FLIGHT SAFETY FOUNDATION

GSIP
GLOBAL SAFETY INFORMATION PROJECT

Year Three Report

OF THE GLOBAL SAFETY INFORMATION PROJECT

Year Three Report

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Executive Summary

During the first three years of the Global Safety Information Project (GSIP), Flight Safety Foundation released annual updates as well as preliminary toolkits on safety data collection and processing systems (SDCPS) that are intended to assist organizations in collecting, analyzing, sharing, and protecting their safety data and information. In fiscal year (FY) 2017, the Foundation continued to expand the reach of GSIP by conducting interactive webinars and workshops, and by actively engaging with aviation safety practitioners in every International Civil Aviation Organization (ICAO) region. And, recognizing that aviation safety and risk management are constantly evolving disciplines, we continued learning from others in the industry, in part by developing and administering a safety performance indicator (SPI) survey. This work culminated in producing detailed toolkits that go well beyond the concepts presented in our preliminary versions.

We continue to believe this work of the Foundation is essential and supportive of the ICAO Global Aviation Safety Plan (GASP), which is an ongoing initiative to virtually eliminate fatal accidents for the commercial aviation business across the world. Such dramatic improvement can only be achieved with a significant amount of study, precise risk mitigation development and a commitment to implement the solutions through the collaborative efforts of regulators and industry.

Like the first two years of this project, a key factor in our success in FY 2017 was the high level of participation and interest in GSIP from a growing number of individuals and organizations. We collected 121 responses to our safety performance indicator (SPI) survey from respondents across the globe, yielding valuable insights into how safety performance is monitored by airlines, air navigation service providers (ANSPs), regulators, and other types of organizations. In our four-part webinar series, 179 individuals from a similarly wide range of organizations participated. For nearly half of these participants, the webinars were their first exposure to GSIP. During the webinars, we provided an update on what the project had accomplished to date and our next steps, and we gathered valuable feedback on the development of our toolkits. In August 2017, we hosted a two-day aviation safety workshop in Manila, Philippines that allowed us to take our draft detailed toolkits directly to the intended audience, gather feedback, and learn from the attendees' real-world experiences.

With the public release of the our detailed GSIP toolkits, we plan to continue familiarizing industry with their contents, and begin collecting feedback and best practices from early implementers. We plan to incorporate lessons learned, including GSIP success stories, in

future version of the toolkits. Based on our findings in the first three years of the project, we also plan to develop reference materials detailing best practices for safety performance monitoring. And, in our efforts to continue to elevate safety to new levels, we intend to develop a new toolkit that presents a strategic blueprint for global safety risk management based on emerging techniques and technologies.

This report summarizes our accomplishments throughout the three years of GSIP and summarizes our findings and work product. We also offer insight into what might come next from this project, and what work remains to be done to achieve the levels of global collaboration necessary to progress to even higher levels of safety performance.

Acronyms and Definitions

R&D	Research and development
FSF	Flight Safety Foundation
SPI	Safety performance indicator
GSIP	Global Safety Information Project
SDCPS	Safety data collection and processing systems
FAA	Federal Aviation Administration
ANSP	Air navigation service provider
SMS	Safety management system
SSP	State safety program
ICAO	International Civil Aviation Organization
IASS	International Air Safety Summit
CARM	Common Aviation Risk Model
BASS	Business Aviation Safety Summit
GASP	Global Aviation Safety Plan
CAST	Commercial Aviation Safety Team
CANSO	Civil Air Navigation Services Organisation
IATA	International Air Transport Association
SPT	Safety performance target

Introduction

Throughout the past three years, Flight Safety Foundation (FSF) made significant progress in understanding top global aviation safety issues. Through extensive marketing and outreach, the Foundation continued its focus on the Pan America and Asia-Pacific regions, successfully expanding GSIP's stakeholder base. In addition, participants from all of the other ICAO regions joined without any additional costs. Stakeholders from these other regions provided valuable insight for our research and development (R&D) efforts, which resulted in the publication of our SDCPS toolkits. Our research also positioned the Foundation to more clearly understand how different regions of the world approach and monitor safety performance. To maximize the utility our findings, the Foundation published an interactive SPI dashboard. This dashboard enables stakeholders to customize their interaction with all elements of the safety performance data that the Foundation gathered in the most current survey. Accompanying these products, the Foundation made several enhancements to the GSIP pages on its website to improve ease of use and stakeholder access to the most current project information.

To begin integrating our toolkits into operations, the Foundation hosted a workshop in Manila Aug. 8–9, 2017. During this workshop, the Foundation introduced each of the three detailed toolkits, facilitated several open-ended risk management discussions, and gathered in-depth SPI data from participants. Building upon the successes of the workshop, the Foundation hosted a four-part webinar series to engage stakeholders in our FY 2017 progress and work product. Together, the workshop and webinars helped the Foundation further its goal of better understanding global safety risk management challenges, emerging risk areas, and future GSIP opportunities.

Historically, aviation safety has been measured by the number of accidents per year. With GSIP, we are working to shift the industry's focus to the number of years between accidents. To accomplish this, industry must start measuring the impact of change. GSIP is helping to drive industry toward this next level of safety by promoting the enhancement of safety data information sharing among regulators, operators, and even competitors. This report shares our cumulative findings with an emphasis on our Year 3 journey. Annual reports for years 1 and 2 are available in the GSIP section of the flightsafety.org website.

Year Three Accomplishments and Work Products

During the third year of GSIP, the Foundation leveraged the project's past accomplishments and completed several new R&D activities in support of the work outlined in the FAA-FSF cooperative agreement. The Foundation applied lessons learned to engage and collaborate with a variety of global stakeholders and safety practitioners to *expand our understanding of SDCPS* across the Pan America and Asia-Pacific regions. Although GSIP is focused on these two regions, the Foundation received comments, suggestions, *and inputs from stakeholders in all ICAO regions*. GSIP stakeholders helped the Foundation gain key insights into *how the global aviation industry monitors safety performance*. This high level of engagement was key in the development and *publication of the SDCPS-focused toolkits*, which aim to help project stakeholders manage their safety programs more effectively. The details of our significant accomplishments are described in the following sections of this document.

SDCPS Toolkit Publication

The Foundation published three SDCPS-focused toolkits on the GSIP web pages that incorporate what we learned in the first three years of GSIP. Each toolkit describes opportunities for stakeholders to assess their current safety data collection, analysis, sharing, and information protection practices. They also include a variety of tools, techniques, and actionable steps to elevate an organization's current safety risk management capabilities.

The Foundation designed each toolkit to accommodate the unique needs of aviation industry stakeholders including airlines, aircraft operators, airports, ANSPs, regulators, manufacturers, and others. The Foundation understands that SDCPS capabilities and interests will vary across organizations, and from stakeholder to stakeholder.

> *For example, an airline or aircraft operator may gather safety data to conduct proactive risk management in order to understand and address a safety concern before it escalates into an accident or serious incident. Similarly, an aircraft manufacturer may gather safety data to conduct predictive risk management in order to better anticipate and control future system failures based on a focused set of operations data.*

The Foundation recognizes that there are different risk management approaches, styles, and needs. Therefore, we provide a variety of examples and operational scenarios in each SDCPS toolkit so that they are relevant to stakeholders across the industry. The content of each toolkit was developed so that underlying SDCPS approaches could easily be tailored to address the operational needs or focus areas of different stakeholders.

The toolkits are organized by level of risk management intensity. This is a concept that was developed by the Foundation during FY 2015 and FY 2016, and solidified in FY 2017 after extensive coordination and validation activities with GSIP stakeholders. Each toolkit provides readers with safety risk management tools, techniques, and examples to clearly demonstrate each level of intensity and to guide the self-identification of SDCPS improvement opportunities. The contents of each toolkit are divided into sections on data collection, data analysis, information sharing, and information protection. The end of each section features a "Plan for Success" checklist to enable readers to quickly identify and relate to the key elements of the toolkits.

The Level 1 intensity toolkit aims to support an organization's effort to implement or sustain a functioning safety management system (SMS) or state safety program (SSP). This includes identifying and responding to risks, issues, and opportunities that are of the highest priority to an organization. The Level 2 intensity toolkit provides opportunities for an organization to develop a clearer organizational risk picture by leveraging more robust safety data sources and analytical techniques. These additional inputs and analysis methods allow an organization to contextualize risk and identify root causal factors. The Level 3 intensity toolkit identifies and details additional data sources and analytical techniques that enable an organization to engage in proactive risk management.

Although the toolkits are organized by intensity level, they are not intended to be used in isolation. As previously mentioned, the Level 1 intensity toolkit supports the basic functions that an organization should perform to maintain a functioning SMS or SSP. As such, we assume that all organizations with a functioning SMS will be using components of the Level 1 toolkit on a day-to-day basis, regardless of their overall capabilities. Likewise, an organization may not need to use the contents of the Level 3 toolkit on a regular basis. Rather Level 3 techniques may only be required when there is a need for more sophisticated analysis activities, such as directed safety studies to address specific areas of interest.

A summary of the levels of intensity is presented in Table 1 (p. 7). Level 4 intensity is discussed in greater detail in the *Components of Level 4 Intensity* section of this report.

Stakeholder Validation and Outreach

Stakeholder engagement is a foundational component of GSIP. Throughout the first three years of this project, the Foundation has relied heavily on input from a variety of individuals and organizations from all regions of the world. To maximize GSIP participation, FSF leveraged a variety of domestic and international platforms to broaden the GSIP stakeholder base and engage participants in the coordination and validation of proposed toolkit contents.

Domestically, FSF participated in the FAA's InfoShare conference and Commercial Aviation Safety Team (CAST) meetings. We also engaged with local stakeholders, FSF members, academia, and subject matter experts through one-on-one working sessions and group forums.

In addition to the webinar series and Manila workshop which extended GSIP engagement opportunities to all the ICAO regions, the Foundation participated in international conferences and meetings facilitated by ICAO, the Civil Air Navigation Services Organisation, the International Air Transport Association, and other industry leaders. We also shared recent project accomplishments at the Foundation's International Air Safety Summit and Business Aviation Safety Summit. At each venue there was strong interest from the participants to learn and apply what we had described. The Foundation found it difficult at times to ascertain the ability of some organizations to adopt our GSIP elements without knowing the scale

Table 1 — SDCPS Toolkit Intensity Matrix

Level 1	Level 2
Objective: Sustainment of a functioning SMS/SSP • Reliance on *external* safety data and known industry risks to drive risk management priorities/activities • Identify and respond to an organization's *top-priority risks* • Conduct quantitative risk assessments using refined ICAO risk matrix severity and likelihood scales • Establish *SPIs and performance metrics* to describe risk priorities • Develop *safety workgroups* to address local issues/needs **Summary of Key Tools and Techniques:** Introductory guide to using Ishikawa diagrams, SPI best practices, complex data summary best practices, basic risk management best practices, data collection maps to help characterize current capabilities	**Objective: Development of a clearer organizational risk picture** • Increased reliance on *internal safety data* (such as FDM) and external data to drive risk management priorities/activities • Begin *contextualizing risks* with respect to daily operations • Begin the root-cause analysis of existing risks and identify potential gaps that could redirect risk management priorities • Establish *performance thresholds*/triggers for automated/system-based data capture tools • Develop *safety teams* to address needs across an organization **Summary of Key Tools and Techniques:** Causal factor checklist, example performance thresholds and resources, introductory guide to using bowtie models
Level 3	**Level 4 – Notional Concept**
Objective: Proactive Risk Management • Harmonize multiple internal and external data sources to develop a *complete current and strategic risk picture* • Identify improvement opportunities through *self-inspection* • Conduct *proactive risk assessments* and respond with the implementation of protective barriers and defenses • Develop a repeatable process to *refine SPI targets* and metrics • Establish *reoccurring feedback loops* with regulators **Summary of Key Tools and Techniques:** Contributory factor checklist, resources/methods to address specific risk areas (such as human performance), statistical trend analysis guide and resources	**Objective: Global safety risk management** • Establish a *collaborative analytics* structure, comparable in concept to ASRS or ASIAS that aims to enhance global safety • Develop *risk profiles* to model future technology risk, procedure risks, and performance benefits • Identify meaningful *risk escalation factors* to understand the potential weaknesses of protective barriers and defenses • Contribute to development of *global SPIs*, standards, and risk management best practices **Summary of Key Tools and Techniques:** Escalation factors guide, benchmarking strategies, collaborative risk analysis resources

and maturity of the SMSs or SSPs of those organizations. For example, the Manilla workshop showed us great differences in understanding SPIs. While we thought the term SPI was reserved for only the highest form of tracking organizational progress, we learned that SPIs were used far more readily as metrics for examination during analysis by small groups as well as all the way up to and including top business executives.

Both domestically and internationally the Foundation advertised the GSIP project, toolkits, and year-to-date accomplishments through a variety of press releases and social media outlets, including one with over 19,000 active participants. These efforts significantly

increased the awareness of GSIP and provided new opportunities to share work products, obtain meaningful feedback, and substantially increase the number of people that could benefit from GSIP. During the year, the Foundation posted draft toolkits to the "members only" section of its website. We continue plans to provide members with an opportunity to view and contribute to the development of the toolkits. Additionally, the Foundation implemented several enhancements to the GSIP webpages, including improved GSIP information presentation and marketing, and functional changes that provide users with the option to subscribe to future GSIP-related alerts.

The Foundation remains committed to alignment of GSIP with current and emerging ICAO Standards and Recommended Practices (SARPs) and guidance materials. We recognize the importance of engagement with ICAO, and coordinated GSIP activities and toolkit development with the:

- Publication of Amendment 1 to ICAO Annex 19, *Safety Management*. This amendment broadens the reach of SMS and the related protections of information within an SMS.
- Implementation of the 2017-2019 Global Aviation Safety Plan (GASP). This document establishes targeted safety objectives and initiatives while ensuring the efficient and effective coordination of complementary safety activities between stakeholders.

To ensure this alignment, the Foundation consulted with SMS, global safety information planning, and safety information protection staff at ICAO Headquarters in Montreal. This coordination was implemented to assure that our SDCPS-focused toolkits and stakeholder outreach efforts are consistent with the future efforts of ICAO and its participating member states that are sustaining or implementing SMSs or SSPs. Throughout this coordination, the Foundation provided ICAO with an opportunity to view, comment, and participate in the development of the draft toolkits. The success of the ICAO GASP depends on some information exchange between the airlines and regulators who together can act as champions of the safety performance improvements. Therefore ICAO was quite interested in materials that may help strengthen industry and government risk management practices. As the Foundation has learned with release in March 2017 of its Go-Around Decision-Making and Execution Project study, the documents we make public are often fully digested many months after they are released.

The Foundation has been an ongoing member of the ICAO Regional Aviation Safety Groups in Asia-Pacific (RASG–APAC) and Pan America (RASG–PA), as well as the ICAO Asia Pacific Regional Aviation Safety Team (APRAST). Among others, including those cited in previous reports, the Foundation provided the following briefings and presentations:

- RASG PA ESC/28 Information Paper IP/03, *Global Safety Information Project Status Update*
- Presentation P/04, *GSIP Update* — RASG-PA ESC
- RASG-APAC Working paper WP/03, *Global Safety Information Project Status Update*

Development and Administration of an SPI Survey

FSF developed an SPI survey to gain meaningful insight into how the aviation industry is using safety data to define safety performance targets (SPTs) and SPIs. This survey also provided the opportunity to understand how industry applies these thresholds to monitor routine operations and identify potential or emerging safety risks. In developing the survey, the Foundation leveraged information gathered during the FY 2015 and FY 2016 focus group

and workshop surveys. This information was used to drive the development of SPI survey content based on industry-wide practices.

Another input to survey development, SPI information collection, and data analysis activities were the following ICAO Annex 19, *Safety Management,* requirements:

- Service providers are required to "*develop and maintain the means to verify the safety performance of an organization and to validate the effectiveness of safety risk controls.*"
- "*Service provider's safety performance shall be verified in reference to the safety performance indicators (SPIs) and safety performance targets (SPTs) of the SMS.*"

SPI survey respondents were asked to indicate their current understanding of the SPI concept, describe their organization's use of specific SPIs and safety metrics across several risk areas, and share their perceived importance rating of SPI data collection and monitoring attributes. To help interpret survey results, the Foundation also included several demographic questions, such as years of experience and geographic location. The Foundation ensured that all survey respondents were aware of the anonymity of their responses and took steps to ensure all surveys were de-identified and not attributable to any one country, organization, or person.

To date, the Foundation has received 121 survey responses with valuable inputs from airlines, aircraft operators, regulators, manufacturers, ANSPs, airports, and other stakeholders from all seven ICAO regions. A summary of responses by stakeholder type and regions is presented in Figure 1 and Figure 2 (p. 10).

In analyzing the survey results, the Foundation developed three preliminary conclusions. First, we recognize that the sample set of 121 responses is not a conclusive indicator of global safety performance monitoring. However, these responses do provide a valuable preview of industry's knowledge and perception of organizational safety performance monitoring. Second, there was variability in the consistency and completeness of surveys across respondents. We believe this could suggest that not all survey respondents were aware of all aspects of their organizations' safety performance monitoring activities. The Foundation understands that there may be very few people within a single organization that have access

Figure 1 — SPI Survey Responses by Stakeholder Type

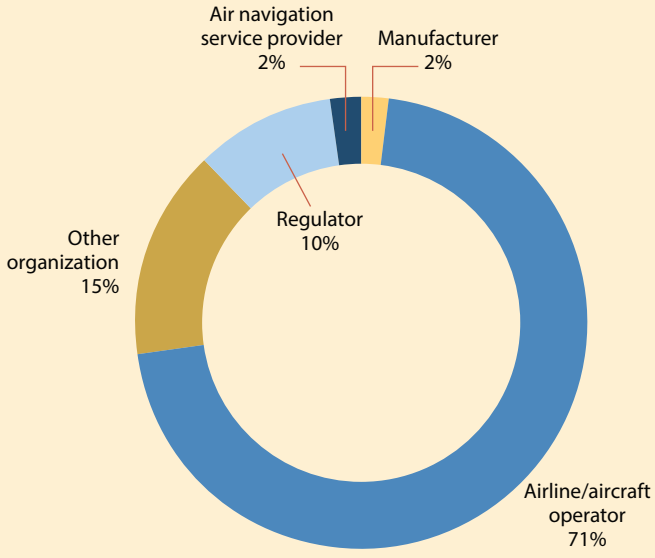
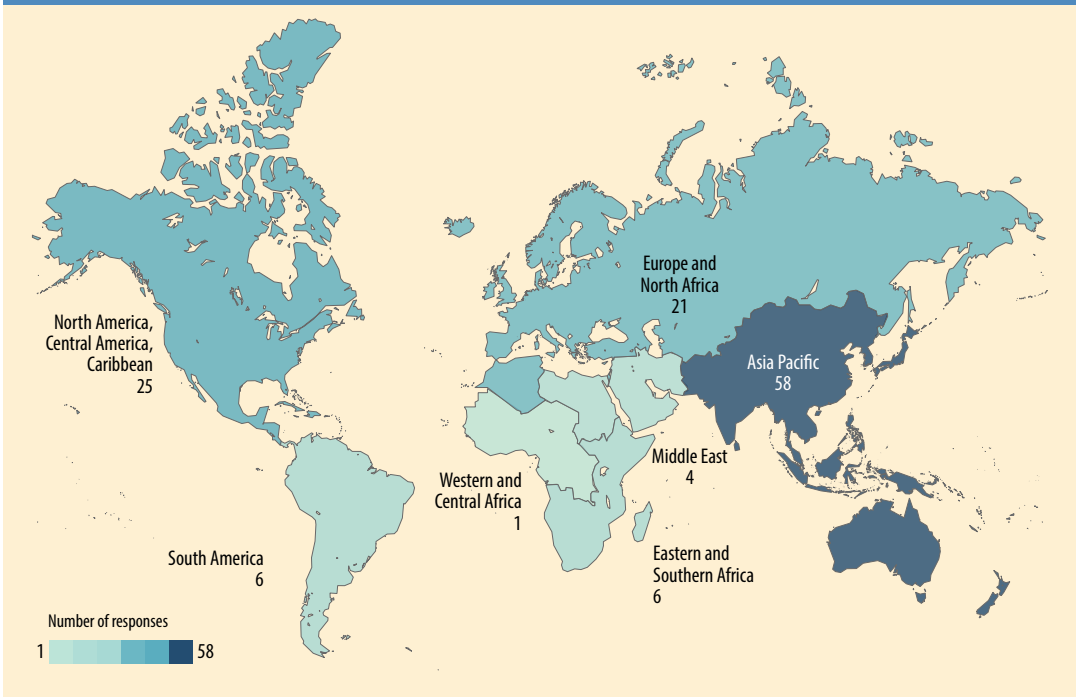


Figure 2 — SPI Survey Responses by ICAO Region



to, or are aware of, every SPI and metric that is actively tracked. We learned in our discussions with GSIP participants that some organizations may choose to delegate responsibility for the detailed elements of individual SPIs and metrics to designated groups. This reality further reduced the likelihood that a single survey respondent would be able to provide all the detailed information requested by the survey. Third, the survey results provided the Foundation with a clear set of next steps and objectives, including a second SPI survey and the development of reference materials. These activities are described in greater detail in subsequent sections of this report.

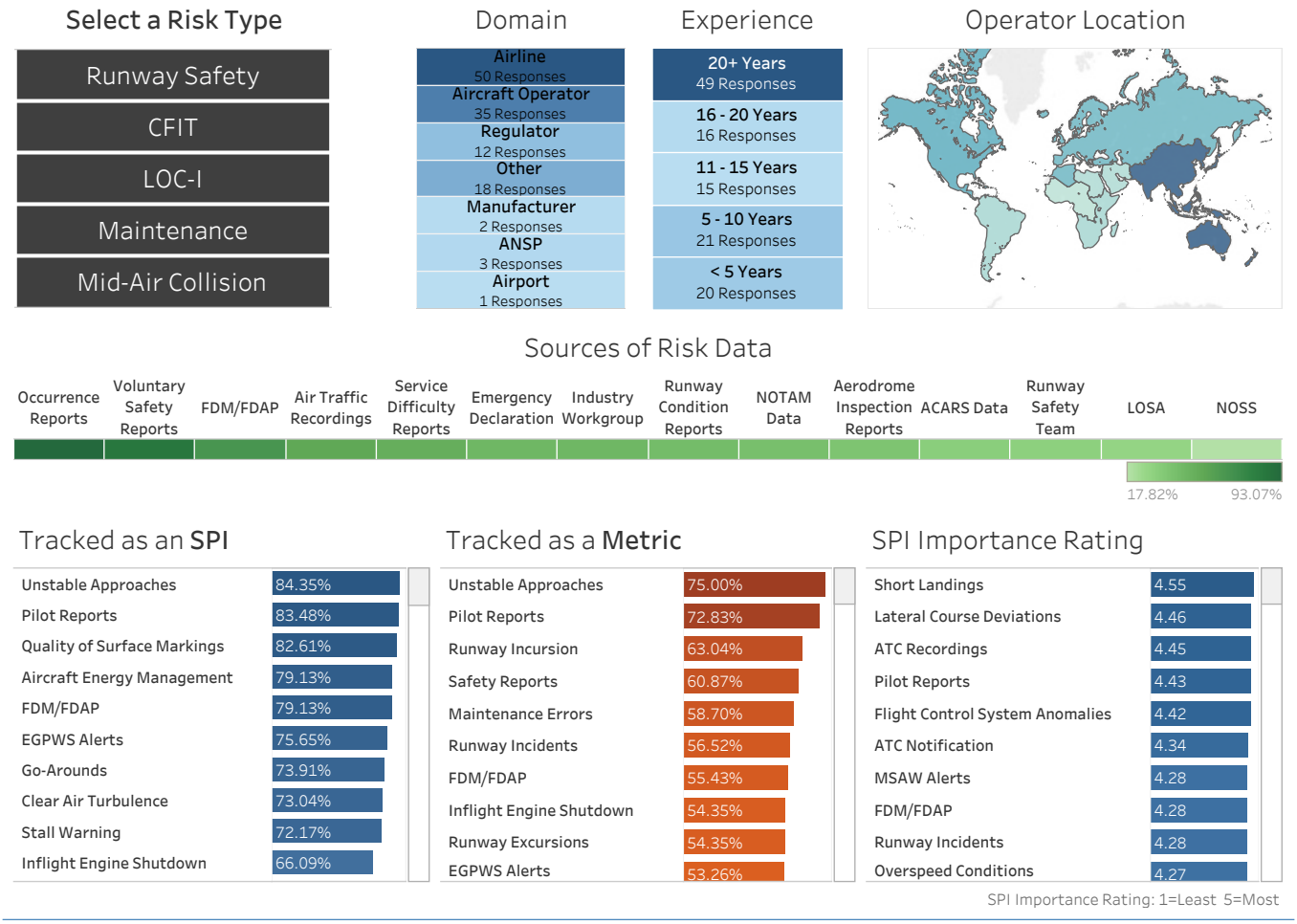
Interactive SPI Dashboard

Through our webinars and focus groups, we learned that there are a variety of interpretations and ways that SPIs and SPTs are being used around the world. To share SPI survey results with GSIP's broad and diverse stakeholder base, we developed an interactive SPI survey dashboard. Accessible through the GSIP webpages, this dashboard enables users to conduct detailed analyses of our SPI survey results. Users are able to develop custom views of the data and generate quick, meaningful conclusions from those views on-demand.

Upon accessing the dashboard, users are presented with an overall summary of survey response data, as illustrated in Figure 3 (p. 11).

In our understanding of data collection and analysis, the existence of an SPI is largely to meet organization expectations on how much to improve safety. Many businesses track certain data to measure how to improve their products. As the understanding of the product and market change, the data measurements may change to improve the focus of an organization to meet market expectations. Throughout the evolution of a product, many forms of data are used to gain a deeper analytical understanding of the product and its performance capability.

Figure 3 — SPI Survey Dashboard Overview



We see managing safety as a similar evolution. SPIs and the metrics to understand underlying performance may change. This survey was aimed at helping us understand both SPIs and their related metrics. Further research will be needed to address how organizations improve both their SPIs and underlying metrics over time.

Beyond the insights that can be drawn from the initial survey response summary, users can develop on-demand safety intelligence through a set of interactive data filters. These filters include survey responses by risk area, domain, operator location, and respondent experience. The following example provides an overview of the steps a user could take to explore the survey results in the controlled flight into terrain (CFIT) risk area.

By clicking on CFIT as illustrated in Figure 4 (p. 12), the dashboard automatically filters the response data and displays all information that relates to CFIT.

Now that the data is filtered by the desired risk area, users can examine sources of CFIT risk data, CFIT related SPIs, CFIT metrics, and the aggregate importance rating for each. Figure 5 (p. 12) provides an expanded view of the lower half of figure 4 for easier reference.

Under the Sources of Risk Data heading, users can see which specific data sources are being used by respondents to track CFIT risks. The sources are arranged in descending order from left to right by number of responses. The dashboard also allows users to quickly see which items are most frequently tracked as SPIs and metrics, as well as a rating of SPIs by perceived importance on a scale from 1 to 5, with 1 indicating least important and 5 most important. By presenting this information side by side, users can develop unique insights, such as discovering which SPIs are considered to be highly important but are not frequently tracked,

Figure 4 — SPI Survey Dashboard Filtered by CFIT Risk

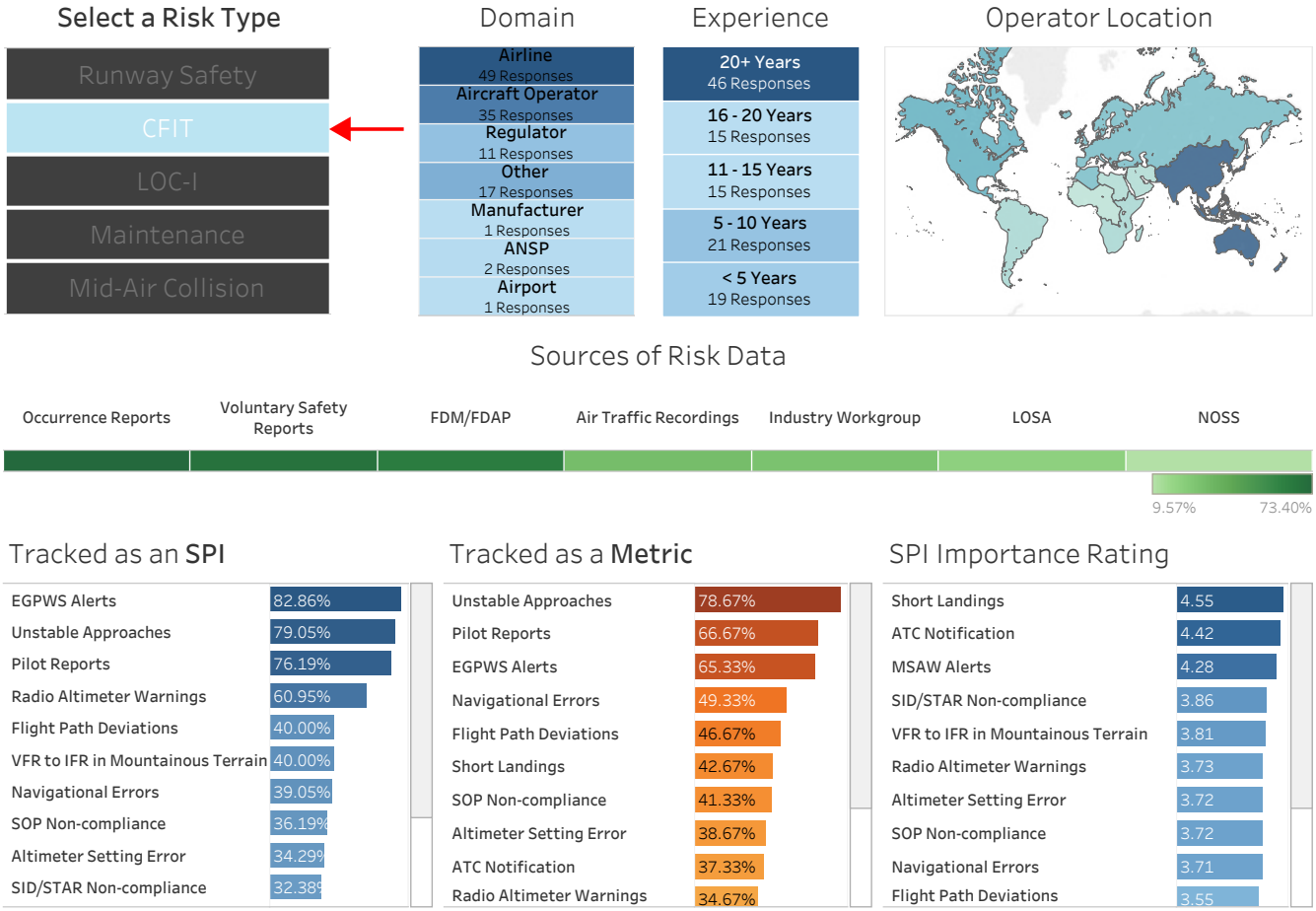
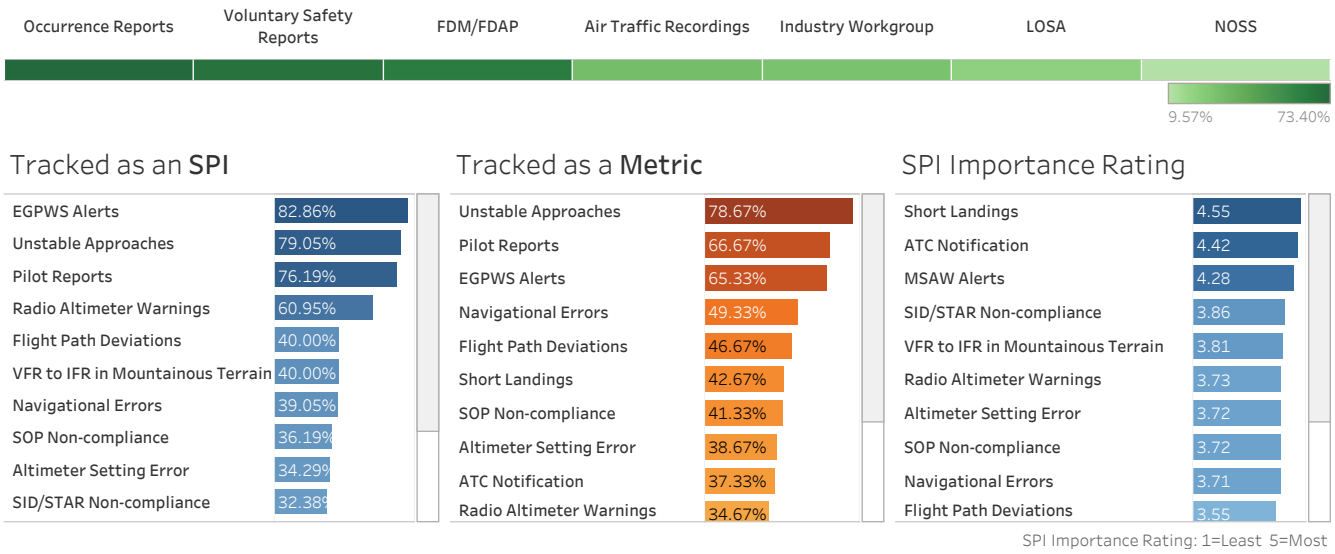


Figure 5 — SPI Survey Dashboard — CFIT Results



or identifying additional data sources their organization could leverage to enhance its safety performance monitoring activities.

While the example presented in the preceding figures detail the CFIT risk area, dashboard users can explore a multitude of risk areas, and perform more specific analyses, such as filtering by domain and/or global region. The dashboard also provides users with the ability to download their analysis results for sharing and distribution. As the Foundation continues to explore SPIs and SPTs, we intend to continue leveraging the capabilities of the dashboard to share our findings with our global audience.

International Harmonization and Outreach

Harmonizing GSIP activities with global aviation safety initiatives is critical to the project's success. The Foundation actively engaged with the aviation community through a workshop in the Asia-Pacific region, as well as a four-part webinar series with a global reach. The Foundation used a variety of tools including social media and the GSIP website to promote these activities. In both the workshop and the webinars, participants expressed interest in the project, and actively engaged with us before, during, and after the events. Additionally, many participants expressed a desire to work directly with the Foundation to further expand the reach of GSIP and integrate the project's work products into their own organizations.

Asia-Pacific Workshop

The Manila workshop, held Aug. 9-10, drew 56 attendees from airlines, general aviation, training providers, regulators, accident investigation authorities, and maintenance providers. While many of the attendees already had some familiarity with GSIP, the workshop was the first exposure for some to the project.

The Foundation introduced workshop attendees to GSIP and provided an overview of the work completed to-date. We also familiarized attendees with the intensity level concept, and detailed the content, themes, and objectives of each SDCPS-focused toolkit. Additionally, the Foundation explored how the toolkits could be helpful to the attendees in their organizations; pursuit of safety and risk management objectives. To facilitate this discussion, the Foundation used case studies and operational scenarios to illustrate how the toolkits could be used in a real-world situation. This technique resulted in a collaborative learning environment for the attendees, and enabled the Foundation to gain a better understanding of the attendees' experience, opinions, and thought processes. FSF received positive feedback from workshop attendees on the use of case studies and scenarios to help guide the workshop discussions, as well as suggestions for future topics.

The workshop also provided an opportunity to promote awareness of the SPI survey. Workshop attendees were asked to complete the survey during the first day of the workshop. The results were then integrated into the interactive SPI survey dashboard and presented on the second day. In accordance with the survey privacy policy, all responses were de-identified so that results could not be attributed to a specific workshop participant or organization. During the summary of results, the Foundation used the interactive SPI dashboard to filter responses into areas of particular interest and facilitated meaningful discussions with attendees. Additionally, respondents provided feedback on the survey and offered suggestions for increasing participation. Some workshop attendees also provided additional reference materials that detailed their organization's use of SPTs, SPIs, and performance metrics.

Webinars with Global Industry

To further international harmonization and promote global awareness of GSIP, the Foundation hosted a four-part webinar series between May and August 2017. The webinars were designed to expand the GSIP stakeholder base, highlight the achievements of the project, validate draft toolkit content, and identify emerging SDCPS needs from participants. Each webinar focused on a particular toolkit, and was held twice during the day to accommodate individuals in different time zones. The Foundation also posted recordings of the webinars on the GSIP webpage to allow individuals who were not able to participate to view the content in its entirety.

In addition to building awareness of the project and toolkit contents, the webinars allowed the Foundation to gather feedback on work performed to date and provided an opportunity to promote participation in the SPI survey, and to share initial survey results with the GSIP community. The Foundation also leveraged commercial webinar technology to conduct live polls of attendees, encourage audience participation through the ability to submit written questions, and facilitate an interactive experience.

The following figures (Figures 6–8) provide an aggregate summary of the polling questions and background information asked of participants during each of the webinars. We found the responses to be helpful in ensuring that the events were appropriately targeting our audience. We also used these results to help shape and prioritize potential future toolkit inputs.

Figure 6 — Webinar Attendance by Stakeholder

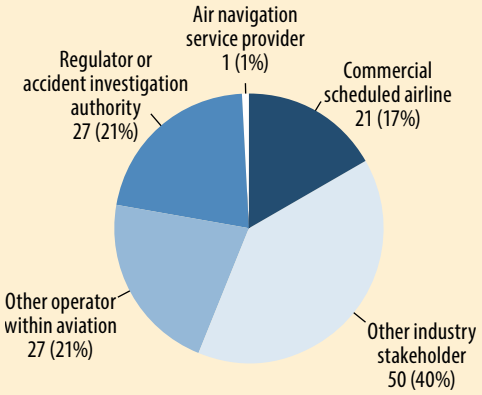


Figure 7 — Webinar Attendee Participation in GSIP

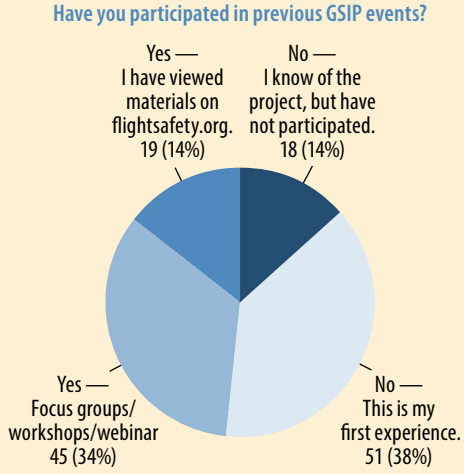
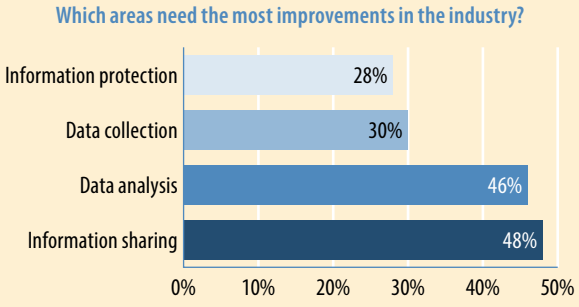


Figure 8— Webinar Attendee Participation in GSIP



GSIP Project Findings

This section provides a summary of what we learned during GSIP's three years. It also describes how the Foundation applied these findings to shape SDCPS toolkit development, and generate strategic GSIP recommendations.

1. The Industry needs common understanding on SPTs and SPIs

The Foundation identified an opportunity to develop SPI and SPT guidance materials. This guidance could assist industry in the consistent development, implementation, and monitoring of operational safety performance goals. Through our webinars, workshops, and SPI survey results, *FSF discovered that there is significant variability in how SPIs and SPTs are defined, interpreted, and used across industry.* While ICAO Annex 19, *Safety Management*, and ICAO Doc 9859, *Safety Management Manual*, offer definitions and examples, FSF also discovered that different interpretations exist across industry and GSIP stakeholders. Whereas ICAO defines an SPI as a data-based parameter used for monitoring and assessing safety performance, some consider an SPI to be a broader term that refers to general risk areas of concern. The Foundation sees this variability as an opportunity to conduct additional research and develop SPI and SPT guidance. In some examples, we witnessed use of some metrics, like those that depend on good consistent reporting, that often increase as the reporting matures. The increase in events measured through these performance indicators does not mean risk has increased and organizations need to understand the impact from maturing systems and processes.

To address this finding, the Foundation began its discussion of SPIs in Level of intensity 1 in our toolkits and continued it throughout each level as maturity in its use progresses. We also identified a need to provide industry guidance for the development of meaningful SPTs and organizational alerting thresholds. While setting an SPT of zero undesired events represents the most ideal outcome, simply identifying all undesired outcomes and setting SPTs of zero for each risk area is not sustainable or beneficial in achieving meaningful safety performance improvements. Rather, it is important to set SPTs that help monitor the impact of change. For example, rather than setting an SPT of zero runway excursions, an aircraft operator may choose to monitor runway excursion risk by tracking a set of SPIs that may have a contributory effect on runway excursion risk, such as long landings or unstable approaches.

The Foundation intends to address these findings in the SPT and SPI reference materials discussed in the Year 4 Recommendations and Next Steps section of this report.

2. The industry needs guidance for safety data alerting

The Foundation learned that alert thresholds and triggers for automated data sources, such as flight data monitoring (FDM)/flight operations quality assurance (FOQA) data for aircraft operators, can vary greatly across organizations and project stakeholders. GSIP participants often told us that they do not struggle with having too little data, rather one of their primary challenges is monitoring the data for indicators of potential safety issues. *The development of appropriate safety alerting thresholds for a variety of data parameters can be used to automate this process, alerting analysts when a chosen parameter exceeds a pre-defined level.* We found that some organizations may also set "soft" and "hard" alerts that trigger different responses within the organization depending upon the magnitude of the deviation or exceedance. An unstable approach may be just beyond the limits but is known by flight crew members to be easily recoverable prior to landing. However, an egregious unstable approach may clearly have risk implications and be worthy of investigation. Soft alerts may require continued tracking and trending while hard alerts (like egregious unstable approaches) require more direct follow-up. To address this finding, the Foundation mentions the use of thresholds in level of intensity 2 and 3 of the toolkits. FSF also recognizes an opportunity to continue gathering information from industry, developing best practices for defining, using, and revising alerting thresholds, and assisting interested organizations in implementation.

The Foundation intends to address these findings in the SPT and SPI reference materials discussed in the Year 4 Recommendations and Next Steps section of this report.

3. Industry still has a high level of SMS/SSP implementation variability

Through discussions at focus groups, workshops, and one-on-one meetings, *the Foundation discovered that several GSIP stakeholders are still in the process of developing and implementing an SMS or SSP.* By engaging with these stakeholders in the beginning stages, we identified opportunities to help these organizations further define their overall SMS or SSP goals, assist in the development of program implementation strategies, and generally help further the success and expediency of their efforts. In particular, the Foundation believes that the GSIP toolkits would be valuable in providing these organizations with techniques for developing and implementing the fundamental elements of an SMS or SSP. To address this finding, the Foundation incorporated SMS/SSP principles in nearly every level of the GSIP toolkits and will also continue to explore opportunities to engage with these organizations and offer assistance, as detailed in the Toolkit Training and Webinars and Continued Work with Industry sections of this report.

4. Bowtie models are a useful tool to understanding deeper issues of risk

Throughout the first three years of this project, the Foundation found that bowtie models are an emerging risk assessment method across the aviation industry. *Bowtie models provide a repeatable process to identify and document multiple risk scenarios, including threats, defenses, and recovery measures.* In a complex system like aviation, barriers are often managed by more than one organization. Bowtie models are a key analysis tool that drive collaborative risk assessments and decision making across stakeholders. Prior to the start of GSIP and integration of this methodology in our toolkits, FSF was already familiar with bowtie models,

having included them as a key component of the Foundation's Basic Aviation Risk Standard program. Additionally, FSF became aware of other organizations and initiatives embracing the bowtie model, including the Common Aviation Risk Model (CARM). FSF conducted research to ensure that our suggested use of bowtie models is consistent with what's already being practiced in the industry to ensure a common approach. To address this finding, the Foundation suggested more complex application of bow tie analysis and suggests quantification of the elements within bow tie analysis within the Level of Intensity 3.

5. There is a need to define components of level 4 intensity

During FY 2017, the Foundation conducted research and engaged with GSIP participants to collect input on what the foundational elements of a Level 4 intensity toolkit might be. *Based on stakeholder outreach and feedback, the Foundation believes that Level 4 intensity will be aspirational for all organizations, domains, and stakeholders.* Due to this strategic nature, it became clear that additional research was, and is, needed to define the suggested toolkit contents.

The Foundation learned that its development approach for Level 4 will need to be different than the methods used to develop the Level 1, 2, and 3 intensity toolkits. To develop those toolkits, we collected information on current practices from the global aviation community. Level 4 is envisioned to promote global safety risk management through collaborative data analytics, sharing of complex safety information under a structured approach, and a unified approach to safety culture and information protection. While some of these components exist in some parts of the world, there are no examples of the entirety of what we envision for Level 4 currently in practice. Because a comprehensive real-world example of Level 4 intensity does not yet, the Foundation identified a need to continue collaborating and engaging with global aviation stakeholders to help define the components of Level 4. During the fourth part of the GSIP webinar series, we presented a high-level framework of possible Level 4 intensity components, but we recognize that further engagement with GSIP stakeholders will be critical in the development process.

In essence we believe some of the most highly effective work comes from greater levels of collaboration at industry and state regulator levels. Some of the most effective processes come from efforts where there is 1) use of good data that represents the actual flight events and activities through FDM programs 2) there are strong analytics group making good use of FDMP and other related data; 3) leadership through a governance body; 4) willingness to collaborate between government and industry; and, 5) commitment to follow through on mitigation actions.

To address this finding, and to give some focus to the most mature and complex organizations of the world, the Foundation has provided its sense of good data in the toolkits, coverage on the analytics that can be applied to good data will explore methods of carrying out our continuing GSIP program through the help and assistance of our membership and potential new sponsors.

6. The industry desires information sharing improvements

The Foundation learned throughout FY 2017 that while most organizations are good at collecting a variety of safety information, there is a need to improve information sharing practices between organizations. *In polling during the webinars, data collection was often cited as one of the areas needing the least amount of improvement. As illustrated in Figure 9, only*

30 percent (n=37) of respondents cited data collection as an area needing improvement in the industry, compared to 48 percent (n=60) for information sharing. We witnessed the desire in our focus groups and workshops regularly as air carriers said limited knowledge was available from regulators on summaries of mandatory safety data, and regulators said scarce information was available from air carriers on their SMS findings. Despite the vast amounts of data collected by most organizations, many do not share it outside of their organization unless such sharing is mandatory, such as reporting an incident or submitting a mandatory occurrence report. To address this finding, the Foundation believes that the information sharing sections of the toolkits will provide actionable steps organizations can take to develop and implement information sharing practices.

7. There are several data integration inconsistencies

Feedback from GSIP stakeholders indicated that there often are inconsistencies in how data is integrated, analyzed, and shared within organizations. The ICAO *Safety Management Manual* recommends keeping a register of different risks that have been identified and where safety mitigations are being implemented. We found different lines of business within an organization may maintain their own individual risk registers and describe their own risk pictures in isolation. *In other words, risk may be assessed and monitored in different ways within a single organization.* GSIP participants provided examples of multiple lines of business within one organization working in isolation on the same safety issues. Due to a lack of coordination, and each line of business approaching issues through its own unique lens, potential cooperative and collaborative benefits were not realized. It is unknown if these inconsistencies are driven by safety culture sensitivities, or if they are caused by resource or infrastructure limitations. To address this finding, the GSIP toolkits outline a variety of strategies for developing a comprehensive risk picture and organization-wide SPIs and SPTs. In particular, the toolkits suggest the development of cross-organizational safety teams to facilitate information sharing between all lines of business within an organization.

Recommendations and Next Steps

In the three years of GSIP, the Foundation conducted 12 focus groups, 14 workshops, six webinars, and successfully consolidated what we learned into SDCPS-focused toolkits. In subsequent years, the Foundation intends to continue R&D efforts to keep learning more about how the industry is managing risk, and collecting, analyzing, sharing, and protecting safety information. The research will be conducted, in part, through additional surveys, webinars, and efforts to work with industry, and will support the development and publication of a Level 4 intensity toolkit. Additionally, the Foundation will continue working with stakeholders to help them use the toolkits, collect success stories, best practices, and share this information back to industry.

Figure 9 — GSIP Activity Map

Additional SPT and SPI Research

Driven by our findings, the Foundation desires to develop a second SPI survey to facilitate the collection of additional information on current safety performance monitoring practices. The information we gather will support the development of the SPT and SPI guidance materials described in the following section. The survey will incorporate feedback we received from GSIP participants to date, and will include additional research questions that arose during our analysis of the first survey results and our discussions with industry. The survey will be promoted to GSIP participants and other stakeholders through the GSIP webpages, social media tools, and international outreach efforts.

Safety Performance Monitoring Guidance

The Foundation identified a significant opportunity to contribute to the industry's adoption and use of SPTs and SPIs through further research and development of guidance materials. Based on the results of the second SPI survey and continued engagement with industry, the Foundation will develop repeatable guidance materials that will summarize best practices for developing, implementing, and monitoring SPTs, SPIs, and alerting thresholds across a variety of aviation domains. Our development will also be based on the collective body of knowledge gained by the Foundation over the course of the first three years of the project.

In addition to assisting stakeholders with the integration of safety performance monitoring into their operations, the Foundation also believes that such materials will facilitate effective information sharing by promoting standardized performance monitoring and benchmarking techniques. This belief is grounded in the expectation that as awareness of SPT, SPI, and safety alerting best practices increases across the industry, there will be increased consistency between organizations. This standardization will, in turn, facilitate the sharing of safety performance information among organizations across the industry.

Throughout the process, the Foundation will actively coordinate with ICAO, industry stakeholders, and other interested parties to ensure the development of relevant, accurate, and useful reference materials. FSF intends to develop materials that are complimentary to ICAO Annex 19, *Safety Management*, ICAO Doc 9859, *Safety Management Manual*, and the ICAO GASP, to assist organizations in ensuring compliance with ICAO requirements.

Toolkit Training and Webinars

The Foundation will leverage international harmonization activities to identify global SDCPS knowledge gaps. In response to validated gaps, we may provide interested GSIP stakeholders with SDCPS toolkit training opportunities. Based on the positive feedback received from the use of case studies in the Asia-Pacific workshop, we believe the training could be case study-based to demonstrate how the tools and techniques suggested by the toolkits could be applied in real-world scenarios. Throughout the project, we have encouraged GSIP participants to share real-world examples of scenarios or issues they have experienced within their organizations. The Foundation also has been actively conducting research to identify additional examples that could be used to facilitate training. In accordance with the GSIP privacy and confidentiality agreements, the Foundation will continue to encourage GSIP participants to share their experiences to assist us in clearly demonstrating the real-world applicability of the toolkits.

The Foundation also hopes to conduct additional webinars focusing on specific areas of the toolkits. These webinars will be driven by stakeholder needs and outputs from toolkit

training sessions. Additionally, the webinars would be an ideal medium for sharing GSIP participant success stories and best practices for using the toolkits.

Continued Work with Industry and ICAO

The Foundation will lead the continued integration of the SDCPS-focused toolkits into operations. In addition to toolkit training, FSF will incorporate success stories and best practices from organizations into annual toolkit updates to ensure their currency and relevance. These success stories may focus on how one or more organizations applied the toolkits to elevate their SDCPS risk management capabilities, or how they applied the recommended tools and techniques to address operationally relevant safety needs.

Over the next several years ICAO is expected to proceed with its GASP and many countries will be implementing their SSPs while their service providers will be implementing or greatly enhancing their SMSs. The safety performance objective is to achieve zero fatal accidents by 2030. The success of this plan depends on robust processes to learn from actual operations and apply protective barriers that are precisely targeted towards the statistically weakest areas. The Foundation continues to participate in the GASP working groups and Regional Aviation Safety Groups to assist in this global initiative.

Level 4 Intensity Toolkit

The Foundation expects to collaborate with industry to develop a Level 4 intensity toolkit. The toolkit will incorporate a variety of strategic suggestions, concepts, tools, and techniques to assist the industry in moving towards global safety risk management. As previously noted, this toolkit will be largely aspirational and based off industry input. As such, FSF will actively promote their progress in drafting this document and solicit comments, feedback, and input from GSIP participants throughout the process. FSF will also continue to monitor the developments of global aviation safety initiatives and programs, such as the European Aviation Safety Agency's Data4Safety program and IATA's Flight Data Exchange system, to ensure the contents of the Level 4 toolkit are developed in line with the most up-to-date, cutting edge developments in global safety risk management.

Acknowledgements

Flight Safety Foundation would like to thank a number of stakeholders who have helped us so far in this project. First on the list are the civil aviation authorities, airline operators, air navigation service providers, airports and manufacturers that contributed to our focus group discussions in the assessment phase of this project. Because we also committed a level of privacy to these stakeholders, we do not list them in our report. However, the following people and organizations are part of the ongoing working set of contributors to this project. We appreciate the tasks they are performing to directly support Flight Safety Foundation in its GSIP work activities.

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