JPDO Paper

Safety Culture Improvement Resource Guide

Paper No.: 08-010 **July 30, 2008**

Prepared by: Joint Planning and Development Office (JPDO), Safety Working Group

This Safety Culture Improvement Resource Guide explains the underlying concepts and the importance of establishing a strong safety culture. This resource guide also provides practical tools for improving safety culture within aviation organizations. Emphasis is placed on fostering an atmosphere of trust, and on improving communication among employees, and between employees and management.

This document was written by the JPDO Safety Working Group's Safety Culture Study Team. The study team is made up of representatives from the JPDO government partners and the aviation industry, as well as aviation safety academic subject matter experts. The team also gathered practical source material from over 20 industry stakeholders and government organizations from around the world for this guide. These organizations contributed valuable information about some of their most effective practices, which were used to help formulate recommendations for strengthening organizational safety culture.

The aviation industry has an opportunity to create and sustain a strong and positive safety culture that will serve as the foundation for building a successful Safety Management System (SMS). These steps will enable the safe implementation of the operational concepts needed for the transition to the Next Generation Air Transportation System (NextGen). This guide is not a mandatory implementation plan, but serves as a supplemental resource to the JPDO SMS Standard. Each JPDO government partner can use the contents of this guide to help develop a tailored approach that is suited to its own organizational structure.

This resource guide will be maintained, reviewed, and updated as necessary by the Safety Culture Study Team. This will help to align the appropriate safety focus with the most current data, and identify and assess the most effective approaches towards safety culture improvement.

TABLE OF CONTENTS

1. BACKGROUND AND PURPOSE 1

2. SCOPE AND LIMITATIONS 3

2.1 ASSUMPTIONS 3
2.2 LIMITATIONS 3

3. INTRODUCTION TO SAFETY CULTURE 5

3.1 DEFINITIONS OF SAFETY CULTURE 5
3.2 COMPONENTS OF A HEALTHY SAFETY CULTURE 8
3.2.1 Reporting Culture 9
3.2.2 Just Culture 9
3.2.3 Flexible Culture 9
3.2.4 Learning Culture 10
3.2.5 Informed Culture 10

4. UNDERSTANDING THE CURRENT AVIATION SAFETY CULTURE 12

4.1 SAFETY CULTURE MEASUREMENT 12

5. DESIRED SAFETY CULTURE AND STRATEGY FOR CHANGE 14

5.1 CULTURE OBJECTIVE FOR THE AIR TRANSPORTATION SYSTEM IN 2025. 14
5.2 TOOLS TO ASSESS SAFETY CLIMATE 15
5.2.1 Surveys 15
5.2.2 Workshops 17
5.3 TOOLS TO IMPROVE SAFETY CULTURE 19
5.3.1 Training 19
5.3.2 Use of an Ombudsman 19
5.3.3 Inclusion of Safety in Annual Performance Assessment 19
5.3.4 Rewards and Recognition for Safety 20

6. ONGOING MONITORING AND ASSESSMENT 21

7. RECOMMENDATIONS AND SUMMARY 22

APPENDIX A EXAMPLES OF THE CORRELATION BETWEEN ORGANIZATIONAL CULTURE AND SAFETY
APPENDIX B OBJECTIVE CRITERIA FOR SAFETY CULTURE ASSESSMENT
APPENDIX C EXISTING AVIATION INFORMATION-SHARING PROGRAMS
APPENDIX D ADVANCED QUALIFICATION PROGRAM (AQP)
APPENDIX E FAA/ATO SAFETY CULTURE / SAFETY CLIMATE SURVEY
APPENDIX F DEPARTMENT OF THE NAVY CULTURE WORKSHOP
APPENDIX G FAA SAFETY CULTURE ENHANCEMENT ACTIVITIES
APPENDIX H REFERENCES
APPENDIX I ACRONYMS

1. BACKGROUND AND PURPOSE

The Joint Planning and Development Office (JPDO) was created in 2004 and tasked with producing an integrated plan for safely implementing the Next Generation Air Transportation System (NextGen), which must be capable of accommodating a threefold increase in air traffic. If the rate of accidents remains proportional to departures as the amount of air traffic increases, a correspondingly greater number of accidents will occur. This is unacceptable. The success of NextGen relies on improvements to the safety of the air transportation system. Factors such as globalization, traffic complexity, business models, public expectations for safety, and funding will require significant changes to the system and corresponding safety measures.

As documented in the Next Generation Air Transportation System Integrated Plan, one mission of the JPDO Safety Working Group (WG) (formerly the Safety Integrated Product Team) is to "establish and track a safety improvement culture where safety and its continuous improvement are seen as the primary goals" (29). The Safety WG is also tasked with creating a comprehensive and proactive safety management approach for NextGen, an important element of which is establishing a standard Safety Management System (SMS) for use by all JPDO partner departments and agencies, and other stakeholders. Recognizing the need for a strong safety culture, which will enable the full implementation of an SMS, the proposed SMS requires organizations to "promote the growth of a positive safety culture" and defines safety culture as:

> the product of individual and group values, attitudes, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, the organization's management of safety. Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measures (Draft SMS Standard 4).

The proposed SMS also incorporates safety promotion activities.

Currently available data from organizations such as the Health and Safety Laboratory and experts like Manoj S. Patankar strongly support the link between safety culture and occupational safety. Case studies of several companies with leading occupational safety records show that they exhibit values, attitudes, competencies, and a corporate culture that promote safety. However, there are differences between occupational safety and system safety, and these should be considered when evaluating the implementation of NextGen. Some of these differences are highlighted in the report of a panel that investigated the 2005 BP oil refinery accident in Texas City, Texas. The report noted that a false sense of security can be generated by relying on occupational safety metrics as the main source of safety data; these metrics alone may not indicate the likelihood of major accidents.

Nonetheless, safety culture is important to improving the safety of Air Traffic Control (ATC) systems and operations. The link between safety culture and safety has been documented in several studies of air traffic service providers (Gordon 29). Studies of military aviation also indicate a correlation between higher safety culture scores and better safety records (Adamshick 276) (see Appendix A). The appendices contain references to additional published studies that suggest a relationship between improved safety performance and a strong safety culture.

This document provides the JPDO partner departments and agencies with information and guidance on improving their organizational safety cultures. It is based on the assumption that a strong safety culture will enable the successful implementation of an SMS and the achievement of high safety performance for NextGen.

2. SCOPE AND LIMITATIONS

This document provides the background, tools, and recommendations for strengthening the safety cultures in JPDO partner departments and agencies (including oversight organizations). It includes recommendations and identifies tools that will provide the foundation for safety improvements for NextGen. However, this document is not a mandatory implementation plan. Each JPDO partner department or agency is responsible for developing its own plan for implementing safety culture improvements, including allocating appropriate resources, tailoring the guidance and recommendations contained in this document, and providing tools to assist stakeholders in strengthening their own safety culture.

As individual agency plans are implemented, lessons learned and best practices will emerge. Sharing lessons and incorporating best practices will improve all agency safety plans. Data and lessons learned from early practitioners of safety culture improvement processes, such as commercial aviation and the military, should be shared with stakeholders, such as General Aviation (GA), for whom stronger safety records are key to the overall improvement of NextGen safety. Although GA faces a somewhat different safety culture challenge than does a large organization, some elements of a strong safety culture are universal. As larger organizations demonstrate the benefits of an improved safety culture, GA can tailor the principles to smaller operations.

2.1 ASSUMPTIONS

This guide is based on the following assumptions:

1. If the rate of accidents remains proportional to departures as the amount of air traffic increases, a correspondingly greater number of accidents will occur. This is considered unacceptable. Therefore, the air transportation system must become safer.
2. Strengthening the safety culture of air transportation services and equipment providers will lead to improvements in safety performance, enabling the reduction of accident rates and the public acceptance of NextGen.
3. The current ATC system is not capable of handling a threefold increase in air traffic. To support the expected increase in air travel, the JPDO and participating agencies will need to adopt and incorporate new strategies, technologies, and practices.
4. The Safety WG will develop national-level standards for implementing an SMS. The SMS will be scalable to accommodate operators and service providers of different sizes and levels of complexity.
5. Each JPDO partner deparment or agency will be responsible for developing detailed guidance and implementing its own SMS, in accordance with SMS standards.
6. A strong safety culture will enable the success of full SMS implementation. This guide will serve as non-mandatory guidance that the agencies may use in developing their SMS implementation plans.

2.2 LIMITATIONS

The following considerations may limit the effectiveness of the Safety Culture Improvement Resource Guide within the aviation community:

1. The Safety WG will be unable to ensure compliance to SMS standards unless a new national policy is developed. While many of the issues that arise can be resolved by a

single agency, a policy defining how the agencies work together is necessary. This policy should define who has the authority to resolve inconsistencies that affect aviation safety, such as the need to share safety data versus the need to protect proprietary information.

2. There is disagreement on the definition, use, and value of safety metrics. Consensus will be needed to measure the value of safety culture improvement efforts. However, a lack of flexibility in choosing the appropriate metrics could also be a limitation.
3. In the safety culture community, there is no agreement on a working definition of safety culture. The solution may be to emphasize safety within an organization's culture by encouraging behaviors and practices that most effectively support safety.
4. Initially, there will be a lack of data to evaluate the existing safety culture of each agency and stakeholder.
5. It is not possible to foresee all the organizational changes and associated risks that may exist during and after the transition to NextGen. This guide provides some suggestions for improving safety culture, but they may have a limited impact on the organization as the structure changes.
6. While data linking strong safety cultures with improved employee health and safety exist, as shown by a reduction in occupational injuries (see Appendix A), demonstrating the correlation between safety culture and system safety is more complex. More research is required since the safety culture elements required to improve employee safety may not be the same as those needed for system or process safety.

3. INTRODUCTION TO SAFETY CULTURE

The notion of using organizational culture as a management tool gained wide acceptance in the 1980s. Following the Chernobyl nuclear power plant catastrophe in 1986, there was a widespread realization that organizational culture is a key factor in safety and that fostering one that supports safety can help reduce the number of accidents that occur in complex systems and organizations. This led to the common use of the term "safety culture."

Studies of several high-profile accidents conducted over the past few years identified poor safety culture as a contributing factor to the accidents. One telling example is the investigation of the March 23, 2005, Texas City refinery accident. An independent review panel urged companies to "regularly and thoroughly evaluate their safety culture, the performance of their process SMSs, and their corporate safety oversight for possible improvements" (Baker i). More and more frequently, investigations probe beyond specific technical failings to identify underlying organizational weaknesses that contribute to accidents, such as a poor safety culture.

3.1 DEFINITIONS OF SAFETY CULTURE

It is important to consider what safety culture is and why it is important to aviation. There are many different definitions of safety culture (see Table 3.1-1). The definition developed by the United Kingdom Health and Safety Commission has been adopted by the Federal Aviation Administration (FAA) Air Traffic Organization (ATO) and is included in the proposed SMS Standard. However, this guide incorporates elements and ideas from other definitions, which are also included in Table 3.1-1.

It is useful to distinguish between "safety culture" and "safety climate." Weigmann defines safety climate as "the temporal state measure of safety culture, subject to commonalities among individual perceptions of the organization. It is therefore situationally based, refers to the perceived state of safety at a particular place at a particular time, is relatively unstable, and subject to change depending on the features of the current environment or prevailing conditions" (10). In other words, safety culture is the measure of the common perception of the importance of safety in an organization at a given point in time. Because safety climate is less enduring and more amenable to change than is safety culture, *measuring and assessing the safety climate* is a valuable step in reaching the long-term objective of *understanding and shaping the safety culture*.

Source	Definition	Comment
United Kingdom Health and Safety Commission	"… the product of individual and group values, attitudes, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety programs. Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measures."	Used in the proposed JPDO SMS Standard and by the FAA's ATO. Within the ATO, describes safe provision of air navigation services, not personnel safety.
James Reason	Equivalent to an informed culture, which comprises four key concepts: reporting culture, just culture, flexible culture, and learning culture (described in section 3.2).	Emphasizes the importance of an effective safety information system.
Hui Zhang, et al.	"... the enduring value and priority placed on worker and public safety by everyone in every group at every level of an organization. It refers to the extent to which individuals and groups will commit to personal responsibility for safety, act to preserve, enhance and communicate safety concerns, strive to actively learn, adapt and modify (both individual and organizational) behavior based on lessons learned from mistakes, and be rewarded in a manner consistent with these values."	
Manoj S. Patankar	"*Safety Culture* represents environmental and psychosocial factors that influence attitudes and behaviors, which impact risk and performance in high-consequence systems."	
Tom Garcia, Culture Dynamics	"A culture of safety is accomplished through effective communication, programs and operations which achieve the goal of continually redefining excellence. Both leadership and employees target hazards and potential hazards with a focus on solutions rather than blame."	
International Atomic Energy Agency	"… that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance."	Followed the Chernobyl accident. Limited to the nuclear industry. Defines safety culture solely in terms of the desired end state.

Table 3.1-1: Definitions of a Safety Culture

Source	Definition	Comment
FAA ATO	"The personal dedication and accountability of individuals engaged in an activity that has a bearing on the safe provision of air traffic services."	Appears in FAA JO 1000.37, Safety Management System
FAA Safety Risk Management Guidance for System Acquisitions	"… a pervasive emphasis on safety that promotes an inherently questioning attitude, resistance to complacency, a commitment to excellence, and the fostering of personal accountability and corporate self-regulation in safety matters."	
FAA Aircraft Certification Service, Safety Management Master Plan	"An organization with a safety culture takes as an overriding priority that safety issues receive the attention warranted by their significance. It is evident when people recognize and act on their individual responsibility for safety, and actively support the organization's processes for managing safety."	
FAA Air Traffic Safety Oversight Service, Safety Oversight Circular 08-06, October 1, 2007	"The product of individual and group values, attitudes, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management. In addition, the four key components of a safety culture are reporting culture (encourage employees to divulge information about all hazards that they encounter), just culture (employees are held accountable for deliberate violations of the rules but are encouraged and rewarded for providing essential safety-related information), flexible culture (to adapt effectively to changing demands and allow quicker, smoother reactions to off-nominal events), and learning culture (willing to change based on safety indicators and hazards uncovered through assessments, data, and incidents)."	Combines United Kingdom Health and Safety definition with Reason's four key components.

Table 3.1-1: Definitions of Safety Culture

3.2 COMPONENTS OF A HEALTHY SAFETY CULTURE

The ultimate objective of a strong safety culture is to prevent accidents. Several researchers (Reason, Weigmann, and Zhang) have noted that as the contribution of technical failures to accidents decreases, the relative importance of the human element, including organizational factors, increases. Reason stresses that limiting organizational accidents requires an "informed culture," which he equates to a positive safety culture that effectively shares information throughout the organization and actively seeks maximum safety (196). In Reason's model, an informed culture contains the four sub-cultures described below and pictured in Figure 3.2-1.

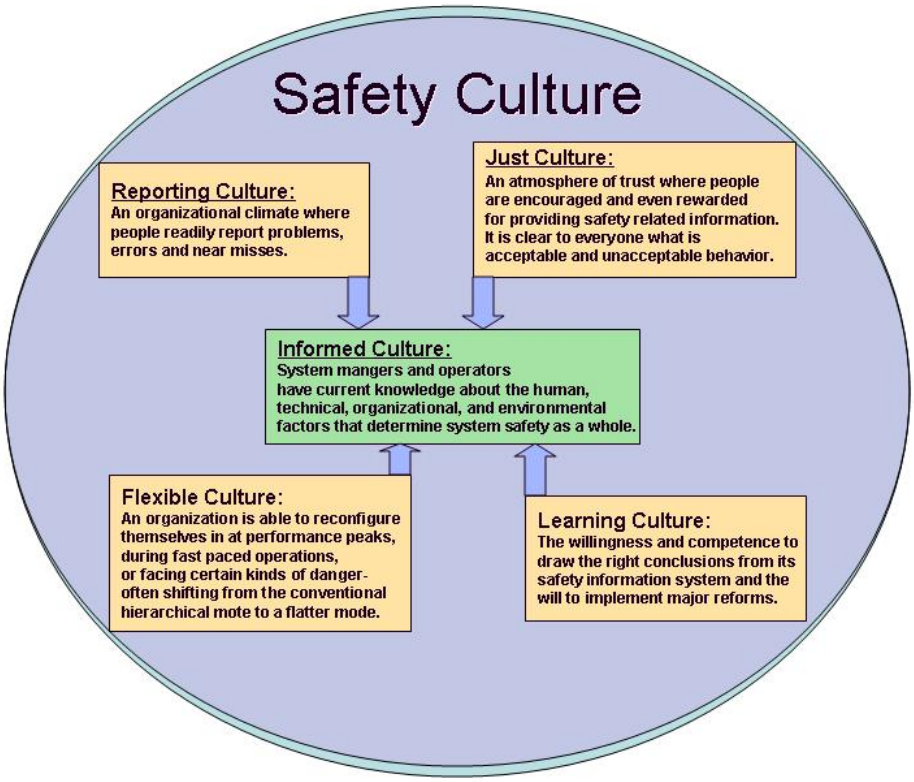

Figure 3.2-1: Components of a Healthy Safety Culture

3.2.1 Reporting Culture

A positive "reporting culture" helps mitigate errors by encouraging employees to divulge information about hazards or safety concerns that they encounter. Reason describes (197) five important factors in determining the quantity and quality of incident reports:

- Protection from disciplinary proceedings
- Confidentiality or de-identification
- The separation of the agency or department that collects and analyzes the reports from those with the authority to discipline
- Rapid, useful, accessible, and intelligible feedback to the reporting community
- Ease of reporting

3.2.2 Just Culture

Norman identifies a problem that hampers improvements to organizational safety:

> People make errors, which lead to accidents. Accidents lead to deaths. The standard solution is to blame the people involved. If we find out who made the errors and punish them, we solve the problem, right? Wrong. The problem is seldom the fault of an individual; it is the fault of the system. Change the people without changing the system and the problems will continue (9).

Following an incident or accident, a poor safety culture may assign blame to the individual responsible for the last action prior to the problem. Such a culture discourages the reporting of unsafe conditions and cooperation with incident investigation.

The healthy alternative to a "blaming culture" is a "just culture," in which employees are held accountable for deliberate violations of the rules but are encouraged and rewarded for providing essential safety-related information. A just culture does not tolerate reckless behavior or deliberate malfeasance. Reason identifies the three elements of a just culture as intention, action, and consequences (205). There must be an atmosphere of trust, which is the single most important element in guaranteeing meaningful reporting. Trust is achieved through either negotiated agreements or faith. There must also be a clear line between acceptable and unacceptable behavior and a well-defined process for dealing with rule violations. This process may include the use of a decision tree, such as the one provided by Reason (see Figure 3.2-2), to determine the intent of an employee who has committed an unsafe act (209).

3.2.3 Flexible Culture

Many organizations in highly-regulated industries operate using strictly defined processes for handling operations and incidents. These Standard Operating Procedures (SOPs) include clear lines of authority and responsibility at local, regional, and national levels; some SOPs leave little room for flexibility and adaptability during non-nominal situations and events. To adapt effectively to changing demands, an organization must foster a "flexible culture" that allows quick, smooth reactions to non-nominal events. A flexible culture allows all employees to question procedures and behavior, thus making the safety culture self-correcting on every level. The role of the human, including the inevitability of human error, is acknowledged. When procedures or behavior are questioned, potentially unsafe practices may be interrupted before

they result in an actual mishap. In a flexible culture, operational roles and responsibilities become less centralized and more fluid, and all employees feel a shared sense of responsibility for the success of the organization. The result is an organization that is oriented toward goals instead of regulations.

3.2.4 Learning Culture

An organization that demonstrates a strong "learning culture" is willing to change based on safety indicators and hazards uncovered through assessments, data, and incidents. Through proactive observation and evaluation, the organization and its employees and policies allow for continuous learning and improvements to safety. These activities help identify vulnerabilities or weaknesses to organizational safety. Implementing a learning culture can be difficult because it often requires a great deal of coordination, a change in attitudes, and management commitment.

3.2.5 Informed Culture

The four subcomponents – reporting culture, just culture, flexible culture, and learning culture – combine to form a safety-conscious, informed organization with the following characteristics:

- Leadership commitment
- Open communication
- Just environment
- Involvement of everyone at all levels of the organization
- Learning throughout the organization
- Effective decision-making process
- Follow-up, feedback, and reporting

These characteristics typify a vibrant safety culture in which each employee sees his/her role as a critical part of the organization's commitment to safety. In such an environment, every employee will feel comfortable – and feel responsible for – reporting any incident or issue that he/she perceives as being a potential safety risk without fear of reprisal or retribution. A vibrant safety culture is built on trust at all levels of the organization working with each other. It depends on the values and behaviors of every individual. Figure 3-2.2 shows an example of a decision tree that helps determine culpability for unsafe acts (Reason 209).

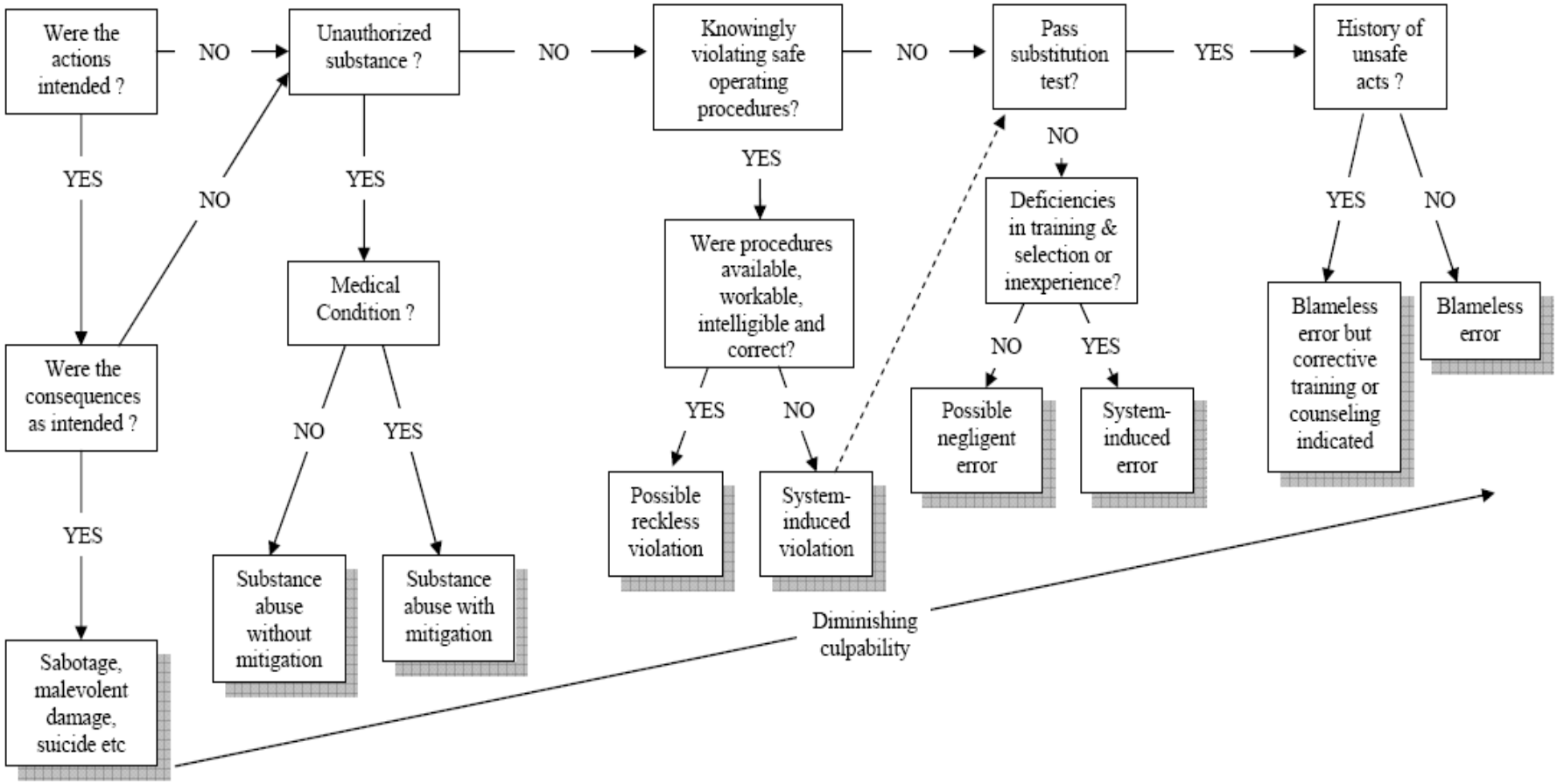

Figure 3.2-2: Decision Tree

4. UNDERSTANDING THE CURRENT AVIATION SAFETY CULTURE

Safety culture is a local phenomenon, an organizational attribute that develops in response to management policies and external requirements. Thus, defining the current state of safety in aviation is a daunting task. Aviation encompasses multiple organizations pursuing different business models and missions. Stakeholders range from single-proprietor GA operations to multi-national corporations and government organizations with tens of thousands of employees. Each organization's culture shares some common characteristics but is also unique to that organization. There is no single, universally-accepted standard by which to evaluate safety culture. To begin to understand the current aviation safety culture, we can examine:

- Available research results from academia, the government, the military, industry, and other organizations with a stake in aviation safety
- The criteria used to measure safety culture
- How the information can be distilled into best practices and lessons learned, which can then be applied to, and tailored for, all classes of stakeholders

Appendix H contains additional references pertaining to safety culture.

4.1 SAFETY CULTURE MEASUREMENT

Safety culture and safety climate cannot be evaluated against standard scales or criteria. The metrics and tools are not precise enough to allow comparisons of different industries or even different parts of one organization. Safety culture, using the standard JPDO SMS definition (see Section 1), can only be assessed, not measured (which would suggest a more exact and quantitative calculation). Since the concept of culture deals with shared practices and beliefs, its components and value can be determined, but it lacks the rigidity upon which numbers or dimensions can be placed. A safety climate, on the other hand, which is based on perceptions, can be measured. The values of measurement are relative and somewhat subjective; one examines which aspects of a safety climate are weakest or strongest, how they change with time, and how interventions produce changes in organizational climate.

Different designers of safety climate measurement methods may use different theoretical constructs that define the aspects of safety climate. This is unavoidable but appropriate for diverse industries or specialties. It is important to maintain consistency in the factors to allow relative comparisons across sets of measurements. Once a construct or framework of factors has been identified, specific procedures can be designed to gather data pertaining to each factor. Surveys of the workforce are often thought to be the primary measurement instrument, but Patankar identifies a range of metrics, which can include:

- Survey instruments
- Qualitative learning tools, such as incident debriefs
- Changes resulting from reporting systems

The FAA recently contrasted two constructs, and the comparison illustrates how widely these frameworks can differ:

	Organizational Factors	Team Factors	Outcome Factors
Patankar	Institutional Identity	Individual Professionalism	Employee Satisfaction
	Information Flow	Interpersonal Trust	Customer Satisfaction
	Relationships	Goal-sharing	Public Image/Perception
	Leadership	Adaptability/Resilience	Regulatory Compliance
	Evaluation	Support Systems	Stakeholder Value

	Organizational Factors	Team Factors	Safety-specific Factors
Behavioral Science Technology, Strategic Considerations	Procedural Justice	Teamwork	Organizational Value for Safety
	Leader-Member Exchange	Workgroup Relations	Upward Communication
	Management Credibility		Approaching Others
	Perceived Organizational Support		

Specific survey questions and observation data might evolve as information is gathered and new areas of interest are identified. If the constructs are consistent, the relative value of these factors and elements can be valuable in designing and implementing organizational changes and determining where leadership and commitment need to be strengthened. A list of some objective criteria for safety culture assessment is provided in Appendix B. Additional survey instruments have been developed by other organizations, including the Keil Center (Safety Culture Maturity Model) and Transport Canada. Examples of the use of some of these criteria are provided in Section 5.2.

5. DESIRED SAFETY CULTURE AND STRATEGY FOR CHANGE

The optimum safety culture appropriately balances risks against benefits as the organization strives to complete its mission. Senior management commitment to safety is essential in establishing and maintaining a strong safety culture. In fact, Adamshick has shown that leadership qualities can be more important to improving organizational safety than specific programs introduced for that purpose (278).

An example of an effective strategy for achieving a strong safety culture involves four steps. These steps may be viewed as the foundation of basic proactive strategy planning:

1. Accurately define the existing culture of safety
2. Assess this definition and formulate a plan to build on its strengths
3. Implement the plan
4. Follow-up to ensure that the appropriate change is achieved

The Naval Safety Center Strategic Plan notes that to understand and shape the safety culture, it is valuable to view safety culture improvement as a measurement and assessment of the safety climate. This section includes descriptions of several tools that are used to assess safety climate and culture. Each organization should choose and tailor the tools that are most applicable to its own situation. Several of these tools should be used in combination to more comprehensively assess, and manage safety climate and culture. With consistent intervention and dedicated management, the organization will embrace safety.

5.1 CULTURE OBJECTIVE FOR THE AIR TRANSPORTATION SYSTEM IN 2025

With the expected substantial increase in air traffic, the need for a strong safety culture in aviation will be even more critical in 2025 than it is today. NextGen stakeholders must make a continuous effort to strengthen the four components of the informed culture discussed in Section 3.2.

Creation of a broad database of incident data will be a key element of a strong reporting culture in aviation. This database will help enable the identification of accident precursors, which will lead to more effective interventions and prevent accidents. However, effective data sharing is not possible without a just culture that emphasizes trust. With a healthy reporting culture and just culture, employees will report all significant hazards that they feel are unknown and will provide additional reports when known hazards are not controlled effectively. Hazard reports will be processed and analyzed promptly, and feedback will be provided at all levels of the organization. Those who report hazards will be provided feedback to show that their efforts really do contribute to improved safety. Some of the information-sharing programs currently used in aviation are described in Appendix C. Users of these programs include pilots, controllers, and maintenance technicians.

Increased flexibility will be necessary to deal with the many changes that will be part of NextGen. With a flexible culture, employees, supervisors, and managers will be knowledgeable about, and take responsibility for, safety. Management will demonstrate its commitment to safety through the authorization of sufficient staffing, training, and safety policies. Employees will be open-minded toward training and accept dynamic roles and responsibilities.

Organizations will be oriented toward safety goals, not regulations. This flexibility will allow the entire aviation system to adapt safely to the anticipated increase in activity. An example of flexibility in aviation is the FAA's Advanced Qualification Program (AQP), which is a voluntary regulatory alternative to the traditional training and evaluation requirements for airline pilots, dispatchers, and flight attendants. The AQP is described in Appendix D. Another example of flexibility is the use of delegated certification authorities, such as Certified Design Organizations currently under study by the FAA (see FAA Order 1110.145). The implementation of the SMS will move organizations to a more flexible culture as risk identification becomes everyone's responsibility.

A strong learning culture will encourage continuous awareness of changes in the air transportation system and ensure that resources are available to assess these changes for hazards and risk. Systematic analyses of lessons learned during implementation of new systems will be conducted routinely. All aviation stakeholders will be ready and willing to learn more from incident data and be proactive about the effects of changes to the air transportation system. This learning culture will lead to increased participation in cross-functional teams. An example of such a team is the Commercial Aviation Safety Team, which is composed of participants from both industry and government and focuses primarily on the reduction of fatal commercial aviation accidents. Another example is the use of a Safety WG, which will be required to assess the risk of changes to the National Airspace System as part of the SMS. A strong learning culture might also lead to increased use of credentialing to certify work skills and enhance safety. A common example of credentialing already in place in aviation is the certification of pilots, mechanics, and air traffic controllers. The FAA's program for credentialing of air traffic controllers is described in FAA Order 8000.90.

5.2 TOOLS TO ASSESS SAFETY CLIMATE

Once the safety culture is understood, the climate can be measured in order to discover the characteristics and behaviors that need modification. Several tools that can be useful in assessing safety climate are described below.

5.2.1 Surveys

The most common way to assess the safety climate is to administer surveys. While surveys are often useful in uncovering problem areas, they require time and resources and need to be repeated to determine changes from the baseline. However, for large organizations, they can provide valuable data about relative movement in the culture. Surveys can be divided into two types: objective and subjective.

5.2.1.1 Objective Criteria for Safety Climate Measurement

As part of the effort that led to the drafting of this guide, the JPDO Safety Culture Study Team developed a list of objective criteria that can be used to assess safety climate. These objective measures check for the presence or absence of certain key elements of a positive safety culture. The criteria include characteristics of a positive safety culture and processes for maintaining a positive safety culture and were gathered from agencies and companies with successful track records in these areas. The objective criteria are organized into three main areas:

- In-house Hazard Reporting – how safety information is provided by employees and how the organization gathers, uses, and disseminates safety data
- Safety Organization – how safety fits into the company or agency structure
- Training – the safety training and feedback that the organization provides to its personnel

Effective use of these surveys requires that participants have a general knowledge of the organization. The most valuable responses are likely to come from personnel in the safety organization. Appendix B provides objective criteria survey questions. Organizations that want to use objective criteria surveys are urged to select the questions that are applicable to their respective domains. It may be useful to administer the same questions periodically and after major organizational changes occur.

5.2.1.2 Subjective Surveys for Safety Climate Measurement

Objective surveys are most effective when used in conjunction with subjective surveys and safety culture workshops (see Section 5.2.2). Appendix E contains a survey used by the FAA ATO to study its safety climate, and it can be used as a starting point for other organizations. Not all of the questions provided will pertain to every agency or industry stakeholder; individual organizations should select the questions that are most applicable and modify them as needed. A preliminary review of the results can provide management with baseline data and insight into areas of weakness. Conducting a safety culture workshop will often help determine the cause of the weaknesses.

Subjective surveys over a wide cross section of the organization will provide a better picture of the organizational safety climate. Upper and middle management are often reluctant to participate, perhaps because they do not see a benefit for management. Such an attitude likely indicates a weak safety culture. However, a well-designed survey of management can be effective in identifying cultural weaknesses. For example, a survey conducted by Behavioral Science Technology of senior and mid-level leaders in the ATO revealed that safety roles and responsibilities need to be more clearly defined and that personnel are reluctant to report information that adversely affects safety. The results also identified the need to apply consistent procedures and standards, hold personnel at all levels accountable, and create a positive and supportive environment for reporting safety issues and concerns. Finally, the results indicated that management believed there was a need for more effective safety measurements than merely tallying the number of operational errors and deviations, an “after-the-fact” indicator that has been used for decades in ATC operations.

5.2.1.3 Online Climate Surveys

Online surveys are a useful way to deliver objective and/or subjective surveys. They permit the collection of safety climate information without the need for travel or an on-site presence. Periodic collection of survey data, over time, helps develop an overall picture of the organization’s culture. Online climate surveys are often used as a precursor or prerequisite to a culture workshop. In order to assure confidentiality, it might be necessary to arrange for an independent group to administer the survey. The Naval Safety Center Web site provides examples of online surveys.

5.2.2 Workshops

Since culture is a group phenomenon, it is useful to work with groups of people to bring underlying culture to the surface (Schein 338). A safety culture workshop is a systematic tool for doing this. These workshops are sometimes referred to as focus groups. But it is not a process of simply asking questions to generate a group response. Rather, it is a process of using a variety of exercises to evaluate the core values, performance, mission, and vision of the organization. Having the group analyze its own results can generate discussion that brings underlying assumptions to the surface.

To eliminate tension and pressure, it is best to use separate peer groups and avoid mixing competing peer groups, such as supervisors and subordinates. This allows for a more open flow of dialogue and less "finger-pointing." The workshop process is typically divided into two phases:

1. Individual interviews with people inside and outside of the organization
2. Facilitated peer group discussions

The purpose of the individual interviews is threefold. First, they help the facilitator(s) gain insight into the operation of the organization. Second, they provide a better understanding of the safety climate. Both successes and shortcomings can be viewed as "symptoms" of the underlying culture. Third, the interviews begin to identify some aspects of the underlying culture that can be validated during subsequent group sessions. It is important to conduct interviews throughout the organization and in some cases outside of the organization (e.g., with contractors). Any group that supports or works directly with the primary organization may provide valuable insight regarding observable characteristics and values.

5.2.2.1 U.S. Navy Safety Culture Workshop

A good example of a safety culture workshop is the one developed and implemented by the Naval Safety Center. Every two years, facilities and organizations conduct an "Operational Excellence Workshop." (The Navy found that the title "safety" was not well-received by its younger sailors, so the emphasis was instead placed on the concept of "operational excellence.") It is not necessary that every individual participate – the optimum number group size was found to be 10 to 15 – but a broad cross section of the peer group is utilized. Through an interview and rating process, the facilitators review the organization's communication, integrity, and trust among peers, staff, and management. Although this process may seem involved and lengthy, it is actually quite efficient. The Navy is able to evaluate an entire squadron of 250 people in a day and a half.

To close the workshop activity, facilitators compose a list of areas for improvement based on the online survey tool, interviews, ratings, and workshop data. Results are provided directly to the unit's Commanding Officer, who is then responsible for developing action plans that address deficiencies. In the end, a successful workshop relies on dedicated leadership. The Naval Safety Center has found that units in which the Commanding Officer and junior leadership agree on the mission statement tend to have a lower mishap rate.

Appendix F describes the roles of the facilitator, notetaker, and participants in the Navy's Safety Culture Workshops. It also provides sample rating sheets and possible questions for participants.

5.2.2.2 Air Force Organizational Safety Assessment

In 1998, the Air Force Safety Center developed the Organizational Safety Assessment (OSA) tool. Its purpose is to identify known and previously unknown risks and provide possible responses. An OSA is performed only after explicit request by the wing commander.

The process begins with a commercially available survey called the Occupational Stress Inventory, Revised, which measures risks and hazards in a unit's culture. A licensed psychologist interprets the survey results, which are provided to the commander during the in-brief. The in-brief begins an eight-day visit by a multidisciplinary team, typically of about eight members, including an aviation psychologist, pilot, maintainer, air traffic controller, and a safety representative. The team conducts one-on-one interviews with senior leaders, followed by group interviews with personnel assembled by rank and organization. No member is ever interviewed in the same room with his or her supervisor.

At the end of the week, the data are analyzed and comments examined for trends. Recommendations are formulated, and the out-brief is drafted. The commander decides who will attend the out-brief, and the brief and data become the property and responsibility of the commander at the conclusion of the OSA. In a typical OSA, about 75 percent of the reported issues were previously known, and 25 percent are new. It is important to note that the OSA is not a crisis response effort; it is intended for use under normal conditions. Following a major mishap with fatalities, the Air Force Safety Center will generally wait about one year before conducting an OSA.

5.2.2.3 FAA ATO Crew Resource Management Course

Another example of a culture workshop is the operations Crew Resource Management (CRM) course developed and implemented by the FAA ATO. This course provides a one-day human factors workshop for all operational ATC personnel, from field managers to controllers, to improve teamwork, individual performance, and manage threats and errors. In the CRM course, thoroughly researched principles and methods from major airlines, the National Aeronautics and Space Administration, and the world's leading human factors experts are presented. ATC management personnel, who manage air traffic controllers and ATC practices in each facility, are challenged to apply these principles and methods to their work practices. The ideas are recorded in a work plan with action items for the facilities. The ATO uses this plan for follow-up and feedback action plans.

Unlike the Navy and Air Force programs, the CRM workshop is not used to assess safety culture; instead, it focuses on improving performance. Nonetheless, it is an example of a program that can play a useful role in safety culture improvement.

5.3 TOOLS TO IMPROVE SAFETY CULTURE

5.3.1 Training

Training organizational leadership is critical to developing and sustaining a strong safety culture. Many leaders understand the importance of safety culture but are unsure of the best way to shape it. A leadership training workshop may be useful for informing management about the tools available for understanding the existing safety culture and actively managing that culture. Some of the tools involve in-house efforts, while others require outside assistance from either a trained facilitator or third party. In order to gain the fullest understanding of an organization's safety culture, the safety climate and underlying culture must be understood.

The FAA ATO has developed a leadership training program. This program, along with other FAA safety culture enhancement activities, is described in Appendix G.

5.3.2 Use of an Ombudsman

An organization may want to appoint an independent ombudsman to receive and resolve safety concerns and protect the interests of the organization. Ombudsmen are currently used by large manufacturing organizations in the aviation field to research claims and provide recommendations for resolution. Complaints may or may not be anonymous and can be filed by anyone within or outside an organization. The ombudsman researches claims thoroughly, handles sensitive issues, and maintains confidentiality when necessary. The ombudsman may be accessed through phone, mail, email, or Web-based form. Regardless of the interface, for the system to be effective, management responses must be timely, and the effectiveness of these responses must be tracked.

An ombudsman's ability to remain impartial creates an atmosphere of trust for employees in a way that management and human resources departments might not. This trust paves the way for amicable solutions to complex safety problems, which can save money while strengthening safety culture and building trust between the company and employee. While many small organizations cannot afford a full-time ombudsman, this position does not necessarily require a full-time employee. It might also be possible to purchase ombudsman services from an industry professional organization.

Other advantages of using an ombudsman include:

- It provides an opportunity for confidential dialogue not afforded by a hotline.
- The process of responding to reported issues, even minor ones, builds trust in management so employees become more comfortable reporting directly to management.
- When trust does not exist, issues can still be reported.
- It keeps management aware of employee concerns.

5.3.3 Inclusion of Safety in Annual Performance Assessment

An organization should continually measure its ability to improve its safety culture, as well as achieve its safety objectives and performance targets. While the safety culture is a combination of the efforts of many individuals in an organization, an individual's annual performance assessment can in some cases address the contribution to a positive safety culture.

Assessing an individual's contribution to a positive safety culture can be done fairly only if the individual's job description includes specific competencies or values that promote safety.

5.3.4 Rewards and Recognition for Safety

Desirable behavior is promoted among personnel when it is rewarded. Currently, there is visible lack of mishaps (including both accidents and incidents) within many parts of the aviation community. However, caution is necessary because the emphasis on a low incident rate may inhibit the reporting of some potentially unsafe acts. Providing recognition for reporting unsafe conditions that have not yet resulted in accidents or incidents can also help identify hazards. Adamshick has shown that such programs work best when they are considered meaningful and produce highly coveted awards (251).

6. ONGOING MONITORING AND ASSESSMENT

As noted in Sections 3.1 and 4.2, organizational safety culture is assessed by making periodic assessments ("snapshots") of the safety climate. An essential feature of an effective safety culture improvement program is ongoing monitoring and assessment. There should be a close relationship between these monitoring activities and the organization's safety assurance function. A successful monitoring strategy will include a loop composed of the following steps:

- Assess climate through interviews and questionnaires
- Intervene through changes in policy and processes
- Allow time for the interventions to take effect
- Reassess climate

Other considerations in designing an effective monitoring program are outlined below:

- Proper tracking tools, data collection vehicles, and reporting processes are vital to maintaining a positive safety culture and identifying accident precursors.
- With time, examination of the correlation between climate assessment results and mishap rates may provide useful data.
- Timely feedback from management to staff will encourage increased incident reporting. Making mishap rates and management actions available to all personnel can be helpful.
- An effort should be made to continue to review new information to help identify new or recurring hazards.

A successful monitoring program should not require extensive additional resources if incorporated into the SMS Safety Assurance process. Existing data-sharing programs, especially the Line Oriented Safety Audit and Normal Operations Safety Survey (see Appendix C), which are based on observations of normal operations, can be helpful in monitoring the safety culture of an organization.

7. RECOMMENDATIONS AND SUMMARY

To ensure that the safety of the air transportation system is improved, the JPDO Safety WG will develop a standard SMS for use by all JPDO partner departments and agencies, and other stakeholders. To enable this, the Safety WG is working within the framework of the multi-agency JPDO partnership to establish common standards, a more comprehensive data sharing and analysis capability, and a strong safety culture for all NextGen stakeholders. As they move forward with SMS implementation, the Safety WG recommends that each JPDO partner department or agency:

1. Promote safety culture and safety improvements through leadership values, trust, integrity, and open communications
2. Define what constitutes a healthy safety culture in its organization
3. Select a tool or combination of tools (see the appendices) to assess the current climate
4. Provide training at all levels on the importance of safety culture
5. Initiate (or continue) monitoring and assessing the organizational safety climate
6. Support research to further validate the link between improved safety culture and improved safety performance

In order for NextGen to successfully absorb the anticipated increase in air traffic, JPDO partner departments and agencies must change many current beliefs and approaches. NextGen's computerized air transportation network will stress adaptability by enabling aircraft to adjust quickly to factors such as weather, traffic congestion, and security issues. By 2025, all aircraft and airports in controlled U.S. airspace will be connected to the NextGen network. They will continually share information in real-time, improving efficiency and safety.

To enable the successful implementation of the standard SMS, the FAA ATO is working to strengthen the safety culture of all stakeholders in NextGen. Continuous monitoring and assessment of safety culture will be required, as will continued research into the safety implications of innovations, such as shared responsibility for separation, the use of four-dimensional trajectories, and dynamic airspace allocation. This guide is offered to give leaders of JPDO partner departments and agencies an understanding of the elements necessary, and tools available, to help shape the culture of the national air transportation community and support the overarching NextGen goal: to maintain the confidence of the American public in the safety performance of the air transportation system.

APPENDIX A: EXAMPLES OF THE CORRELATION BETWEEN ORGANIZATIONAL CULTURE AND SAFETY

Figure A-1 is taken from an Organizational Culture Diagnostic Instrument (OCDI) study of the culture of 16 manufacturing facilities conducted by Behavioral Science Technology. The study assessed the relationship between the organizational culture and occupational injury rates. The results show that the facilities with sound safety cultures had lower injury rates.

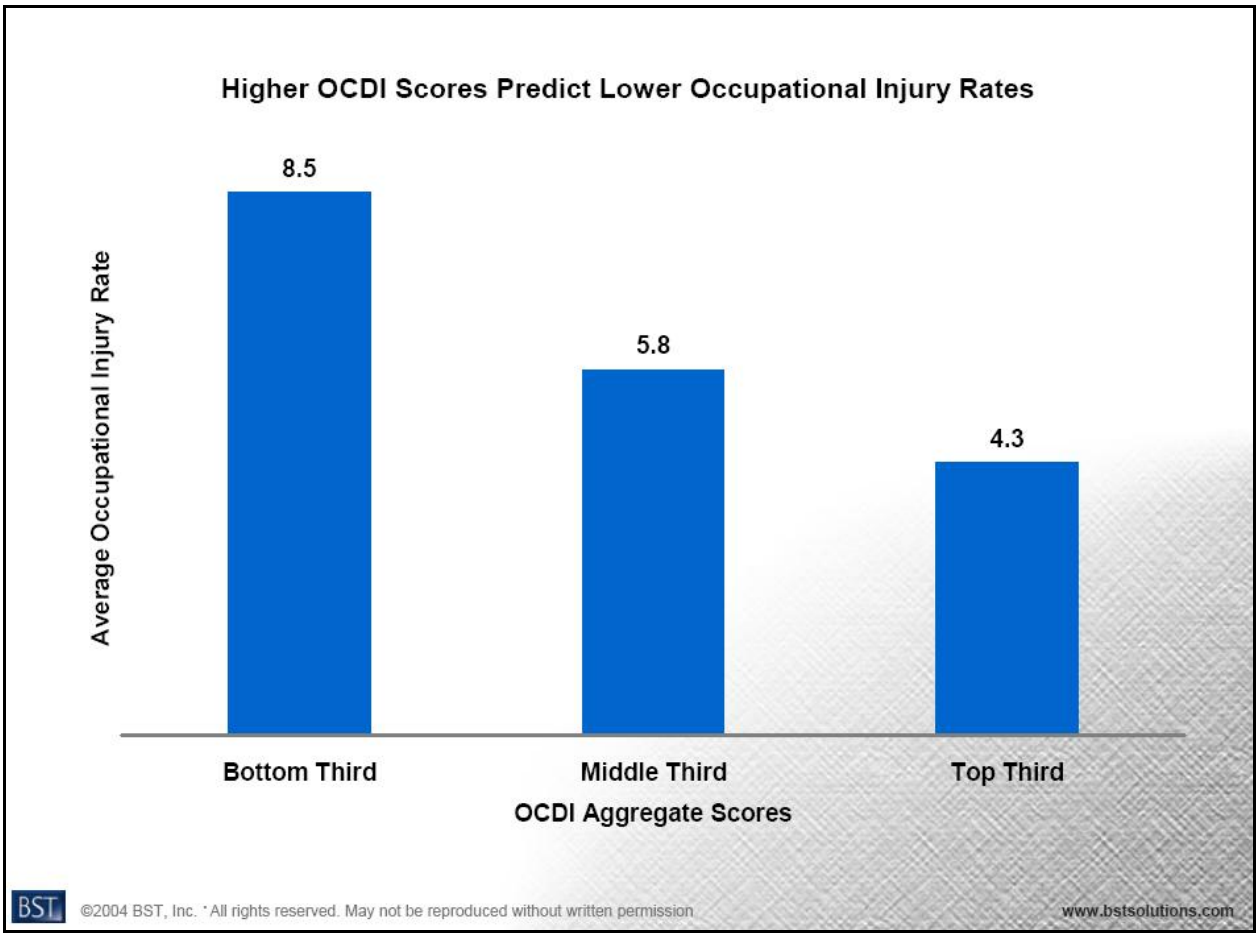

Figure A-1: Relationship between OCDI Scores and Occupational Injury Rates

Figure A-2 shows the results of a study of the U.S. Navy's Maintenance Climate Assessment Survey (MCAS) (Naval Safety Center, "Safety Climate Assessment Survey Brief" 85). It is clear that high climate scores are correlated with low mishap rates.

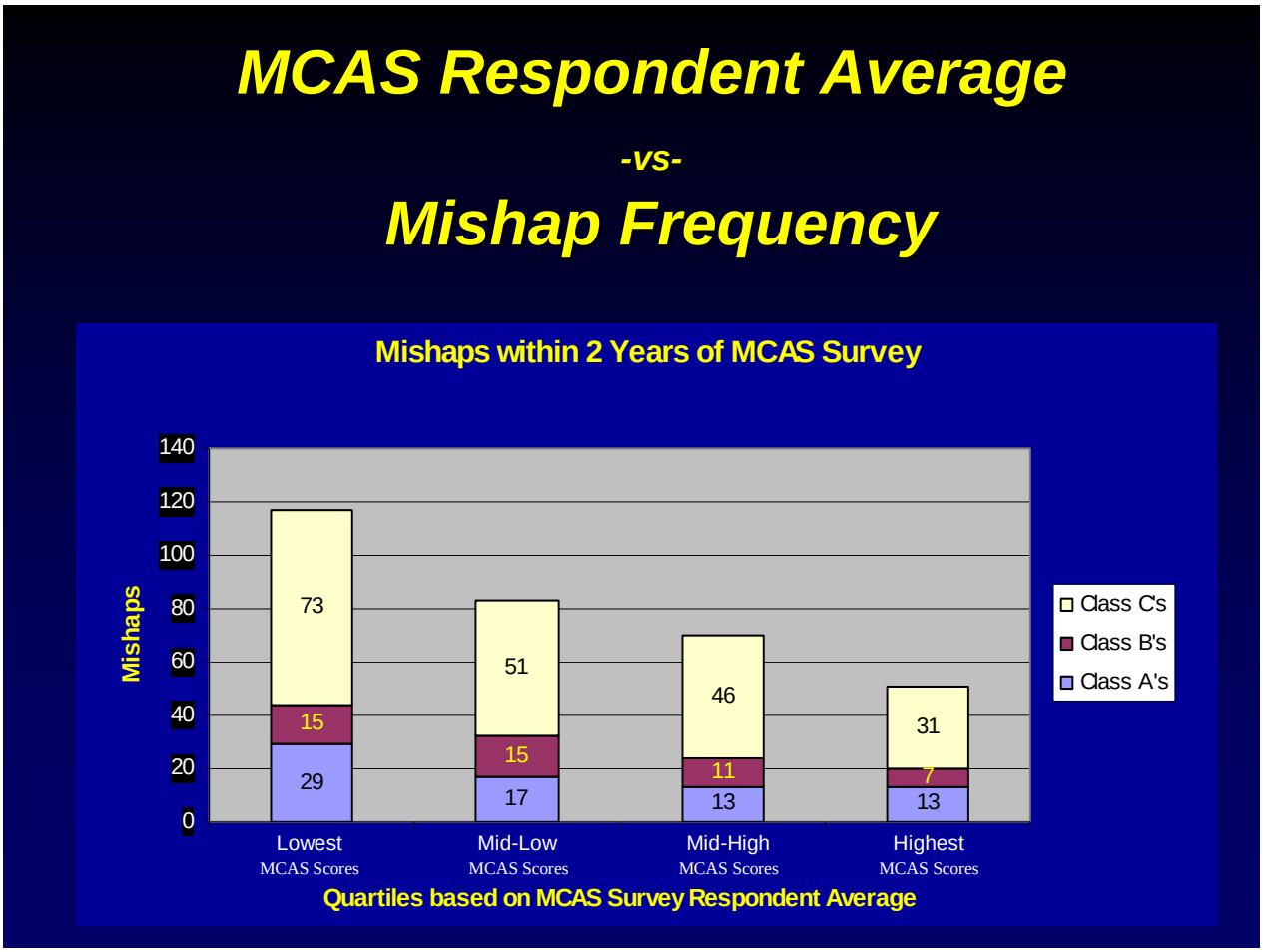

Figure A-2: Mishap Frequency versus Average Scores on an MCAS

APPENDIX B: OBJECTIVE CRITERIA FOR SAFETY CULTURE ASSESSMENT

The following table presents a list of objective criteria, developed by the JPDO Safety Culture Study Team, which can be used in assessing safety culture. Each criterion is also cross-referenced to the four characteristics of James Reason's safety culture: reporting culture, just culture, flexible culture, and learning culture. This list can be used as a checklist to conduct a self-assessment on the foundational components of organizational safety culture. Not every criterion is applicable to every organization; stakeholders should select those that are most helpful.

		Reporting	Just	Flexible	Learning
1	Hazard reporting				
1.1	Existence of a hazard reporting system	x			
1.2	Confidentiality	x	x		
1.3	Existence of a program to inform employees and encourage them to use it	x			x
1.4	Percentage of employees who know about the hazard reporting system	x			
1.5	Existence of a process to use results to improve safety	x		x	x
1.6	Administration separated from the enforcement organization	x	x		
1.7	De-identification of safety reports before dissemination within the organization	x	x		
1.8	Use of metrics on organizational response to reports	x		x	x
1.9	Frequency of analysis and reporting	x		x	x
1.10	Percentage of reports that are responded to within nominal response time	x			
2	Safety Organization				
2.1	Existence of a separate organization for safety		x	x	x
2.2	Published roles and responsibilities		x	x	x
2.3	Published safety policy		x	x	x
2.4	Existence of Safety Plan			x	x
2.5	Regular Safety Plan updates, and frequency			x	x
2.6	Performance metrics in Safety Plan			x	x
2.7	Percentage of employees who know about the safety organization				x
2.8	Assignment of safety staff from within or outside the organization			x	x
2.9	Percentage of employees who can correctly name their safety point of contact	x			x
2.10	Assignment of safety points of contact throughout the organization down to the line worker level	x		x	
3	Training				
3.1	Existence of an ongoing safety training program				x
3.2	Types of safety training			x	x
3.3	Percentage of employees who are up to date on safety recurrent training				x
3.4	Systematic tracking of safety training within the organization	x		x	x
4	Senior Management Involvement				
4.1	Frequency of senior management presentation of safety issues to the organization			x	x
4.2	Organizational levels having personal contact with senior management regarding safety issues			x	x
4.3	Inclusion of the Safety Manager in the senior management structure			x	x
4.4	Safety Manager responsibility for or involvement in financial decisions			x	
4.5	Safety criteria used for manager selection and evaluation			x	
4.6	Inclusion of a manager's safety responsibilities in job performance reviews			x	x
4.7	Staff with safety degrees or certification			x	x
4.8	Staff assessed for role in achieving safety goals			x	

APPENDIX C: EXISTING AVIATION INFORMATION-SHARING PROGRAMS

Data sharing is an essential part of hazard identification and a good reporting culture. Building a broad database of incident data enables the identification of accident precursors, which leads to more effective prevention. However, effective data sharing is not possible without a strong safety culture that emphasizes trust. When designing or joining a data sharing program, it is important to note that:

- Programs should be adapted for the particular discipline, organization, or agency.
- The intended use of the data should be made clear to all participants.
- Data must be protected from misuse, and voluntary submission of data should be encouraged in accordance with the principles of a just culture, as explained in Section 3.2.2.
- Efforts should be made to strengthen communications and data sharing among the different programs, especially where programs overlap in reporting criteria and oversight.

Voluntary programs that encourage the sharing of aviation safety data include:

- Aviation Safety Action Program (ASAP)
- Flight Operational Quality Assurance (FOQA) Program
- Voluntary Disclosure Reporting Program (VDRP)
- Aviation Safety Reporting System (ASRS)
- Line Operations Safety Audit (LOSA)
- Normal Operations Safety Survey (NOSS)

ASAP

An ASAP provides a vehicle for employees of contracted aviation activities (14 Code of Federal Regulations (CFR), Parts 121, 135 and 91, operators; and Part 145, Certificated Repair Stations) to report safety concerns, including possible violations of regulations by employees. This program is established through a Memorandum of Understanding signed by the FAA, the company, and if applicable, a labor association.

An ASAP focuses on fixing problems, not enforcing compliance through punishment or taking disciplinary action. The program requires that corrective action be taken for all safety issues disclosed under the program. The disposition of each ASAP report is determined by a three-person event review committee composed of representatives from the FAA, the company, and if applicable, front line labor. The report must be submitted on a timely basis, alleged violations must be inadvertent and not appear to involve intentional disregard for safety, and the reported event must not appear to involve criminal activity, controlled substances, or intentional falsification.

Under FAA policy, enforcement is limited to administrative action. No FAA action is taken if the employee is the sole source of the information. The vast majority of ASAP reports submitted to date have in fact been sole source, meaning that ASAP provides the FAA and participating companies with safety-related information that otherwise would not have been obtained. There are currently several dozen ASAPs in the U.S. The details of the program are described in FAA Advisory Circular 120-66B.

FOQA PROGRAM

FOQA is a program for the routine collection and analysis of digital flight data generated during routine operations. FOQA provides objective data not available through other means. The information and insights provided by FOQA can be used to reduce operational costs and significantly enhance training effectiveness, operational procedures, maintenance and engineering procedures, and ATC procedures.

An FAA rule (14 CFR 13.401) establishes FOQA as a voluntary program open to any aircraft operator. Operators are not required to obtain FAA approval to operate such a program. However, an operator who seeks protection from the use of FOQA data for FAA enforcement must obtain FAA approval of its FOQA Implementation and Operations (I&O) Plan. The rule stipulates that the I&O Plan must contain the following elements:

- A description of the operator's plan for collecting and analyzing flight recorded data on a routine basis, including identification of the data to be collected
- Procedures for taking corrective action that data analysis indicates is necessary in the interest of safety
- Procedures for providing the FAA with aggregate FOQA data
- Procedures for informing the FAA of any corrective action being undertaken based on analysis of FOQA data.

Under 14 CFR 13.401, operators with FAA-approved FOQA I&O Plans are provided with regulatory protection from the use of FOQA data for enforcement, except for criminal or deliberate acts. FOQA is described in detail in FAA Advisory Circular 120-82 and on AQP-FOQA.com.

VDRP

The FAA's VDRP provides a means for certificated air carriers and production approval holders to voluntarily disclose violations of regulations. Following the initial disclosure, the operator is required to submit to the FAA a plan identifying a comprehensive remedy to prevent the recurrence of any further regulatory violations. The FAA office responsible for oversight of the operator will follow up to verify completion of the corrective action. Subject to satisfactory completion of corrective action, the FAA limits enforcement for violations revealed under the VDRP to administrative action (i.e., a Letter of Correction or Warning Notice), which remains on file for only two years. To be accepted under the VDRP, the FAA must determine that the apparent violation is inadvertent. The VDRP does not cover issues pertaining to unqualified certificate holders.

ASRS

The ASRS collects, analyzes, and responds to voluntarily submitted aviation safety incident reports. The primary goal is to lessen the likelihood of aviation accidents through human factors research and issuing recommendations for future system or process enhancements. Reports may describe any unsafe or hazardous condition and can be submitted by pilots, air traffic controllers, flight attendants, maintenance technicians, and others.

Reports sent to the ASRS are held in strict confidence. More than 600,000 reports have been submitted to date, and no reporter's identity has ever been disclosed. The program removes all personnel and organizational names. Dates, times, and related information that could be used to infer an identity are either generalized or eliminated.

The FAA offers ASRS reporters further guarantees and incentives to report. It has committed not to use ASRS information against reporters in enforcement actions; the agency has also chosen to waive fines and penalties, subject to certain limitations, for unintentional regulatory violations that are reported to ASRS. The FAA's initiation and continued support of the ASRS program and its willingness to waive penalties in qualifying cases demonstrates the value it places on the safety information gathered through incident reporting to the ASRS.

ASRS immunity and confidentiality are explained in further detail in:

- 14 CFR 91.25
- FAA Advisory Circular 00-46D
- FAA Order 7210.3S, Facility Operation and Administration Handbook
- The NASA ASRS Web site: http://asrs.arc.nasa.gov

LOSA

The LOSA is a program for the management of human error in aviation operations; it helps develop countermeasures to operational errors. LOSA uses expert and highly trained observers to collect data about flight crew behavior and situational factors on "normal" flights. The audits are conducted under strict no-jeopardy conditions; therefore, flight crews are not held accountable for any errors that are observed. During flights that are being audited, observers record and code potential threats to safety; how the threats are addressed; the errors such threats generate; how flight crews manage these errors; and specific behaviors that have been known to be associated with accidents and incidents. Evaluators also conduct interviews during and after flights to gain additional insight into how pilots manage safety threats, such as weather issues.

Data from LOSA provide a real-time picture of system operations that can guide organizational strategies with regard to safety, training, and operations. A particular strength of LOSA is that it identifies examples of superior performance that can be reinforced and used as models for training. Data collected through LOSA are proactive and can be immediately used to prevent adverse events.

Although initially developed for the flight deck, the methodology can also be applied to other aviation sectors, including maintenance, cabin crew, and dispatch. More information about LOSA is available at the University of Texas LOSA Web site and in International Civil Aviation Organization (ICAO) Doc. 9803.

NOSS

The NOSS is a safety management tool similar to LOSA, but it is used for ATC operations instead of the flight deck. Like LOSA, NOSS is based on the framework of Threat and Error Management. Under NOSS, safety data are collected during a series of targeted observations of normal ATC operations. (A normal operation is defined as an operation during which no incident, accident, or other event takes place requiring reporting per current regulations.) Air

Traffic management can use NOSS results to help prioritize national and facility safety improvements and investments. NOSS procedures have been developed by ICAO, which is drafting a NOSS manual (Ruitenberg).

APPENDIX D: ADVANCED QUALIFICATION PROGRAM (AQP)

The Advanced Qualification Program (AQP) is an example of the benefits of a flexible culture. AQP is a voluntary regulatory alternative to the traditional training and evaluation requirements for pilots, dispatchers, and flight attendants that appear in 14 CFR, Part 121, Subparts N and O. AQP is a flexible program designed to be responsive to new technology and changing needs. It employs instructional systems design methodology to develop scenario-based training and evaluation that integrates CRM and technical skills. An airline operating an AQP uses data from ASAP, FOQA, incident/accident reporting, and other sources to develop the content of scenarios that reflect timely real world issues. Unlike a traditional training program, AQP requires submission of detailed data from training and evaluation, including line checks, to the FAA. The operator uses data collected under the AQP for curriculum quality control, and the FAA uses it to verify that AQP flexibility does not compromise safety.

AQP is described in detail in FAA Advisory Circular 120-54A and on AQP-FOQA.com.

APPENDIX E: FAA/ATO SAFETY CULTURE/SAFETY CLIMATE SURVEY

The Air Traffic Organization developed the following survey to assess the safety climate and safety culture of air traffic controllers. Other organizations may use this example as a starting point and remove or tailor the questions as desired. It may be useful to include background questions to collect certain data, such as age, gender, and occupation.

FAA/ATO Safety Culture / Safety Climate Survey

Purpose

In order to measure the safety culture as exhibited by existing safety climates across the FAA's Air Traffic Organization (ATO), the ATO sponsored the MOVES Institute at the Naval Postgraduate School to conduct a safety culture benchmark survey.

Your knowledge and background in ATC is needed to provide useful information concerning the current status of your ATC facility's safety climate, and the state of air control operations and associated operational risks.

The FAA/ATO Safety Climate-Culture Survey should take no more than 30 minutes to complete.

Instructions to Participants:

1. This survey is completely voluntary, and your inputs are provided anonymously, such that no one's responses can be associated in any manner with their individual identity. In accordance with federal law, your name and other personal identification information will not be collected or used as a part of this survey.

2. Please read and respond to each question on the survey. Provide your best judgment regarding safety climate-culture ratings and candidly answer the open-ended questions using the FAA/ATO Safety Climate-Culture Survey (attached).

3. At the end of the survey, please provide limited demographic information about your professional background and experience. The background information is only used for aggregate statistical analysis, with no personal identifying information.

4. **After completing the survey, place the survey in the pre-addressed, postage-paid envelope provided and send it to Center for the Application of Behavioral Sciences (CABS)**, a third party. This group will receive the surveys and populate a database with your responses. This ensures that neither the researchers conducting the survey nor the ATO will have direct access to your hand written responses. The MOVES Institute at the Naval Postgraduate School will then analyze the responses and provide a report to the ATO.

Your participation is considered extremely valuable to our effort, and is sincerely appreciated.

If you have questions about the survey please contact <<NAME>> at <<PHONE NUMBER>> or by e-mail at <<E-MAIL ADDRESS>>

Safety Management System Implementation
Air Traffic Organization, Safety Services

Survey begins on the next page ►

FAA/ATO Safety Culture / Safety Climate Survey

Instructions

Before completing this survey, please be sure that you have read the attached cover letter, which gives details regarding the purpose of this survey, and the sponsoring agency. We very much appreciate your candid answers to the following survey items. Please be assured that this survey is completely anonymous and no attempt will be made to identify particular participants and their questionnaire survey answers. Respond to the rating items by darkening the circle that best represents your level of agreement with a given statement, using the rating scale shown below:

①	②	③	④	⑤	Ⓝ	Ⓓ
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable	Don't Know

1.	I believe that FAA/ATO has a very effective process for reporting safety concerns.	① ② ③ ④ ⑤ Ⓝ Ⓓ
2.	Our facility's method of reporting unsafe conditions is likely to identify any problems that could lead to a serious accident.	① ② ③ ④ ⑤ Ⓝ Ⓓ
3.	FAA-ATC management provides adequate support for preventing personal injury or damage to equipment at our facility.	① ② ③ ④ ⑤ Ⓝ Ⓓ
4.	This facility has an effective process in place to identify any person who may pose a safety hazard on the job due to unsafe behaviors.	① ② ③ ④ ⑤ Ⓝ Ⓓ
5.	We have an informal process in place to report errors that are not serious enough to warrant using a more official process of reporting.	① ② ③ ④ ⑤ Ⓝ Ⓓ
6.	As far as I know, no serious unsafe acts have gone unreported at this facility.	① ② ③ ④ ⑤ Ⓝ Ⓓ
7.	I receive feedback on the resolution of safety issues that I report.	① ② ③ ④ ⑤ Ⓝ Ⓓ
8.	I have an effective means to provide input on safety issues.	① ② ③ ④ ⑤ Ⓝ Ⓓ
9.	I have never observed anyone that failed to comply with important safety procedures at my facility.	① ② ③ ④ ⑤ Ⓝ Ⓓ
10	Supervisors encourage reporting any safety concerns.	① ② ③ ④ ⑤ Ⓝ Ⓓ
11.	I am comfortable reporting safety concerns with no fear of management reprisal.	① ② ③ ④ ⑤ Ⓝ Ⓓ
12.	I believe that there is a reluctance to report errors and potentially hazardous conditions because we still treat such reports in a punitive manner.	① ② ③ ④ ⑤ Ⓝ Ⓓ
13.	All levels of management are actively involved in our safety program.	① ② ③ ④ ⑤ Ⓝ Ⓓ
14.	Working safely is an integral part of all operations in this facility	① ② ③ ④ ⑤ Ⓝ Ⓓ
15.	An employee that intentionally violates procedures or safety rules is given appropriate correction.	① ② ③ ④ ⑤ Ⓝ Ⓓ
16.	Intentional violations of procedures and/or safety rules are rare at my facility.	① ② ③ ④ ⑤ Ⓝ Ⓓ

Continue on Next Page ►

FAA/ATO Safety Culture / Safety Climate Survey

①	②	③	④	⑤	Ⓝ	Ⓓ
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable	Don't Know

17.	The supervisor at my work location encourages all employees to follow the rules.	① ② ③ ④ ⑤ Ⓝ Ⓓ
18.	Any employee can stop or delay an operation if he/she believes that an unsafe condition exists.	① ② ③ ④ ⑤ Ⓝ Ⓓ
19.	I am comfortable admitting to my supervisor that I have made a mistake.	① ② ③ ④ ⑤ Ⓝ Ⓓ
20.	I would not hesitate to ask my supervisor for help when needed.	① ② ③ ④ ⑤ Ⓝ Ⓓ
21.	There is genuine commitment to safe work practices at this facility.	① ② ③ ④ ⑤ Ⓝ Ⓓ
22.	I am comfortable asking my supervisor to release me from work due to personal problems or illness that may affect my job performance or safety.	① ② ③ ④ ⑤ Ⓝ Ⓓ
23.	My facility has a reputation for high-quality work	① ② ③ ④ ⑤ Ⓝ Ⓓ
24.	My facility closely monitors work quality and corrects any deviations from standard practices.	① ② ③ ④ ⑤ Ⓝ Ⓓ
25.	This facility's best practices are followed in my organization to ensure high quality work.	① ② ③ ④ ⑤ Ⓝ Ⓓ
26.	Management clearly communicates the need to maintain high-quality standards.	① ② ③ ④ ⑤ Ⓝ Ⓓ
27.	Employees at my location are held accountable for below average work performance.	① ② ③ ④ ⑤ Ⓝ Ⓓ
28.	Employees at my location are recognized for above average work performance.	① ② ③ ④ ⑤ Ⓝ Ⓓ
29.	Air Controllers at my location routinely assess potentially hazardous situations due to changing air traffic or airport conditions.	① ② ③ ④ ⑤ Ⓝ Ⓓ
30.	Supervisors consider safety issues in the day-to-day management of all our work.	① ② ③ ④ ⑤ Ⓝ Ⓓ
31.	My supervisor would not ask me to do something against ATO policy just to improve operational efficiency.	① ② ③ ④ ⑤ Ⓝ Ⓓ
32.	Safety is a key part of all the operational planning in my organization.	① ② ③ ④ ⑤ Ⓝ Ⓓ
33.	Safety personnel at my work location are very influential in promoting safety.	① ② ③ ④ ⑤ Ⓝ Ⓓ
34.	I have received specific training on the high-risk elements of my job.	① ② ③ ④ ⑤ Ⓝ Ⓓ
35.	I don't feel overly burdened by my daily work assignments.	① ② ③ ④ ⑤ Ⓝ Ⓓ
36.	I am never too tired to stay alert on the job.	① ② ③ ④ ⑤ Ⓝ Ⓓ

Continue on Next Page ►

FAA/ATO Safety Culture / Safety Climate Survey

①	②	③	④	⑤	Ⓝ	Ⓓ
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable	Don't Know

37.	We have a non-punitive approach to handling any controller, regardless of seniority or status, if he/she appears to be under excess stress or fatigue.	① ② ③ ④ ⑤ Ⓝ Ⓓ
38.	In my opinion, changes in the ATO structure and/or policy have not affected focus on the safety of our operations.	① ② ③ ④ ⑤ Ⓝ Ⓓ
39.	I don't believe it will be too difficult to achieve a uniform culture across various ATC geographic locations.	① ② ③ ④ ⑤ Ⓝ Ⓓ
40.	This facility provides a positive climate that promotes safe operations.	① ② ③ ④ ⑤ Ⓝ Ⓓ
41.	The safety goals of my work facility have been clearly communicated to me.	① ② ③ ④ ⑤ Ⓝ Ⓓ
42.	My immediate supervisor can be relied upon to keep his/her word.	① ② ③ ④ ⑤ Ⓝ Ⓓ
43.	Management is fully committed to safety at this facility.	① ② ③ ④ ⑤ Ⓝ Ⓓ
44.	Management ensures that all employees are responsible and accountable for safety.	① ② ③ ④ ⑤ Ⓝ Ⓓ
45.	Supervisors willingly provide advice concerning safety matters.	① ② ③ ④ ⑤ Ⓝ Ⓓ
46.	I am adequately trained to safely conduct all of my job assignments.	① ② ③ ④ ⑤ Ⓝ Ⓓ
47.	I believe that employee morale in this facility is high.	① ② ③ ④ ⑤ Ⓝ Ⓓ
48.	Management consistently enforces adherence to procedures for all employees.	① ② ③ ④ ⑤ Ⓝ Ⓓ
49.	I get all the resources that I need to perform my job safely.	① ② ③ ④ ⑤ Ⓝ Ⓓ
50.	My supervisor knows which employees may pose a greater risk to safe operations, because of low proficiency or poor attitude.	① ② ③ ④ ⑤ Ⓝ Ⓓ
51.	My supervisor listens carefully to employees regardless of job title or position.	① ② ③ ④ ⑤ Ⓝ Ⓓ
52.	Communication among workers, while performing their jobs, is very good.	① ② ③ ④ ⑤ Ⓝ Ⓓ
53.	Senior management (service area or above) can be trusted to keep their promises to employees.	① ② ③ ④ ⑤ Ⓝ Ⓓ
54.	Local facility management keeps me informed about important safety matters.	① ② ③ ④ ⑤ Ⓝ Ⓓ
55.	Senior management (service area or above) has adequately prepared employees for ongoing changes to operations and organizational structure.	① ② ③ ④ ⑤ Ⓝ Ⓓ
56.	I have a clear understanding of my job duties and responsibilities in spite of changes ongoing in ATO policy and organizational changes.	① ② ③ ④ ⑤ Ⓝ Ⓓ

Continue on Next Page ►

FAA/ATO Safety Culture / Safety Climate Survey

①	②	③	④	⑤	Ⓝ	Ⓓ
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable	Don't Know

57.	I believe that I am paid fairly for the work that I do.	① ② ③ ④ ⑤ Ⓝ Ⓓ
58.	Good communications flow exists up and down the FAA-ATO organization.	① ② ③ ④ ⑤ Ⓝ Ⓓ
59.	ATO sets very high standards for recruiting, hiring, and controller duty assignments.	① ② ③ ④ ⑤ Ⓝ Ⓓ
60.	Position Relief Meetings are conducted in sufficient detail to ensure that job requirements and safety issues are adequately covered.	① ② ③ ④ ⑤ Ⓝ Ⓓ
61.	All of our facility operations are adequately supervised.	① ② ③ ④ ⑤ Ⓝ Ⓓ
62.	I don't foresee any difficulties recruiting or retaining qualified controllers.	① ② ③ ④ ⑤ Ⓝ Ⓓ
63.	The training standards program is functioning effectively to ensure that all of our personnel meet regulatory and operational requirements.	① ② ③ ④ ⑤ Ⓝ Ⓓ
64.	Supervisors at this facility encourage employees to continually seek improvements that will enhance our performance and safety.	① ② ③ ④ ⑤ Ⓝ Ⓓ

Background Information

1. Service Area ○ Eastern ○ Central ○ Western

2. Discipline ○ Enroute ○ Terminal ○ SYS-OPS

3. Type of facility ○ ARTCC ○ ATCT ○ TRACON ○ FCT ○ TMU ○ FSS

4. Facility Level ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10 ○ 11 ○ 12

5. Current Shift ○ Day ○ Evening ○ Midnight

6. Do you work a rotating shift? ○ Yes ○ No

7. Do you work overtime? ○ No ○ Seldom ○ Occasionally ○ Frequency

8. Do you supervise personnel? ○ Yes ○ No **9. If yes, number supervised:** _____

Continue on Next Page ►

FAA/ATO Safety Culture / Safety Climate Survey

Background Information (continued)

10. Sex ○ Female ○ Male

11. Years of service at current facility: _____

12, Total years of service in ATO: _____

13. Job Title: _____

14. Age: _____ **15. Today's Date**: ____/_____/_____
Day / Month / Year

Open Ended Questions

1. In your view, what situation or specific hazards or other factors may lead to an operational error, or a possible accident?

_____

_____

_____

2. The most significant safety actions that this facility, or my organization, can take to reduce the chances of operational errors, or an accident are:

_____

_____

_____

3. What additional training would help you perform your job more effectively?

_____

_____

_____

4. What aspects of ATO policy do you think have had a positive impact on the safety or risk of your operations?

_____

_____

_____

Continue on Next Page ►

FAA/ATO Safety Culture / Safety Climate Survey

5. What aspects of ATO policy do you think have had a negative impact on the safety or risk your operations?

_____

_____

_____

6. Do you have any further comments about operations or safety in ATC or about your own organization or work area? If so, please comment:

_____

_____

_____

7. Do you believe that any programs or procedures now operating elsewhere in the ATC system should be adopted by your own organization? If so, which one(s)?

_____

_____

_____

8. Did you find any part of the survey hard to understand or interpret? If so, tell us how we might improve the survey to make it easier to understand or use:

_____

_____

_____

Any additional comments.

_____

_____

THANK YOU VERY MUCH FOR YOUR PARTICIPATION.
PLEASE USE THE BACK OF THE LAST QUESTIONNAIRE PAGE FOR ADDITIONAL COMMENTS

Enclose your completed questionnaire in the pre-addressed postage-paid envelope provided and drop in the U.S. Mail To:
Center for the Application of Behavioral Sciences
P.O. Box 270298
St. Louis, MO 63127

APPENDIX F: DEPARTMENT OF THE NAVY CULTURE WORKSHOP

This Appendix describes some aspects of the Department of the Navy Culture Workshops, including:

- A summary of the workshop process
- The roles and responsibilities of the facilitators, notetaker, and participants
- Characteristics of the Navy and Marines that might be shared by civilian organizations or are likely to be unique to the military
- Examples of questionnaires and participant rating sheets

The workshop facilitators interview several groups within an organization. Each group is composed of 10 to 15 people from the same level (e.g., Group 1: maintenance mechanics; Group 2: first-line supervisors). There may be one or several groups interviewed at each level. The only personnel present during the interview sessions are one facilitator, one notetaker, and the group participants. At the end of the workshop, the facilitators compile the findings and present them to the unit's Commanding Officer. Participant names are withheld. The findings include an assessment of whether the safety climate is improving or deteriorating. It is up to the Commanding Officer to take action and correct flaws as appropriate. It is not the role of the facilitators to devise an action plan; however, they may provide guidance if asked.

Facilitator roles and responsibilities:

- Assist the group in defining communication, trust, and integrity and how these qualities are reflected in their peers and the unit
- Guide group discussions
- Help the group understand its own processes in order to work more effectively
- Clearly delineate perception versus reality to maintain accuracy of the items discussed
- Use consensus to help the group make decisions that take into account all participants' opinions
- Help the group communicate effectively
- Create an environment in which the participants enjoy a positive, growing experience while they work to attain group goals
- Create trust between the facilitator and the participants
- Create trust between participants (stress confidentiality)
- Maintain confidentiality when leaving the room – do not disclose names to management
- During the session, look for:
    - Trust between the different levels (junior to senior)
    - Integrity of management as well as perceived integrity of peers
    - Relationships up and down the chain of command
    - Effective communication that is created and sustained
    - Signs of ineffective communication
    - Differences in perceptions at different levels and the level at which perceptions change
    - Extreme negativity and chronic complainers
    - Operational problems that can be discussed by the group

Notetaker roles and responsibilities:

- Capture key thoughts
- Be aware of trends
- Capture ratings
- Note the general mood of the group

Note that nobody else is authorized to take notes. Participants rate the communication, trust, and integrity, both among their peers and between them and their superiors.

Navy characteristics that may differ from civilian organizations:

- Squadron personnel are primarily young and transient, changing units every few years.
- Commanding Officers are in command for a short term. An individual Commanding Officer may only experience a workshop once or twice during his or her tenure with the unit, making it challenging to implement long-term changes.

Navy characteristics similar to civilian aviation organizations:

- Need to deliver under tight time pressure
- The existence of high-risk hazards

It is important to note that civilian and military organizations may implement different improvements following a culture workshop. However, these differences do not appear to have much effect on the actual workshop results, as this type of workshop has been found to be effective in identifying similar cultural problems in a variety of industries (Civarelli).

Much of the guidance provided to the facilitators is taken from the book *Facilitating with Ease!* by Ingrid Bens. The following page gives an example of one of the worksheets furnished to workshop facilitators. It is important to note that the facilitators come from an outside organization – the Naval Safety Center – not from the organization that is being assessed.

CULTURE WORKSHOP PARTICIPANT INPUT WORKSHEET

1. What did you learn through your participation in the process? _____

_____

_____

_____

2. What are the top three hazards to operational excellence/mishap prevention in your command? _____

_____

_____

_____

3. In regards to question number 2, what control measures would you recommend to your unit commander? _____

_____

_____

_____

4. What action(s) will you take as a result of your participation? _____

_____

_____

_____

5. What suggestions and ideas do you have for improving the culture of your unit? _____

_____

_____

_____

6. What recommendations do you have for improving today's Seminar? _____

_____

_____

_____

APPENDIX G: FAA SAFETY CULTURE ENHANCEMENT ACTIVITIES

This appendix describes several training and promotion exercises that the FAA's safety organization, Safety Services, has created and distributed throughout the Air Traffic Organization, with the objective of strengthening safety awareness and improving the culture in ATC facilities across the United States.

Safety Services produced and distributed two safety culture awareness DVDs to all 572 ATC facilities in the United States. They use the Challenger space shuttle disaster and the Überlingen midair collision to illustrate how poor safety culture contributed to the accidents. Using lessons learned from these catastrophes, the remainder of each video explores how every employee is responsible for safety and modeling positive safety culture attributes. These DVDs were used as briefing items for operational personnel.

Safety Services also developed posters displaying the "Lessons of Heinrich's Triangle." Using Heinrich's concept (24) and adapting it to the ATC environment, the poster illustrates how an accident is preceded by a large number of known and unknown unsafe acts. These posters are displayed near the operating quarters in each facility as a reminder that seemingly small variances from approved practices can culminate in accidents and incidents.

Terminal Services and Safety Services teamed to produce the Tower Best Practices Training videos known as "BASICs," which illustrates structural cooperation within the ATO. This effort was initiated to reduce operational errors in the terminal environment by focusing on basic control principles and procedures. It focuses on surface safety (i.e., reducing runway incursions) and consists of a four-DVD series highlighting "best practices" to eliminate some of the common errors. Over 500 Air Traffic Control Towers currently have and are using the DVDs.

In conjunction with periodic audits of normal operations at En Route and Oceanic Services facilities (Air Route Traffic Control Centers), Safety Services conducts safety awareness seminars with the middle management team. In these seminars, middle managers first receive a high-level briefing on SMS initiatives. Safety Services personnel then facilitate a discussion with the managers to empower them and their employees to reduce hazards by minimizing unsafe acts and nonstandard behaviors.

As an interdisciplinary approach to surface safety, Safety Services leads Runway Safety Action Teams at airports across the country. With the mission of reducing hazards, runway incursions, and surface collisions, this recurrent workshop includes airport management, operators, pilots, flight standards personnel, and air traffic controllers. Using a systems model and taking advantage of the diverse skills and experiences within the aviation community, airports create innovative solutions to safety hazards. These solutions are accepted more readily because they are developed through consensus decision support. During these workshops, Safety Services personnel routinely deliver briefings on "Runway 101: System Safety and Safety Culture" to participants. These briefings have helped to raise awareness of individual roles in promoting safety culture across the ATO and the aviation community.

APPENDIX H: REFERENCES

Adamshick, Mark H. *Leadership and Safety Climate in High-Risk Military Organizations.* Diss. University of Maryland, College Park, 2007.

Baker, James A., et al. "The Report of the BP U.S. Refineries Independent Safety Review Panel." January 2007. 22 Mar. 2007 <http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/SP/STAGING/local_assets/assets/pdfs/Baker_panel_ report.pdf>

Behavioral Science Technology, Inc. "ATO Leadership Summit Safety Climate and Culture Survey, Report of Results." Ojai, California. 2006.

Behavioral Science Technology, Inc. "Organizational Culture Diagnostic Instrument (OCDI) is Predictive of Injury Rates." 15 Feb. 2008. <http://www.bstsolutions.com/insights/research_injuries.shtml>

Behavioral Science Technology, Inc. "Strategic Considerations for Safety Excellence." Ojai, California. 2006.

Bens, Ingrid. *Facilitating With Ease!* San Francisco: Wiley, 2005.

Bowser, LaGretta, and Jennifer Allen-Tallman. "Crew Resource Management Human Factors in Air Traffic Control." Federal Aviation Administration, 2008.

Civarelli, Anthony. "Safety Climate and Risk Culture: How Does Your Organization Measure Up?" To be published in AeroSafety World, <http://www.flightsafety.org/asw_home.html>

Commercial Aviation Safety Team. <http://www.cast-safety.org/>

Draft Safety Management System Standard, version 1.3, 18 Dec. 2007. 31 Jan. 2008. <https://ksn.faa.gov/km/jpdo/safety/SMS-SME/Lists/Announcements/Attachments/10/20071218_Draft_JPDO_SMS_Standard_v1-3-no_changes.pdf>

FAA Advisory Circular 00-46D. *Aviation Safety Reporting System.* February 26, 1997.

FAA Advisory Circular 00-58A. *Voluntary Disclosure Reporting Program.* September 8, 2006.

FAA Advisory Circular 120-54A. *Advanced Qualification Program.* June 23, 2006.

FAA Advisory Circular 120-66B. *Aviation Safety Action Program.* November 15, 2002.

FAA Advisory Circular 120-82. *Flight Operational Quality Assurance.* April 12, 2004.

FAA Air Traffic Organization (ATO) Safety Management System (SMS) Implementation Plan

For Fiscal Years 2008-2010. Version 1.0. November 2007.

FAA Order 1110.145, *Certified Design Organization (CDO) Aviation Rulemaking Committee*. May 22, 2006.

FAA Order 8000.90, *AOV Credentialing and Control Tower Operator Certification Programs*. August 11, 2006.

Gordon, Rachel, et al. "Understanding Safety Culture in Air Traffic Management." EEC Note No. 11/06. Brussels: Eurocontrol Experimental Center, 2006.

Health and Safety Laboratory, Human Factors Group. "Safety Culture: A Review of the Literature." Sheffield, England: Crown, 2002.

Heinrich, H.W. *Industrial Accident Prevention.* New York: McGraw-Hill, 1950.

International Civil Aviation Organization. Doc. 9803. "Line Operations Safety Audit (LOSA)." September 2002.

Naval Safety Center. "Culture Workshops." 14 Feb. 2008. <http://www.safetycenter.navy.mil/culture>

Naval Safety Center. "Safety Climate Assessment Surveys." 14 Feb. 2008. <http://safetyclimatesurveys.org>

Naval Safety Center. "Safety Climate Assessment Surveys Brief." 15 Feb. 2008. <http://www.safetycenter.navy.mil/culture/downloads/Safety_Climate_Assessment_Surveys_Brief_for_CW_5-01-07.ppt>

Naval Safety Center. "Strategic Plan 2007-2008." 22 Feb. 2008. <http://www.safetycenter.navy.mil/staffdirectory/NSC_StratPlan06FINAL_1-16-07.doc>

Next Generation Air Transportation System Integrated Plan, version 1. 12 Dec. 2004. 31 Jan. 2008. <http://www.jpdo.gov/library/NGATS_v1_1204r.pdf>

Patankar, M.S., et al. "A Comparative Review of Safety Cultures." St. Louis: Saint Louis University Press, 2005.

Reason, James. *Managing the Risks of Organizational Accidents.* Aldershot, England: Ashgate, 1997.

Ruitenberg, Bert. "The ICAO NOSS Manual." 15 Feb. 2008. <http://www.icao.int/anb/humanfactors/noss2/ICAO_3%20.ppt>

Safety Culture Maturity Model. The Keil Center. 28 Feb. 2008. <http://www.keilcentre.co.uk/html/human_factors/safety_culture%20maturity%20model.htm>

Schein, Edgar H. *Organizational Culture and Leadership*. San Francisco: Wiley, 2004.

Skyguide. "Information regarding the air accident at Uberlingen on July 1, 2002. 28 Feb. 2008." <http://www.skyguide.ch/en/Dossiers/DossierUeberlingen/>

Transport Canada. "Score Your Safety Culture." 28 Feb. 2008. <http://www.tc.gc.ca/CivilAviation/systemSafety/Brochures/Tp13844/menu.htm>

University of Texas, Human Factors Research Project. "Line Operations Safety Audit." 28 Feb. 2008. <http://homepage.psy.utexas.edu/HomePage/Group/HelmreichLAB/Aviation/LOSA/LOSA.html>

Wiegmann, Douglas A., et al. "Safety Culture: A Review." Technical Report ARL-02-3/FAA-02-2. Savoy, Illinois: University of Illinois at Urbana-Champaign Press, 2002.

Zhang, Hui, et al. "Safety Culture: A Concept in Chaos?" Proceedings of the 46th Annual Meeting of the Human Factors and Ergonomics Society. Santa Monica, California: Human Factors and Ergonomics Society, 2002.

APPENDIX I: ACRONYMS

AQP	Advanced Qualification Program
ATC	Air Traffic Control
ATO	Air Traffic Organization
CRM	Crew Resource Management
FAA	Federal Aviation Administration
GA	General Aviation
JPDO	Joint Planning and Development Office
NextGen	Next Generation Air Transportation System
OSA	Organizational Safety Assessment
SMS	Safety Management System
SOP	Standard Operation Procedure
WG	Working Group

Safety Culture Improvement Resource Guide

Document Revision History

VERSION	DATE	DESCRIPTION
ATOS-JPDSC-PL01-D	October 2, 2007	Draft transmitted to SMS Standing Committee; revisions provided; more guidance material added and terminology better defined
ATOS-JPDSC-PL01-02-D	November 5, 2007	Transmitted to SMS Standing Committee and Safety Working Group; revisions provided; more guidance material added
ATOS-JPDSC-PL01-03-D	December 20, 2007	Transmitted to SMS Standing Committee and Safety Working Group; revisions provided; more guidance material added
ATOS-JPDSC-PL01-04-D	February 28, 2008	Transmitted to JPDO Working Groups and Divisions for final technical edit; references reviewed and corrected, bibliography removed and recommendations incorporated
ATOS-JPDSC-PL01-05-D	March 1, 2008	Document title changed
ATOS-JPDSC-PL01-06-D	April 14, 2008	Formatting changes provided
ATOS-JPDSC-PL01-07-D	May 5, 2008	Formatting changes reviewed and incorporated
ATOS-JPDSC-PL01-07-D	July 30, 2008	Revised abstract and changed title
ATOS-JPDSC-PL01-07-D	July 30, 2008	Published on JPDO Web site