acceptance. • Ineffective planning of resources. • Ineffective use of resources. • Ineffective control of resources. • Failure to implement safety risk processes. • Process owner not clearly identified. • Unqualified. • Other.	• Unacceptable safety risk acceptance.* • *Failure to ensure adequate supervision* (including reward safe behavior and correct unsafe behavior).* • *Leadership ignores/ do not address procedural deviations or unsafe behavior.*^* • *Failure to prioritize safety over competing demands / failure to manage mission pressure*.* • *Process owner authorities, roles, and responsibilities not clearly defined or understood.** • *Tension or lack of mutual trust and respect between management and workforce.** • *Tension between company and regulator.** • *Corrective actions focus on individuals rather than root cause/systemic process improvements.** • Ineffective planning of resources *(e.g., staffing, workload, scheduling, pressure, frequent instances where tasks were not completed on time).*^ • Ineffective use of resources *(e.g., money, internal and external personnel, equipment/tools, training).**^

Current Response Details	Proposed Response Details
	• Equipment/tools are not adequate, available, or calibrated. • *Inadequate training (e.g., not effective, current/updated, or relevant).* • *Facilities not adequate.* • Failure to implement safety risk processes. • Process owner not clearly identified. • *Unqualified to make key safety risk acceptance decisions.* • Failed to ensure quality performance of process. • Other.

Table 20
Controls Attribute Comparison

DCT example question: Did the certificate holder's controls effectively mitigate unacceptable levels of risk(s) for the____ processes?

Current Response Details	Proposed Response Details
• Failure to identify hazards or ineffective risk controls. • Failure to develop and maintain risk controls. • Failure to effectively mitigate risk before applying risk controls. • Risk controls ineffective. • Unclear risk controls. • Failure to assess risk for a new system. • Failure to assess risk when revising an existing system.	• Failure to develop and maintain risk controls *(for new systems, revising existing systems, or developing operational procedures).* ***** • Failure to follow risk controls *(i.e., because they are unclear, poorly communicated, burdensome, or tribal knowledge/group norms).*^ • *Communication failure (e.g., between management and employees; between departments; within a department).*^ • Failure to identify hazards or ineffective risk controls.

Current Response Details	Proposed Response Details
• Failure to assess risk when developing operational procedures. • Failure to maintain records of outputs of risk control assessments. • Other.	• Failure to maintain records of outputs of risk control assessments. • *Failure to effectively evaluate substitute/residual risk before applying risk controls.* • Risk controls are ineffective *(i.e., fail to mitigate risk).* • Other.

Table 21
Interfaces Attribute Comparison

DCT example question: Did the certificate holder's ____ process ensure consistency of related processes between departments and employees (interfaces)?

Current Response Details	Proposed Response Details
• Internal communication failure(s). • External communication failure(s). • Lack of interfaces. • Inconsistent interfaces. • Poor coordination between departments and employees. • Failure of interfaces between processes or procedures. • Other.	• Failure of interfaces between processes or procedures.^ • Internal communication failure(s) *within a single department.* • Internal communication failure(s) *between multiple departments (i.e., maintenance and flight ops).* • Internal communication failure(s) *between management and employees.* • External communication failure(s) *outside the organization (i.e., with contractors, FAA).* • Other.

Table 22
Process Measurement Attribute Comparison

DCT example question: Were the certificate holder's process measurement(s) used to evaluate the performance of the ____ processes and if necessary, implement corrective action?

Current Response Details	Proposed Response Details
• Inadequate monitoring of operations processes. • Ineffective evaluations of processes or systems. • Undocumented or insufficient investigations. • Failure to conduct audits. • Ineffective audits. • Failure to detect changes in the operational environment. • Personnel failed to perform/follow process (procedures, guidance, etc.). • Process failed to meet desired outcome. • Process oversight failure. • Other.	• Failure to detect personnel not following procedures/processes.^ • Inadequate monitoring/evaluations of *new or existing* operations processes or systems *(e.g., repeated failures not detected).* • Undocumented or insufficient investigations. • Failure to conduct audits. • Ineffective audits. • Failure to detect changes in the operational environment *(i.e., physical, regulatory, financial).* • Failure to identify issues/process deficiencies in process measurements and/or procedures. • Process failed to meet desired outcome. • Inadequate data acquisition. • Other.

Table 23
Safety Ownership Attribute Comparison

Current Response Details	Proposed Response Details
• Unaware or ineffective safety policies or processes. • Unaware or ineffective safety related reporting tools. • Unclear safety policy. • Ineffective safety related training. • Lack of safety culture. • Unclear safety objectives. • Other.	• *Management does not communicate/demonstrate a commitment to safety (negative/unhealthy safety culture).**^ • *Employees are unwilling to report hazards/risks/events, including unclear procedures.**^ • *Ineffective/lack of safety programs (i.e., VDRP, ASAP).** • *Ineffective/inconsistent response to reported hazard/risk/events, event investigations, and/or corrective actions (fairness/justness).** • *Employees are* unaware of safety policies or processes. • Unclear *or ineffective* safety policy. • *Unclear* or ineffective safety objectives. • Employees are unaware of safety related reporting tools. • Lack of confidential/voluntary employee reporting tools. • Ineffective safety related training. • Other.