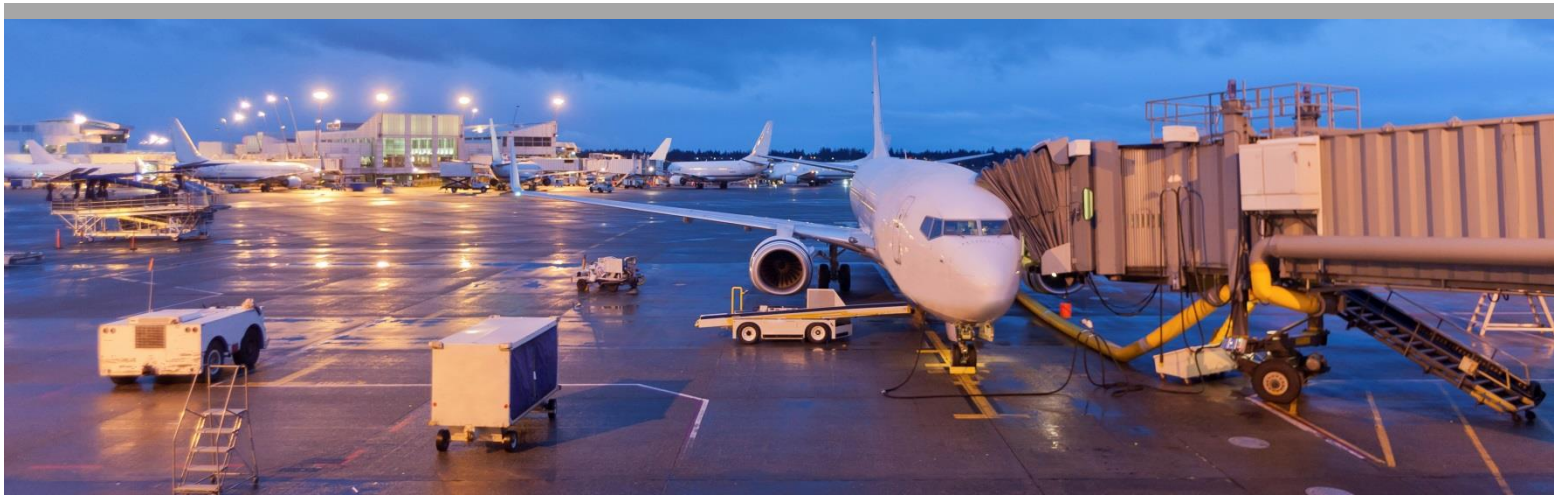




PARAS PROGRAM FOR APPLIED RESEARCH IN AIRPORT SECURITY



PARAS 0003

January 2017

Enhancing Communication & Collaboration Among Airport Stakeholders

National Safe Skies Alliance, Inc.

Sponsored by the Federal Aviation Administration

Barich, Inc.
Chandler, AZ

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PARAS PROGRAM OFFICER

Jessica Grizzle *Safe Skies Special Programs Manager*

PARAS 0003 PROJECT PANEL

Sarah Demory *Boise Airport*

Cedric Johnson *Baltimore Washington International Airport*

Deborah Schwartz *Strategic Aviation Solutions, LLC*

Raymond Wong *TecSecure Solutions, LLC*

Robert Benstein *Capital Region International Airport*

Marci Greenberger *Airport Cooperative Research Program*

AUTHOR ACKNOWLEDGMENTS

This research was performed under PARAS 0003, “Enhancing Communication and Collaboration among Airport Stakeholders.” Barich, Inc., was the primary research consultant. Frank Barich, Principal of Barich, Inc., was the Principal Investigator. The research team was composed of Frank Barich, Bill Bayham, Marc Gartenfeld, Joseph Kratzer, and Jim Miller, all of Barich, Inc.; Tim Anderson, Chief Executive Officer (CEO) of Anderson Airport Consulting, LLC; Rose Agnew, Founding Principal of Aviation Innovation; Charlotte Bryan, CEO Charlotte Bryan Solutions, Inc.; and Carolyn Binder, Owner of Carolyn Binder CPA, LLC. Additional support was provided by Allison Larson, Jan McCormick, and Tyler Wilson of Barich, Inc., as well as Christina Coverdell of Aviation Innovation. Graphical elements were designed by Katie Barich.

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SUMMARY

ABSTRACT

This Guidebook provides practical, hands-on, interactive material useful to Airport Operators for enhancing communication and collaboration (C2) among internal and external airport stakeholders. It is designed to fit the needs of a broad spectrum of airports, and is scalable to airports of various sizes and types. This Guidebook provides a tool to assess an airport's current conditions relative to C2. Research findings reflect that it is helpful to take a systematic approach to airport C2 to ensure and sustain successful outcomes. The Guidebook, therefore, presents a practical step-by-step approach, the C2 Program Life Cycle, for enhancing C2 among airport stakeholders. It also offers other tools, including printable checklists of how to get started putting the C2 Program Life Cycle approach into action. Additional findings conclude that, throughout this life cycle, face-to-face meetings are an indispensable mechanism to establish and sustain the necessary relationships and provide the foundation for overcoming C2 related barriers and challenges. Further findings indicate that information technology can be a significant enabler of C2 among airport stakeholders, and that opportunities to leverage technology increase substantially as you move from smaller to larger airports. To that extent, this Guidebook focuses on how technology can be of help in enhancing C2.

The purpose of this Guidebook is to provide practical, hands on material to Airport Operators for enhancing communication and collaboration (C2) among airport stakeholders. Since the safe and secure operations of an airport depend upon many different airport personnel and multiple stakeholders, in both the private and public sectors, an overarching goal of C2 is to increase the efficiency and effectiveness of airport operations in the areas of safety, security, and passenger services.

This Guidebook is designed to fit the needs of a broad spectrum of airports and is scalable to airports of various sizes and types. It provides an assessment of an airport's current conditions relative to C2, and offers a practical step-by-step approach for enhancing C2 among airport stakeholders.

The research methodology to support the development of this Guidebook included the following four components:

1. Performing a comprehensive Literature Review.
2. Interviewing a variety of airports and non-airport industry entities to assess challenges and barriers relative to stakeholder C2 and to discover best practices and lessons learned from their successes.
3. Establishing an Advisory Group for direction and validation of the Guidebook approach and content. This group consisted of industry representatives with expertise in the following focus areas: Operations, Public Safety, Security, Communications, Financial, Public Relations/Social Media, Administrative/Legal, and Technology.
4. Conducting two focused workshops at a large and small airport (discussed below as an Aviation Management Hackathon) that involve structured problem solving for known issues related to stakeholder C2, and developing solutions for reinventing C2 processes.

Findings from the research reflect that it is helpful to view airport communication and collaboration in relation to a C2 Program Life Cycle. This life cycle addresses everything needed for successfully enhancing C2 among airport stakeholders.

Based on the research, larger airports comprise the primary target for implementing in its entirety such a comprehensive, structured C2 approach, including Part III (information technology [IT]). That does not mean, however, medium and smaller airports cannot benefit from considering such an approach, as they certainly will benefit substantially by implementing the elements and guidance that are applicable to them.

Therefore, by putting the Guidebook together, an attempt was made to strike a workable balance between (a) providing everything larger airports should consider and (b) to what extent smaller airports can find guidance by adapting information pertinent to them. The difficulty here is that covering smaller airports to the level of detail that would provide an approach suitable for them specifically would possibly require a separate Guidebook; this is because that there is discrepancy among the large and small airports in regard to a C2 approach and (especially) IT.

Nevertheless, this Guidebook addresses small airport concerns and provides guidance in every chapter, including the IT ones. In general, smaller airports have the choice to do as much of this process as they want or can. It benefits them greatly to read this Guidebook in its entirety, since by knowing about the comprehensive approach, they are fully informed and can then adapt it to their liking and ability.

Establishing Commitment and Structure – Developing and communicating a shared C2 vision and identifying a champion are important foundations for success. Building an organizational framework to support the shared vision is essential for including all stakeholders in the vision’s execution, and for obtaining buy-in moving forward. Because the enhancement of C2 among stakeholders often requires a transformation of existing business processes, Airport Operators should establish an appropriate governance model, laying the ground rules on how priorities are set, decisions are made, problems are escalated, successes and failures are monitored, and effective change management procedures are employed.

Building Relationships Through Face-to-Face Interaction – While leveraging technology to communicate and share information among stakeholders can be of significant value and greatly facilitate collaborative processes, it does not replace the importance of establishing relationships in person. The enhancement of C2 processes must follow a human-centered approach in order to effectively build and establish relationships and networks among stakeholders. Communication is most effective when done face-to-face; there are several effective formal and informal approaches for accomplishing this objective.

Identifying Information Sharing Requirements – Since information sharing is a vital component of stakeholder C2, it is incumbent upon Airport Operators to take the steps necessary to identify the information requirements of both internal and external stakeholders. Techniques exist for assessing and documenting what information is needed by each stakeholder. This includes addressing security concerns and identifying when the information is needed, how it will be used, and for what purpose.

Establishing and Revising Policies and Procedures – Creating meaningful policies and procedures is an effective way to promote consistency, efficiency, and effectiveness. It also helps to mitigate or manage risk. Establishing a well-written policy, with C2 as a part of the vision, sets a framework for the development of procedures that allow personnel to clearly understand their roles and responsibilities within predefined C2 activities. Written procedures also help educate new personnel, transition existing staff, and lessen the impacts of employee turnover. Steps for establishing effective procedures include (a) identifying stakeholders, (b) creating lists of existing operating guidance documents, (c) determining overlaps, gaps, and inconsistencies, (d) incorporating informal communication process, and (e) testing the efficacy of the plans.

Developing Key Performance Indicators (KPI) – Leveraging KPIs is an objective way to monitor and track how well an airport is doing relative to its C2 shared vision and goals. By establishing and tracking measurable and relevant performance indicators, a formal process is established for (a) communicating progress to all stakeholders, (b) identifying successes, (c) determining where there are opportunities for course corrections, and (d) establishing a path for continuous improvement. Based on identified information sharing requirements, Airport Operators should draw out key C2 contributions and apply them to specific KPIs. A continuous joint review and measuring of KPIs is helpful as it monitors stakeholder behavior and interests, and will help ensure communication mechanisms are effective.

Executing Partnering/Alignment Agreements – In order to ensure reliable and consistent operations, Airport Operators should formalize the roles and responsibilities of all airport stakeholders in a comprehensive interagency agreement and, where applicable, in Service Level Agreements. The latter is of particular significance when partners undertake certain services on behalf of others. Whenever possible, it is best to formalize and execute agreements to align all stakeholders relative to C2. Focus areas include handling of proprietary information or intellectual property; granting access to sensitive information; restricting information usage; and understanding regulatory requirements and indemnification.

Ensuring Staff and Stakeholder Training – Taking steps to ensure proper training of airport staff and stakeholders promotes successful outcomes, and helps to sustain an airport’s shared C2 vision and goals. A key benefit of training is that it leads to effective and efficient responses by appropriate stakeholders to shared activities and events. In regard to training, the old adage “one size fits all” does not apply. Therefore, three categories of training to improve C2 include initial, recurring, and event-specific. In addition, Airport Operators training should address a variety of subject matters, including effective communication, safety and security, stakeholder engagement, IT systems and tools, and customer service.

Reviewing and Refining C2 for Sustainability and Continuous Improvement – In order to protect investments in stakeholder C2, Airport Operators need a formal approach to sustain an airport’s C2 Program. Three key elements of the formal approach include (a) applying established KPIs to track and report progress, (b) reviewing trends in performance, and (c) holding regular joint review meetings where issues or ideas for continuous improvement can be discussed and acted upon to maintain momentum.

Information Technology – Further findings from the research indicate that IT is a significant enabler of C2 among airport stakeholders. For this purpose, an entire section of the Guidebook focuses on how technology helps the C2 Life Cycle. The level of investment in the IT solution is somewhat impacted by the size and complexity of the airport. Many of the smaller airports simply cannot afford the upfront or recurring costs for technology investments. As a result, the opportunities to leverage IT solutions for enhancing C2 are limited. However, IT still plays a positive role for smaller airports, and Airport Operators of these smaller airports can assess the level of IT investment in priority C2 functions. Easy access to the many and varied types of social media may provide a C2 methodology that would be inexpensive and easily grasped by all stakeholders. Robust and preemptive participation in Snapchat, Facebook, and Twitter, can provide that important link to an airport’s stakeholder community, as well as the general public.

On the other hand, Airport Operators of the larger airports have invested heavily in IT and typically have the budgets to continue to make IT investments when, and if, a business case can be established. Despite these advantages, the size and complexity of the IT landscape for a large airport can become a challenge when attempting to communicate and share information across its stakeholder community with both

speed and accuracy. This is especially true if the data and technology is not managed effectively to enable interoperability across multiple technology platforms.

With such broad differences in the IT landscape moving from very small to very large airports, it becomes increasingly more critical for Airport Operators to manage their technology assets effectively. To assist Airport Operators in addressing these challenges and realizing the potential of IT to facilitate C2, the Guidebook presents the following best practices:

Manage Data as an Enterprise Resource – Effective information sharing necessitates the management of data as a critical enterprise resource of an airport. To maximize the speed and accuracy for which data is exchanged for use by stakeholders, Airport Operators should consider investments in enterprise data management (EDM) frameworks and disciplines. EDM frameworks help organize airport IT and business personnel into a program for managing data as partners. Setting your C2 goals for information sharing is important in securing management support for EDM investments. Because EDM is a process, not a project, establishing key performance indicators that demonstrate the impact of these investments can be useful in obtaining additional funding.

If immediately jumping into an EDM framework is not possible or practical, such as for some smaller airports, it is important to remember that an EDM strategy can be phased in. Also, not all of the EDM components need to be in place simultaneously in order to realize important benefits. Start with easily attainable tasks in order to achieve early wins, or focus first on those areas that are causing your airport the most challenges or barriers to effective C2.

Design and Implement a Systems Integration Platform – The building of an effective Systems Integration Platform takes time to evaluate, select, and acquire the tool sets appropriate for the size and complexity of the airport. Airport Operators should make sure the long-range plan focuses on organizational factors such as providing training for personnel and ensuring proper skills are in place for a successful IT transition. Airport Operators should also ensure that scalability of the airport's Systems Integration Platform is considered for the long-range plan. One such approach may include installing a Service-Oriented Architecture (SOA). An SOA uses standard components and open IT standards, and is a strategic approach that enables Airport Operators to integrate information without regard for its source, thereby protecting the existing investments in technology while improving interoperability between heterogeneous systems.

Establish Data Display Strategies – Once critical components of the enterprise data management framework are in place, and an adequate integration technology platform has been established for sharing information from disparate stakeholder sources, it is incumbent upon Airport Operators to consider strategies for how key information will be delivered to and displayed for stakeholders. Airport Operators must tailor the delivery and display of information to support the specific operational roles of each stakeholder. Given the proliferation of computer devices in use today, Airport Operators can find it a challenge communicating across this multi-device landscape. As such, it becomes imperative for Airport Operators to develop an effective multi-platform, multi-device strategy for data delivery and display.

PART I: SETTING THE STAGE

Chapter 1: Overview

Introduction

This Guidebook is a comprehensive, user-friendly, and practical interactive resource that provides the reader with the information and tools necessary to enhance communication and collaboration (C2) among all airport stakeholders. This Guidebook considers C2 from an airport-wide perspective, and its guidance is intended to establish an understanding of the benefits of continually enhancing C2 across all operational conditions: normal, emergency, irregular, and security incidents. It assists the reader in assessing the airport C2 environment, and provides instructional guidance on how to enhance and refine in areas where it is most needed. By doing so, it introduces processes and approaches to improve efficiency of operations, thereby reducing costs for Airport Operators and airport stakeholders. The Guidebook has a special emphasis on considering C2 practices that can help the Airport Operator ensure airport security and overall operations are effectively improved.

This Guidebook has a broad reach and is intended for use by all Airport Operators, regardless of airport size and governance, and by a variety of airport stakeholders (internal and external) at various levels of responsibility. A primary audience, especially for implementation purposes, is the airport's Chief Operating Officer (COO) and his or her staff. All stakeholders, internal and external, will also benefit from this Guidebook for understanding and facilitating consensus decision-making. Other relevant audiences include executive management and IT division staff members.

By enhancing C2, Airport Operators can begin to positively impact operational efficiencies across both normal and emergency operations, thus creating a self-promoting and continuously improving C2 Program. The use of the word *Program* is to show how enhancing C2 requires a dedicated and well thought-out approach. To that extent, this Guidebook is structured in three parts:

- Part I – Setting the Stage (Chapters 1–3)
- Part II – The C2 Program Life Cycle (Chapters 4–11)
- Part III – How Can Technology Help You (Chapters 12–16)

In addition, various appendices provide other useful material, such as Best Practices (Appendix B), List of the C2 Health Assessment Questions (Appendix C), “Getting Started” Checklists (Appendix D), Aviation Management Hackathon Summaries (Appendix E), Bibliography (Appendix F), and Glossary (Appendix G). For smaller airports, Appendix B and the Burbank Bob Hope Airport (BUR) section of Appendix E are especially valuable. Also, Appendix A provides a financial consideration discussion that focuses on guiding the reader through recommended steps of a feasibility analysis as it relates to justifying C2 initiatives.

Part I: Chapter 1 provides introductory and background information to create a foundation of understanding regarding the purpose, structure, intended audience, research approach, and use of this document. Chapter 2 provides an easy-to-use C2 Health Assessment tool for readers to assess the condition of C2 within the respective airport stakeholder community. This tool (discussed in more detail in the “How to Use the Guidebook” section below) also helps to guide the reader to the most appropriate sections of the Guidebook, depending on the reader's responses to the questions. Chapter 3 identifies existing airport stakeholders and discusses the most prevalent benefits and challenges faced by airports in their efforts to engage in effective C2 activities.

Part II is designed to guide the reader through the eight phases of the C2 Life Cycle using a step-by-step approach. Each one of the eight chapters is designed to discuss all the details of how to enhance stakeholder C2 in each phase. Chapter content is presented in an easy-to-follow format, providing chapter insight summaries, highlighting call-out boxes, tools, best practices, and including “Getting Started” checklists. Some of these elements are identified with unique icons (discussed in detail in the “How to Use the Guidebook” section) to better guide the reader through the chapter content. These icons and other graphical elements, such as charts, figures, and tables, are used throughout all Parts, to help make the entire Guidebook a user-friendly and easy-to-read resource.

Part III is focused on the technological considerations of enhancing C2. In its five chapters, Part III, provides guidelines on how to better manage IT as an asset for enhancing C2 among airport stakeholders. It also provides guidelines for establishing technical architectures that will improve integration between stakeholder systems and facilitate information sharing across all stakeholder technology platforms. Although Part III is targeted primarily to the airport IT audience, it is important for all airport managers to be generally aware of the concepts and guidelines presented therein.

Research Approach

The Research Team collected the information used to develop the content of this Guidebook through various research methods, including a literature review, Advisory Group engagements, conferences, and Aviation Management Hackathon Workshops¹. The goal of the combined research was to provide guidance to the reader in incorporating the topic’s most current information, processes, approaches, experiences, and best practices. Primary research subjects included airports, airlines, related industry associations, and non-airport entities, such as emergency management organizations and technology vendors. Secondary resources included publications from airport and airline industry associations; Airport Cooperative Research Project (ACRP) reports; and various aviation, technology, and C2 related websites. The following ACRP reports have been especially helpful during the development of this Guidebook. [*Note: To access or download these reports, simply click on it. This will open your default browser and lead you to the reports summary and download page on the ACRP website.*]

- ACRP Report 13: Integrating Airport Information Systems (2009)
- ACRP Report 88: Guidebook on Integrating GIS in Emergency Management (2013)
- ACRP Report 92: Guidebook to Creating a Collaborative Environment Between Airport Operations and Maintenance (2013)
- ACRP Report 103: A Guidebook for Integrating NIMS for Personnel and Resources at Airports (2014)
- ACRP Report 136: Implementing Integrated Self-Service at Airports (2015)
- ACRP Synthesis 60: Airport Emergency Post-Event Recovery Practices (2015)
- ACRP Synthesis 65: Practices to Develop Effective Stakeholder Relationships at Smaller Airports (2015)




¹ A Management Hackathon is structured problem-solving approach, including a variety of stakeholders that involves learning, diagnosis, priority setting, idea generation, idea ranking, and feedback. This term helps to draw out the primary point of conducting the group-based problem solving sessions in a fast and focused approach.

How to Use the Guidebook

This Guidebook is designed to meet the varying needs and objectives of its diverse readership. The following elements make that possible:

- C2 Health Assessment* – This tool, provided in Chapter 2, creates an assessment report based on the user’s (your) responses. This report provides useful guidance by pointing you to chapters (or sections within chapters) identified as subject areas in which opportunities for improvements exist. It should be noted that the tool has been developed around the C2 Program Life Cycle. Although smaller airports might be inclined to skip tool questions relating to areas that don’t seem pertinent or applicable, it does not mean that the Guidebook chapters/section should be skipped. Each chapter contains insightful small airport discussions, applications, and examples that should not be missed. Instead of skipping questions, the reader should answer with “No” and read the corresponding chapters/sections to (a) broaden the understanding and (b) read the small airport examples woven throughout these discussions. The tool is accessible via a large clickable icon link at the end of Chapter 2, immediately after the detailed instructions on how to navigate the tool are provided.
- Icons* – The Guidebook uses various icons to identify different types of content, as shown in Table 1. These icons are placed in the margin next to the associated text and offer access to other content or tools by simply clicking them. Table 1 also provides details regarding each icon’s purpose and how you can use them to get the most benefit out of the Guidebook. Depending on your objectives, you can then specifically focus on certain information and skip unwanted content.

Table 1. Guidebook Icons and Their Purposes

Best Practices	Tool	Checklist
<div style="text-align: center;">  </div> <p>Identifies airport best practices examples. Clicking this icon will lead to the Best Practices Appendix B, which compiles best practices discovered during research, or to the Management Hackathon Appendix E.</p>	<div style="text-align: center;">  </div> <p>Indicates a useful tool (such as a spreadsheet or the C2 Assessment tool) that when clicked opens externally in another application to use without having to close the Guidebook.</p>	<div style="text-align: center;">  </div> <p>Indicates “Getting Started” checklist. Clicking it will lead to the chapter-specific checklists in Appendix D for easy printing. Clicking the same icon in the appendix returns you back to the checklist in the document body.</p>

- Chapter Insights* – In the beginning of each chapter in Parts II and III, the Guidebook provides statements summarizing what insights can be expected. These statements are conceptually tied to the C2 Health Assessment tool questions, thereby providing a link between the assessment report results and chapter content.
- Highlight Call-outs* – These helpful box-type inserts bring out useful information from the main text.
- “Getting Started” Checklists* – These are step-by-step checklists on how to start implementing the guidelines discussed in each chapter of Part II. Usually, they are provided at the end of each chapter. In some cases, however, this list is embedded in the text discussion as process steps, so as not to break the flow of the chapter content. These checklists are also provided in Appendix D for easy printing.

- *C2 Life Cycle Roadmap* – This interactive graphical element, as shown in Figure 1, presents the C2 Program Life Cycle. Each life-cycle phase is represented by its own icon. Within each chapter, the roadmap is slightly modified to highlight the phase (i.e., enlarged icon) that chapter addresses.

Figure 1. C2 Program Life Cycle Roadmap



The unique feature of this roadmap lies in its *interactive functionality*. Every roadmap image, including Figure 1 and all chapter-specific versions, provides hyperlinks to the related chapters. By clicking a phase icon, the reader is taken to the appropriate chapter. This functionality improves your maneuverability through the Guidebook as you use the guidance provided by the assessment report. This interactive functionality is also applied to the icons discussed above.

- **Checklist icon** – Clicking a checklist icon in the main body of the Guidebook leads you to the associated printable checklist in the Appendix. Clicking the checklist icon in the upper right hand corner in the appendix leads you back to the checklist in the main text of the Guidebook. Alternatively, you can return to the checklist in the main text by choosing the Alt + Left Arrow or Command + Left Arrow on your keyboard. Doing so always leads back to the originating page where the link was clicked.
- **Best Practices icon** – Clicking a best practices icon in the main body of the Guidebook leads you to the best practices Appendix. In this case, in order to return to the page where the best practices icon was clicked, you can simply choose Alt + Left Arrow or Command + Left Arrow on your keyboard. Doing so always leads back to the page where the link originated.
- **Tool icon** – Clicking the tool icon opens the navigation bar on the left-hand side of the document. Click the tool you want to use and follow the prompts to open the tool externally in your spreadsheet software.

Chapter 2: Where Do You Stand with C2?

This chapter provides a C2 Health Assessment (*Assessment*) through which you are able to identify the status of C2 within your airport stakeholder community. This Assessment is divided into two separate tools: the C2 Assessment and the IT Assessment. The questions for each are designed to be answered with “Yes” or “No.” Relevant information is provided to clarify each question. It is important to read this clarifying information to ensure the most accurate results. The Assessment provides you with an Assessment Report (*Report*) based on your responses. The Report provides guidance by pointing you to the content in the Guidebook that offers you the greatest opportunity for C2 improvement.

Detailed Instructions

Please note that these instructions include multiple screenshots, which do not contain any links. The link for the actual tool is located at the end of these instructions.

The instructions are divided into the following categories:

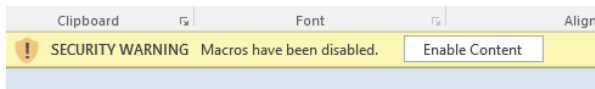
- Opening the Tool
- The Getting Started Screen
- The Question Page
- The Report Page

OPENING THE TOOL

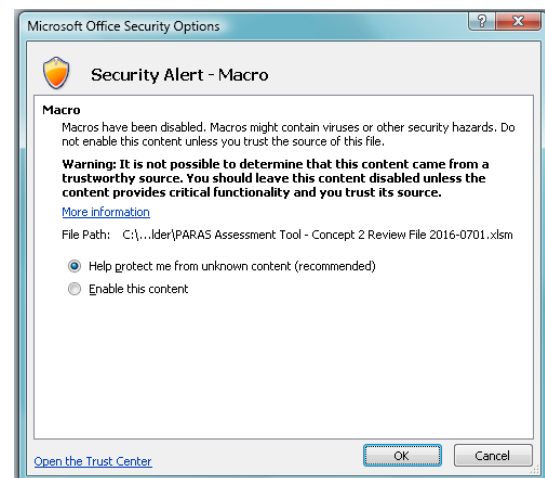
1. The Assessment Tool is accessed by double-clicking the tool icon at the end of these instructions. If you have Excel installed (or another application capable of reading Excel files), it will open this application separately in a new window. The Getting Started screen will be visible.

Notes: The Guidebook PDF file will stay open while the assessment is performed.

Be aware of the yellow banner (below) and the pop-up window (right). These will appear and prompt you to enable Macro content. This action is required to run the Assessment, and does not pose a security risk.



2. Click “Enable Content” on the banner to be able to perform the Assessment. Then click “OK” on the pop-up window.



THE GETTING STARTED SCREEN

1. After enabling the macro content, the Getting Started Screen is visible (see screenshot below). The annotations explain each different area and its purpose and/or function.

Enhancing Communication & Collaboration among Airport Stakeholders
Health Assessment Tool

Before you begin -- Read instructions below

General Instructions: (see Detailed Instructions in Chapter 2 of the Guidebook further explanation)

Getting Started:

- To begin click one of the blue buttons below to start the desired assessment (either C2 or IT assessment).
Note - It does not matter which one you begin with but we recommend starting with C2.

Taking the Assessment:

- While taking the Assessment follow these steps for each question.
 - Step 1: Read the question
 - Step 2: Read the information box by clicking on the orange info icon ⓘ to the right of the question. This will provide relevant content before answering the question.
Note - You should only answer a question with "Yes" if you can say "Yes" to everything addressed in that information box. If you cannot do that, you should answer the question with "No".
 - Step 3: Answer the question with either "Yes" or "No" by using the drop-down to the right of the information box. The default answer to all questions is "No".
- After all questions have been answered, click the "Create XX Assessment Report" button at the bottom of the assessment page.

Viewing the Report:

- After reviewing the report you decide to change a response to any of the questions, go back to the appropriate Assessment page and change your response. Click the "Create XX Assessment Report" button again to regenerate the report
- Use the "Print" button at the top/right of the report page to print out the results. This is optional.
- Continue to next Assessment and repeat taking the assessment steps above. You can select to begin the next assessment from the report page by clicking on the button in the top/right corner or go back to the "Getting Started" page.

Click Here to Begin C2 Assessment Click Here to Begin IT Assessment

Summary of the instructions

Click either of these buttons to begin the Assessment of your choice. Once one Assessment is completed, the Tool gives the option to do the other Assessment

2. Click the appropriate button to perform the Assessment of your choice. The Assessment Question Page will open (see screenshot on next page).
Notes: The instructions have been prepared based on performing the C2 Assessment; these instructions are, however, applicable to the IT Assessment as well. Only the content shown in the screenshots would be different.
After performing the chosen Assessment, you will have the option to perform the other Assessment as well.
3. The Question Page includes:
 - Questions grouped by chapter title (see A in graphic below)
 - Information icons (see B)
 - Answer fields (see C)

THE QUESTION PAGE

C2 Health Assessment

The screenshot displays the 'C2 Health Assessment' interface. It features a list of questions under the heading 'Establish Commitment and Structure'. Questions 1 through 5 are visible. Each question has an information icon (a lowercase 'i' in a circle) to its right. A box labeled 'A' points to the first question. A box labeled 'B' points to the information icon for the first question. A box labeled 'C' points to the 'Yes' radio button for the first question. A box labeled 'D' points to the information pop-up box that appears when the information icon is clicked. The pop-up box contains the following text: 'A C2 vision is a vision (composed of vision, mission, and value statements) that is specific to C2 yet does not fall outside the boundaries of the overall airport vision. A shared C2 vision becomes the fundamental building block for improving C2 across an organization internally as well as with a variety of external stakeholders. It is best established through a series of face-to-face meetings between the executive staff from all participating stakeholders. Financial and resource support from executive management is needed from the onset. Executive management also needs to provide visible support to demonstrate the importance, necessity, and benefits of short- and long-term C2 commitments. There must be stakeholder buy-in, agreement, and commitment to the joint effort and the related process changes necessary to achieve a shared vision and ultimately improve C2.' An 'OK' button is located at the bottom right of the pop-up box. A box labeled 'E' points to the dropdown arrow next to the 'Yes' radio button for the first question.

1. Read the Question
2. Click the information icon and read the information (see D)

*Notes: It is **very important** that the information icons (B) are clicked before the question is answered. Clicking the information icon will provide you with the necessary explanations for what each question is inquiring about. This way, any personal interpretation of a term or concept asked in the question will be eliminated. Without knowing the intent of the question, your assessment will be inaccurate. Therefore, for you to answer a question with “Yes,” you should say “Yes” to everything addressed in the information pop-up box (see D). If you cannot do that, you should to answer with “No.”*

If you are a smaller airport, refrain from simply skipping questions that are not pertinent or applicable to you (due to financial and resource limitations, for example). In such a case, it is recommended to a simply answer the questions with “No,” and then read the corresponding chapters/section in the Guidebook. Otherwise, you will miss the insightful small airport discussions, applications, and examples provided throughout all chapters.
3. Click “OK” in the bottom right of the information pop-up box to close it.
4. Using the dropdown arrow to the right of a question (see E), choose your answer.
5. Repeat steps 4–7 for all questions.
6. Review your answers before creating the Assessment Report.
7. Create the Assessment Report by clicking the blue banner that appears on the Question Page in the tool (screenshot shown below). The Report Page will open.

Click Here to
Create C2 Assessment Report

THE REPORT PAGE

- The Report Page (see screenshot below) includes:
 - Red or green health indicator (see F)
 - Answers to the questions grouped by chapter title (see G)
 - “Back to Getting Started” button (see H)
 - “Back to Assessment” button (see I)
 - “Print” button (see J)
 - “IT Assessment” button (see K)

C2 Health Assessment Report

Establish Commitment and Structure

F You indicated you do not have a shared C2 vision. To learn more about the importance and how to get started, read Chapter 4, sections: "A Shared Vision - Foundation for Success" and "How to Establish a Shared Vision." [pp.xx-xx.] In addition, a printable checklist is provided in Appendix xx.

F You indicated you have a C2 champion. That means, you have a stakeholder that shares your vision and has a fundamental role in its establishment. He also is responsible for managing and engaging stakeholders, along with other tasks, and drives the efforts across the entire organization and external stakeholders involved. If your C2 champion's responsibilities and characteristics do not line up with these mentioned here, you would greatly benefit from reading the following section in Chapter 4, section "Create Commitment," including subsections: "A Shared C2 Vision- Foundation for Success" and "C2 Champion." [pp.xx-xx]

G You indicated you do not have a C2 organizational structure in place. To learn more about the importance and a general framework recommendation, read Chapter 4, sections: "Importance of an Organizational Structure" and "Organizational Structure Framework." [pp. xx-xx]

G You indicated you do not have a C2 governance model in place. To learn more about the importance and how to get started, read Chapter 4, sections: "Governance Model," [pp. xx-xx], and " Airport Governance Model Example," [pp. xx-xx].

G You have indicated that you have your stakeholders' roles and responsibilities clearly understood. And you have defined them within the established organizational framework structure. That means, stakeholders know who makes the decisions, how the decisions are made, how expectations are managed, how operational processes are managed, how information is exchanged and communicated, how actions are approved/authorized, how problems are escalated, and how services are measured. If your roles and responsibilities are not to this point, you would benefit from reading Chapter 4, section: "Roles and Responsibilities," including subsections: "The Joint Executive Steering Board," "The Advisory Committee," and "The Functional Working Group," [pp. xx-xx].

H

Back to Getting Started

Back to Assessment **I**

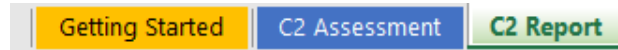
Print **J**

Click Here to Begin IT Assessment

K

- The red or green bars (F) in front of the Assessment answers (G) represent “No” and “Yes” answers, respectively. They provide a quick visual overview of the “Health” status of your airport’s C2 efforts.
- Each question has a corresponding answer:
 - For “No” responses, the answers provide you with reference to insights/information regarding the topic. These references point you to chapters and sections, including page numbers.
 - For “Yes” responses, the answers will first paraphrase the information pop-up box content to make sure your answer is truly a “Yes” (see the note under step 5, above). It then provides the Guidebook references to point you to the appropriate content covered by the question.
- If after reviewing the report you decide to change a response to any of the questions, click the “Back to Assessment” button (I) to change your response(s). Click the “Create XX Assessment Report” button again to regenerate the Report.
- Clicking the “Back to Getting Started” button (H), will return you to the opening screen.
- By clicking the “Print” button (J), the multi-page Report can be viewed in the “Print Preview.”
Note: Each Page of the Report covers the answers and Guidebook references for one chapter, so you can decide which pages (Chapters) to print, or to print the entire Report.

7. Follow the printer prompts to print; you will be returned to the Report page.
8. Clicking the blue “IT Assessment” button (K) lets you perform the IT Assessment, as well. (Or, if you opted to perform the IT Assessment first, you would now have the option to perform the C2 Assessment.)
9. If you opt for not performing the other Assessment, you can:
 - a. Exit the Tool, which will close Excel. You can now follow the Assessment Report guidance as you continue to read the Guidebook; or
 - b. Click another tab to return to either the Question Page or Getting Started Screen.



CLICK THE TOOL ICON BELOW TO RUN THE C2 HEALTH ASSESSMENT



Chapter 3: How Does All of This Affect You?

An airport is a collective of a widely disparate grouping of businesses and agencies who know they must rely upon each other to accomplish their individual missions. The more effective and productive their interactions are, the more likely they are to be successful in accomplishing their individual goals and objectives. Successful communication among stakeholders requires forging collaborative partnerships, which generally fall into three categories:

- Those required for the smooth conduct of day-to-day airport operations
- Those aimed at preventing disruptions and/or resolving conflicts
- Those designed to develop and advance a shared vision for the future

In all cases, Airport Operators, airlines, ground handlers, and other airport and non-airport stakeholders benefit when they share information and work together to improve their interactions. Airport leadership that creates and nurtures a culture of partnership, sharing, cooperation, communication, and collaboration is an enlightened leadership that understands that working together benefits both the individual and the collective whole.

Stakeholders

Figure 2 contains an extensive list of stakeholder groups. These groups were developed after research with airports of varying sizes, types of governance, and geographic locations. However, the stakeholder groups may not be all-inclusive and will vary at any given airport depending on circumstances. For example, if there is a trip-and-fall event, C2 with stakeholders may be primarily internal, limited to maintenance, operations, public safety, and the risk management departments. If there is, however, an emergency or disaster situation, such as a severe weather event or security breach, Airport Operators would likely engage a more comprehensive set of stakeholders, both internal and external. In general, the more complicated the event, the more stakeholders will be involved; this might include, for example, airlines that do not fly to the airport under normal circumstances. Additionally, even when the stakeholder groups remain static, the responsible persons within any stakeholder group may change based on the situation or type of event.

Independent of changes in stakeholders or stakeholder groups, when moving from normal day-to-day operations to irregular operations (IROPS) conditions or to emergency events, the critical nature of communication does change, although it will become more focused, and the level of C2 with stakeholders will intensify commensurately as events unfold. In addition, communication requirements are scalable and can be expanded to a level where everyone needs to know everything; for example, a National Special Security Event such as a political party's national convention. Stakeholder involvement is, therefore, varied and complex and may include the majority of stakeholder groups listed in Figure 2, depending on circumstances.

Figure 2. Airport Stakeholder Groups



Benefits and Challenges

Although there are many known benefits to investing in enhancing and maintaining C2, an equal amount of challenges accompany these benefits. Consider, for example, the following cited group of well-known benefits to improved C2:

- **By more effectively sharing real-time information with stakeholders during a crisis, Airport Operators can greatly improve response to and effectiveness of emergency results.**

On July 6, 2013, Asiana Airlines flight 214 struck a seawall at San Francisco International Airport (SFO). Among the findings of this accident, a synopsis from the National Transportation Safety Board's report (NTSB, 2014) noted the need for improvements in emergency communications at the airport, stating: *“Numerous problems with communications occurred during the emergency response, the most critical being the inability for responding mutual aid units to speak directly with units from the airport on a common radio frequency. Although some of the communications difficulties encountered during the emergency response, including the lack of radio interoperability, have been remedied, others, such as the breakdown in communications between the airport and city dispatch centers, should be addressed.”*

- **By improving the C2 within monitoring and response to security measures, Airport Operators can establish a safer and secure airport.**

On November 1, 2013, an active shooter incident at Los Angeles International Airport (LAX) resulted in the death of a TSA officer. This event revealed multiple shortcomings in regard to communication and collaboration efforts, including technological, personnel, and training issues. Although the police responded within minutes to the emergency call, *“... senior police and fire commanders had no idea where to go or what the others were doing, and they didn't unify multiple command posts for 45 minutes. There was nearly no communication between command post officials and the airport's emergency operations center, which the report described as being staffed by untrained midlevel managers,”* and *“... not ever fully mature(d)”* (FoxNews, 2014; Los Angeles World Airports, 2014). There was also an unnecessary delay in medical aid provision. In addition to the technical malfunction in the terminal's emergency alert system, a post-event study by auditors also revealed that some panic alarms and emergency phones did not operate properly.

- **By improving the C2 of ongoing commerce and travel activities that take place every day, Airport Operators can benefit by increasing daily operational efficiencies.**

Travelers during the LAX active shooter event were largely uninformed about the status of their travel related activities (FoxNews, 2014). Many were confused, not knowing if their flight would be rebooked or canceled, or whether they should book a hotel for the night.

- **By improving the C2 between Airport Operators and tenants, the airport can increase revenue.**

Since C2 has started to improve among the stakeholders at Sacramento International Airport (SMF), the airport, the airlines, and the concessionaires have reached agreement on the best course of action for enhancing retail and food and beverage offerings to the public, such that money is now being made “hand over fist” in the revamped Terminal A. This can result in a direct financial benefit to the airport in terms of negotiating higher minimum annual guarantees for retail/concessionaire space. In addition, if the gross sales exceed a contractually predetermined amount, the airport benefits because the tenant has to pay additional rent based upon a percentage of those gross sales.



- **By implementing a C2 culture and environment, Airport Operators can begin to positively impact operational efficiencies across both normal and emergency operations, thus creating a self-promoting and continuously improving C2 Program.**

At the Denver International Airport (DEN), the Airport Operator supported the C2 culture by developing a C2 process around the collaborative environment of aircraft deicing. This effort led to the creation of a deicing tool that speeds up the deicing times. Although DEN is a large hub, the process used by the Airport Operator can be adopted by any airport of any size. This process generally consisted of the following:



- The C2 process required an initial set of five collaboration workshops where all stakeholders contributed to defining the criteria for success. For these workshops to be successful in improving C2, the following was needed:
 - Stakeholders had to define what they wanted to improve: managing de-icing queues and reducing all negative aspects around poor management (delays, fuel costs, frustrated passengers, etc.) Then ground rules needed to be set; most importantly, no one could have the mind set of "If they lose, I win."
 - Once all stakeholders agreed on the process, compliance and non-compliance criteria were defined. This was important in order to set the ground rules. For the effective use of this tool, the Airport Operator had to establish a new and improved means of C2 among the key stakeholders.
- The Airport Operator prepared A Concept of Operations (CONOPS), defining all operational procedures.
- Using the CONOPS, the Airport Operator established the parameters of the tool and ensured that every stakeholder received a dedicated user license for this tool.
- After the workshops achieved the goals, and the tool was in place, the Airport Operator conducted training with an expanded set of stakeholders, thus achieving awareness across all divisions.

Outcomes:

- The system has become self-policing
- Communications have greatly improved, showing equally impressive improvements in process efficiencies
- Having the means to track compliance does not necessarily require strict enforcement—commonsense must be applied to a new process such as this
- **By improving the monitoring of key performance indicators and, subsequently, the C2 practices of the indicator results, Airport Operators can minimize the number of disruptive events.**

The C2 Program developed during the deicing improvement effort at DEN yielded immediate, quantifiable benefits for the Airport Operator. Since its implementation, the Airport Operator monitors KPIs, such as "On-Block" and "Target Off-Block," deicing queue times, and aircraft counts. Through these KPIs, the Airport Operator has been able to assess trends in actual aircraft queue and taxi times, and calculate subsequent fuel expenditures resulting from aircraft taxi times. The result is that the Airport Operator has been able to show a reduction of aircraft deicing times by 2.6 minutes per aircraft, leading to savings of \$107.30 per aircraft and \$88,000 per ice-day, ultimately resulting in a \$5.8 million cost benefit after its first year of use.

- **By improving the C2, Airport Operators can reduce operating costs of the Airport.**

The following are examples of how collaboration with multiple stakeholders can produce financial efficiencies at airports:

Miami International Airport (MIA) is in the process of building a centralized operations center. In addition to gaining operational efficiencies from the command center being in a single location, an additional benefit is a reduction in operating costs from maintaining employees in multiple work locations throughout the airport property. The Airport Operator should realize reduced operating costs in the form of reduced overhead, such as utility costs, employee transportation expenses, and staffing efficiencies.



In a state emergency management office, effective C2 has eliminated a dual-hatted system that had Public Safety personnel assigned to the Emergency Operations Center (EOC) rather than performing roles on-scene as potential Incident Commanders, reducing staffing needs in the EOC by 60 personnel. Good C2 has allowed the EOC to move from putting out fires to directing and supporting others on-scene in that work.

At DEN, the Management Hackathon identified that improved C2 in the aircraft deicing process could eliminate bottlenecks and match deicing capacity with demand, leading to fewer delayed departures and substantial cost savings.



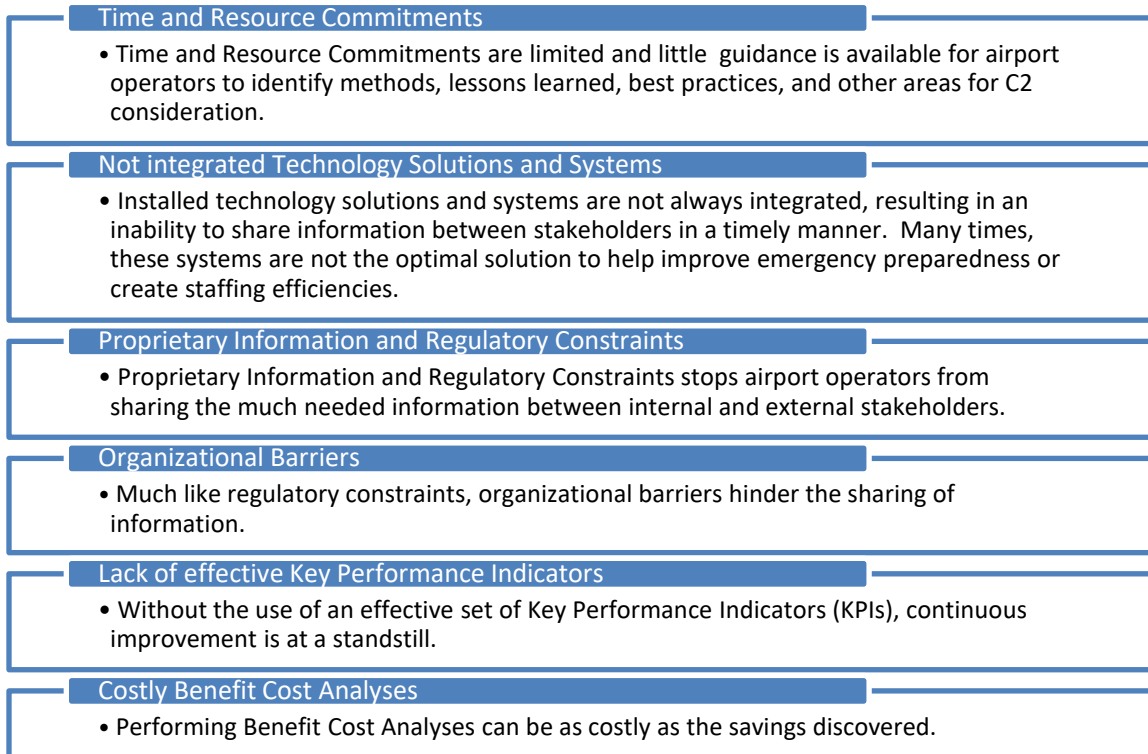
Minneapolis–St. Paul International Airport's (MSP) MIST (MSP Incident Support Team) initiative provides for scalability of response and minimization of redundant and oversized response activities. MIST requires effective C2 to be viable.



- **By more effectively working with stakeholders during the day-to-day occurrences, or during IROPS and other safety/security related incidents, Airport Operators can reduce insurance liability exposure and/or lawsuits.**

Many Airport Operators interviewed discussed the importance of effective and timely C2 in regard to administrative or legal issues. Specifically, in relation to loss prevention initiatives, the need to implement a work-order maintenance system was mentioned frequently. Such a system provides stakeholders—in the form of airport customers, concessionaires, and vendors, and other tenants—an opportunity to report maintenance issues in real time. An Airport Operator's response time to issues such as inoperable equipment, water intrusion, and other potentially dangerous maintenance situations is greatly enhanced, thereby reducing customers' and employees' exposure to injury. In addition, liability potential exists when an airport fails to respond effectively or appropriately to safety and security related incidents, which are even more demanding of effective C2.

For each of the benefits described above, Airport Operators may be faced with a myriad of challenges; many of which can very easily stop the forward progress of improved C2. Figure 3 presents some of these challenges.

Figure 3. C2 Challenges

In considering the noted benefits and challenges, it is clear that the establishment of a better C2 operating picture is needed for internal and external stakeholders to achieve enhanced situational awareness and communication. Part II will help Airport Operators do exactly that.

PART II: THE C2 PROGRAM LIFE CYCLE

Part II presents the C2 Program Life Cycle in a step-by-step approach, through eight chapters. Each chapter provides helpful guidance for effective communication and sustaining collaborative stakeholder relationships. The C2 Program Life Cycle chapters are:

- Establish Commitment and Structure (Chapter 4)
- Build Relationship Through Face-to-Face Interactions (Chapter 5)
- Identify Information Sharing and Documenting Requirements (Chapter 6)
- Establish and Revise Policies and Procedures (Chapter 7)
- Develop Key Performance Indicators (Chapter 8)
- Execute Partnering/Alignment Agreements (Chapter 9)
- Ensure Staff and Stakeholder Training (Chapter 10)
- Review and Refine for Sustainability and Continuous Improvement (Chapter 11)

Each chapter includes examples of industry trends and best practices. Helpful “Getting Started” lists are included with each chapter.

Although this comprehensive approach, if implemented in its entirety, is better suited for larger airports, smaller airports will greatly benefit from being exposed to the big picture. Then, based on each specific situation, they can evaluate what element of this life cycle is pertinent at this time and decide what guidance should/could be applied.

Chapter 4: Establish Commitment and Structure



You will get insights into:

- *Why a shared vision is the foundation for a successful C2 Program effort*
- *The value of having a C2 champion*
- *How to develop a shared C2 vision*
- *Why it is important to have a structure in place to facilitate C2*
- *A recommended organizational framework to enhance stakeholder C2*
- *Why a governance model is another vital aspect of a successful C2 strategy*
- *How roles and responsibilities are defined*
- *A security-centric governance model example*
- *What other airports have accomplished in this area*

Create Commitment

Developing a C2 program across all stakeholders is an effort that is driven by differing perspectives and motivations, rising from a diverse set of needs. These differing needs often include a wide range of regulatory and security requirements that complicate the promotion of a collaborative environment. Other complications come from a broad array of technologies. The technologies deployed to help Airport Operators improve emergency preparedness, create staffing efficiencies, and get additional life from older equipment are often not optimal for sharing information between organizations.

Within these complications, the relationships among Airport Operators, airlines, and the vast number of airport stakeholders are becoming increasingly interwoven. As airport operations continue to grow in complexity, these interwoven relationships demand the need for all organizations to better communicate and collaborate with each other. In fact, it is only through improved C2 that an Airport Operator can consistently expect to safely, securely, and efficiently operate its airport. Therefore, all stakeholders must move toward a higher level of commitment to a C2 Program, regardless of the challenges, and the first step is a conscious effort in establishing a shared C2 vision.

A Shared C2 Vision – Foundation for Success

Successful expressions of an organization’s vision generally include three elements: vision statement, mission statement, and values statement. The vision statement is a declaration of where the organization is heading and what it wants to be in the future. It is overarching and aspirational in nature. In contrast, the mission statement is based on the now and states the organization’s purpose and its reason(s) for existing. It also states what it does and how to achieve the vision. These two statements work closely together and are usually very specific to the organization and its industry. Also, the verbiage in both should reflect the culture of the organization. That culture, with its specific priorities, is then further expressed in the values statement.

DEN, in words from its vision statement, is a good example of an airport that has “...a unified collaborative team... [that] extends far beyond our staff. We will partner with our airlines, our concessionaires, our contractors, our neighbors and our sister city agencies.” In addition, its mission statement promises to “operate to the highest standards of safety and security” and to “provide members of our team the resources they need, including training to broaden and deepen key skills and competencies” (Denver International Airport, 2009).



Hong Kong International Airport (HKIA) has a mission statement that says: “To excel in the operation and development of HKIA in collaboration with our partners by upholding high standards in safety and security.” Its values statement also highlights continuous improvement and collaboration as pillars (Hongkongairport.com, 2016).

Although the vision and mission statements of Dallas/Fort Worth International Airport (DFW) are rather broad, the Airport Operator clearly emphasizes C2-related elements in three of its five core beliefs (values statements). These include (Dallas/Fort Worth International Airport, 2008):



- “Reach Out! I collaborate with others to build trust and mutual success” (Collaboration)
- “You’re Important! I value you, your unique contributions and your success” (Stakeholder Involvement)
- “Step Up! I overcome obstacles and influence outcomes” (C2 Champion)

It is just as important for small hub and general aviation airports to adopt and broadcast their mission. At BUR, the mission statement is clearly displayed on their website and states, “the mission of the Airport Authority is to provide state of the art regional airport facilities and related services which are efficient, safe, convenient, and user-friendly, while being a good neighbor.” (Burbank Bob Hope Airport, 2016)



The above examples show that Airport Operators include C2 elements in their vision statements. Consequently, efforts to establish a shared C2 vision should be C2 specific in all its elements and comport with the overall airport vision. Later in this chapter, the discussion focuses on how to develop appropriate C2 verbiage in the vision and mission statements, as well as the importance of considering C2-specific values of customers, shareholders, employees, and the community in the values statement.

For a C2 Program to be successful, it is also important that executive management be ready to provide both financial and resource support. Executive management also needs to provide

SHARED C2 VISION

- ✓ Vision and mission statements should include appropriate C2 verbiage, yet not fall outside the boundaries of the overall airport vision.
- ✓ Must consider C2 values of customers, shareholders, employees, and the community

visible personal support to demonstrate the importance, necessity, and benefits of effective C2. Sustained, visible support can facilitate the early success of this Program, especially as challenges occur. Although there will be immediate successes, the long-term goal is a consistent C2 process resulting in benefits to all stakeholders on a sustained basis.

A well-conceived and thoroughly justified C2 Program can, however, quickly lose support as a result of a single poorly implemented initiative. After the significant investment of time and energy in strategy development and program planning, actual C2 implementation is not the time to start cutting corners. Each initiative must adhere to a structured implementation process that applies the appropriate depth of planning for the size and scope of the initiative.

The success of a shared C2 vision is directly linked to the level of involvement of airport executive management. Commitment from the top can ensure that the initiative will encompass the entire airport organization and include the commitment from its external stakeholders. Of the parties directly involved, key contributors typically come from Operations, Security, Public Safety, and IT. Although it is true that a shared C2 vision cannot be fully successful without executive management support, how the vision earns buy-in can vary from airport to airport. The drive toward a shared C2 vision often originates in mid-level management with boots on the ground. It is from these professionals that a C2 Champion most often emerges.

The C2 Champion

Since each contributor to the C2 vision effort has a fundamental role in forming a shared vision, any one of them can act as the “champion” for the cause. Regardless of who becomes the champion, executive management support is needed from the onset. Lasting enhancements to C2 are doomed if executive management does not actively endorse the shared vision. The C2 Champion is the person who helps to direct actions toward the C2 vision, and helps to keep all participants in the C2 Program informed. When all the actors are fully informed, collaboration across the organization is optimized and the support of senior level managers is more assured. This was the case during the efforts in improving the deicing process at DEN. In that initiative, the Ramp Tower Manager functioned as the C2 Champion, and the subsequent collaborative efforts among all stakeholders resulted in measurable successes, noted by the Senior Vice President of Airport Operations. This success then led to executive support for future initiatives using a structured C2 process, such as the Aviation Management Hackathon conducted as part of the research for this Guidebook. This Management Hackathon picked up where the original deicing initiative left off, yielding additional benefits for the Airport Operator and the stakeholders involved.

Keep in mind that, although the Guidebook presents a multi-tiered approach inclusive of executive management, in a small airport you may find the role of the C2 Champion being performed by the senior airport executive. The Executive Director of Centennial Airport, for example, is also the Executive Director of an airport-sponsored charitable foundation, allowing him to create and strengthen relationships with many of his airport’s stakeholders during foundation outreach efforts.



C2 CHAMPION

- ✓ Is the one that directs actions toward the C2 vision
- ✓ Needs to have the support of the executive management
- ✓ Often a boots on the ground mid-level professional

The following section discusses in detail how you can develop a shared C2 vision.

How to Establish a Shared C2 Vision

An important aspect to keep in mind when developing a shared C2 vision collaboratively is the conscious effort to be C2-specific without contradicting the intent of the overall airport vision. For airport stakeholders to be both efficient and effective in C2, a series of face-to-face meetings between the C2 Champion and executive staff from the participating internal and external stakeholders has proven beneficial throughout the process.

First, face-to-face meetings are valuable in the beginning to kick start the vision definition and alignment effort. As you discuss possible verbiage, you could consider the following two sample statements as starting points: “Demonstrating fail-safe communication processes at all times in all conditions.” or, “Providing safe and effective operations of the highest quality and value by working together as an airport community, continuously improving communication and collaboration.” Second, face-to-face meetings are needed to deploy the C2 vision throughout the community to ensure it is understood and accepted at all levels of operation. The tremendous value of face-to-face meetings in enhancing C2 is discussed in more detail in *Chapter 5 – Build Relationships through Face-to-Face Interaction*.

The following are recommended steps to create commitment and develop a shared C2 vision:



1. Get management support for developing common vision, mission, and values statements.
2. Identify a champion who is responsible for leading group discussions and facilitating the creation of common vision, mission, and values statements. Consider identifying a deputy champion who can keep the C2 efforts on track in case personnel changes occur.
3. Have the champion establish a Work Team of executive staff from the airport and participating external stakeholders.
4. Hold face-to-face meeting(s) to co-create the draft vision, mission, and values statements. Create and use a process that ensures full participation, openness and creativity. Research has shown that vision, mission, values statements can improve performance providing they have the following characteristics:
 - Statements should be concise and clear.
 - The vision statement explains what the airport is striving to become in the future and does so in a way that creates understanding and alignment throughout the airport. It needs to be both inspirational and aspirational; a catalyst for change.
 - The mission statement accurately describes the responsibilities of the airport currently, day-to-day.
 - The values statement incorporates those aspects of the community’s culture that serve to support and forward the mission and vision of the organization, and are both lofty and specific.
5. Ensure the champion documents each statement in written drafts, ensuring the following answers are provided in each statement:
 - Vision: Where are we going? (future oriented)
 - Mission: Why do we exist? What greater good do we serve? (significant purpose)
 - What services does our airport provide?
 - What is the airport’s competitive advantage?
 - Who are the airport’s customers?
 - Values: What principles guide our decisions and actions on our journey? (clear values)

6. Do the cosmetic work offline. Circulate statement drafts to Work Team members for edits, and then create a final draft that incorporates all team member inputs. The champion can do this offline, with volunteer help as required.
7. Reach out to any outliers. If there was anyone who disagreed with any of the final documents, or whose favorite idea was not incorporated, talk with them privately to gain their commitment to the end product. Explore ways to incorporate their interests and needs.
8. Reconvene the Work Team and review the final draft before sharing it with airport senior management. Also, review the draft with those stakeholders who were not participants in the process.
9. Communicate the vision, mission, and values statements to relevant airport and stakeholder staff, and add to policy manuals, as appropriate. Also, post these statements on the airport website, intranet, or other communication means as applicable to your airport.
10. Have the champion revisit the statements on an annual basis and update them as needed with assistance from the Work Team.

Organizational Structure and Framework

People perform best when collaborative frameworks and protocols exist to guide the sharing of information on an agreed-upon basis for improved results.

Importance of an Organizational Structure

FRAMEWORKS

- ✓ Ensure effective communication and collaboration takes place
- ✓ Deliver target results through accountability and transparency
- ✓ Position airport for continuous improvement

A formalized organizational structure helps ensure that roles and responsibilities are clearly understood and that decisions are carried out as planned. For an effective C2 Program, this is particularly important, as roles may change based on the operational event or situation. In addition, because of the importance of external stakeholders, preparing an organizational structure takes on an even more important role. Once in place, the organizational structure should be tested through face-to-face meetings, ensuring everyone agrees with the communication process identified.

In addition to the functional benefits of a well thought-out C2 organizational structure, several other aspects are positively impacted. One important aspect is that the C2 Program is far more

sustainable as people move in and out of roles, and as business needs change. As such, issues specifically related to ensuring the C2 Program is sustained can be identified, and subsequent resolutions can be defined (such as more training). It is also through the organizational structure that policies and procedures can be standardized among stakeholders.

Finally, an organizational structure helps address employee concerns by sending clear messages, and helping employees throughout the stakeholder community understand the C2 shared vision and the role good C2 plays in day-to-day operations, irregular operations (IROPS), or emergency events.

Organizational Structure Framework

The preparation of a C2 organizational structure can largely be determined by the profile of the stakeholders who engage in the collaboration process, and the attitude they have toward different facilitation and organizational options. Stakeholder perceptions of organizational structures can be one of suspicion, for example, if they do not see the structure as credible, representative, or inclusive. The key is to create organizational structures that best accommodate the needs of the relevant stakeholders without compromising the outcome.

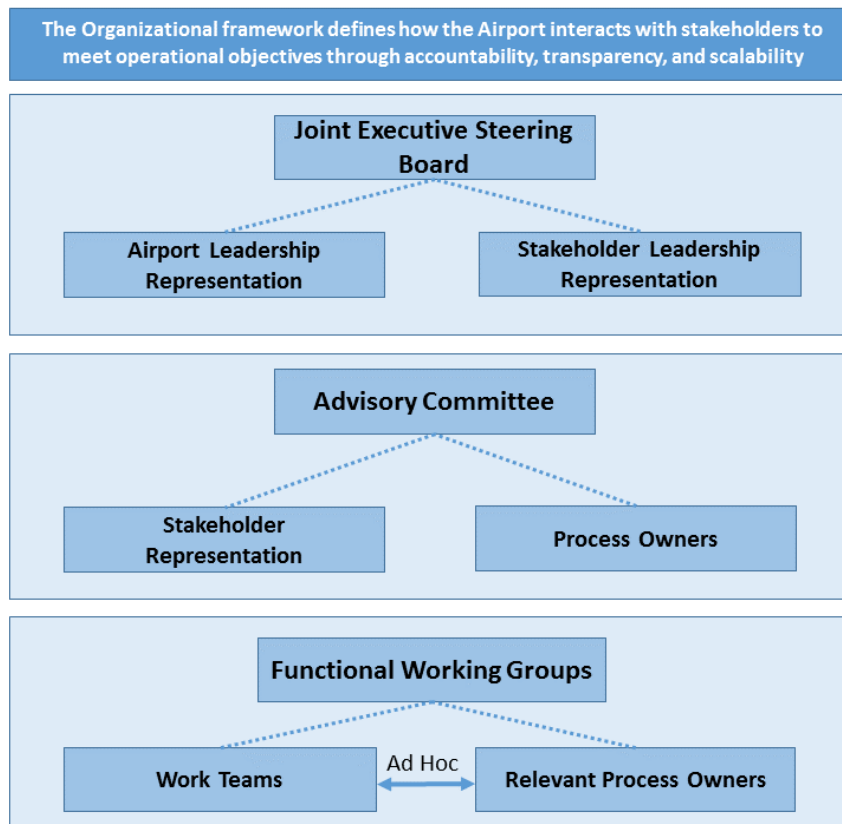
For example, executive staff of the Metropolitan Airports Commission, which operates MSP, has created a culture of inclusion and partnership, guided and demonstrated by senior leadership. Numerous teams and committees exist, which meet regularly. This structure fosters a culture of understanding, trust, and respect. Committee and team members know one another well enough to know who to go to for help or information depending on the situation.



Creating an overarching organizational structure that all involved stakeholders can feel comfortable with is ideal. However, if that is not achievable, it may be necessary to develop a number of different structures for different aspects of a collaboration process. This may involve a specific operation or task among airports, airline operators, ground handlers, and the Federal Aviation Administration (FAA); or integrating emergency response procedures with Airport Community Emergency Response Teams (A-CERT).

It is not within the scope of this Guidebook to define and establish a specific organizational structure that will encompass all operational scenarios where an airport may need to collaborate with its stakeholder community. Instead, a recommendation for a general framework is illustrated in Figure 4.

Figure 4. Organizational Framework for Stakeholder Collaboration



Once you have determined what specific framework works best for your airport, for consistency and to avoid confusion and mission overlap, it is highly recommended that you use this organizational framework to support operations across the airport enterprise. However, in recognizing that there are always exceptions to a rule, some operational scenarios may require you to customize and establish a different organizational framework. The framework shown above is built upon a 3-tiered structure, which is used quite effectively by many organizations. Nonetheless, it may be too robust for smaller airport operators. If that is the case at your airport, results can be achieved by using only one or two of the proposed structures. Regardless of the final framework, you should ensure all responsibilities are covered in the final agreed upon structure.

At SFO, executive management has been successful in developing an organizational framework nestled within a strong culture of inclusion in planning and decision-making. This framework allows for a proactive rather than reactive way of communicating and collaborating. The Airport Operator considers good C2 an investment. The following breaks down some details of the airport's multilevel organizational structure, which has numerous standing committees of staff and stakeholders that deal with safety, security, and operational issues.



- A Quarterly Security Council is composed of the Federal Security Director (FSD), the highest ranking official of the Federal Bureau of Investigation (FBI), Customs and Border Protection (CBP), the Chief Operating Officer (COO), Deputy Director of Operations, Director of Safety and Security Services, the County Sheriff, and the Police Chief. The last topic discussed was SFO's security posture in light of the events in Brussels, and whether the airport should change direction. There has never been a situation where the Council had to come together specifically for an event (although they would if needed), because this Council deals strictly with strategic decision-making, leaving the tactical decisions to teams at levels below.
- In addition to the quarterly Council meeting, there are also monthly Emergency Operations Group meetings and weekly Security Operating Group meetings, both of which include many internal and external stakeholders. There is also an International Terminal Operations committee.
- There is an Airlines Ground Handlers meeting where safety rules and regulations are discussed, and there is also a local Runway Safety Team that includes the Airlines for America representation.
- There is an Aircraft Recovery Team and Strike Teams, and the Duty Managers have the authority to make decisions for the airport, and can convene ad hoc meeting as situations dictate.
- Finally, working with air carriers and others, the airport quickly put together a working group to respond to the 2015 Ebola scare, creating guidance documents and plans in the event of problematic arrivals at SFO.

Governance Model

Enhancing C2 among airport stakeholders often requires significant transformation of business processes. Both the Airport Operator and its stakeholders are often challenged to employ effective change management. Moreover, new levels and kinds of communication may be needed for areas where all stakeholders are expected to interact. Success in these areas depends on establishing a governance model that confirms the business case for stakeholder C2, and defines the purpose, the roles, and responsibilities assigned, the processes covered, and the services delivered. As you prepare and use such a governance model you will ensure transparency, create escalation measures, and assess accountability and strategic alignment.

Some guidelines to consider as you establish governance include constructing a model that:

- Is robust enough to support performance issues by clearly defining the outputs of collaborative processes, outlining the means of tracking and assessing this output, and providing solutions to dealing with any deviations from what is expected.
- Drives understanding and manages the relationships between the internal and external stakeholders.
- Defines agreements between stakeholders, their respective roles, and their expectations for performance, such as:
 - Who makes decisions
 - How decisions are made
 - How expectations are managed
 - How operational processes are managed
 - How information is exchanged and communicated
 - How actions are approved/authorized
 - How problems are escalated
 - How services results are measured
- Defines the organizational framework and responsibility for addressing failures in operational processes caused by poor stakeholder C2
- Clarifies C2 processes by eliminating uncertainty in areas such as:
 - Scope compliant processes
 - Roles and responsibilities
 - Information inputs, operations, and information outputs
 - Service standards and metrics
 - Costs and benefits
 - Escalation procedures

Roles and Responsibilities

With an organizational structure and a governance model in place, roles and responsibilities need to be identified. To that extent, the roles and responsibilities, as they apply to the 3-tiered organizational framework shown in Figure 4, are discussed below. Again, this framework may be too robust for smaller airports. If that is the case, good results can still be achieved by modifying and simplifying the structures to suit your airport needs.

The Joint Executive Steering Board

The Joint Executive Steering Board (*Board*) should be composed of senior level management from both the airport and its stakeholder organizations. The Board gives voice and authority to the operational departments, which ultimately manage the collaborative processes. The Board meets at the beginning of the planning phase and acts as the sponsor throughout the collaborative initiative, resolving issues as may be required. It also appoints the other two bodies, namely the Advisory Committee (*Committee*) and Functional Working Group (FWG). The Board is focused on strategic issues, providing critical issue resolution when necessary, and monitoring progress. It also provides strategic leadership and direction,

ROLES AND RESPONSIBILITIES

- ✓ Need to be clearly defined
- ✓ Could use a 3-tiered organizational framework approach
- ✓ Smaller airports may want to modify and simplify the 3-tier approach to fit their needs

communicates the agreed upon business case, vision, and values, and makes strategic decisions on issues, such as policy setting and budget approvals.

The Advisory Committee

The Committee is primarily focused on business coordination, process approval, identification of information to be shared, and standard operating procedures. The Committee should be composed of the right blend of stakeholder business unit representatives necessary to provide appropriate levels of input and feedback. As with the Board, membership may change over time, but it is a permanent organizational unit. Populating the Committee with business managers as well as process owners can help balance the line-staff relationship and minimize the risk of an internal and staff-centric orientation.

A business manager is typically the owner of a specific service or set of services. For example, at an airport there is usually a manager who is responsible for security operations and who is the key point of contact for all security operations. The business manager does not have to know everything about all the specific business processes associated with security services, but must know who in the organization does have that knowledge. A process owner owns a specific process associated with a service and is accountable for it. For a typical example, one employee manages the security credentialing process at an airport. The process owner is accountable for the process and is responsible for identifying improvements to ensure that the process continues to be effective and efficient.

The Committee needs to meet often enough to provide timely guidance on processes and procedures, decide on Service Level Agreements (SLA), track performance, resolve issues and disputes, and implement continuous improvement initiatives. It can also ensure that cross-functional C2 is being consistently managed in accordance with stakeholder requirements and in compliance with agreements and established standards.

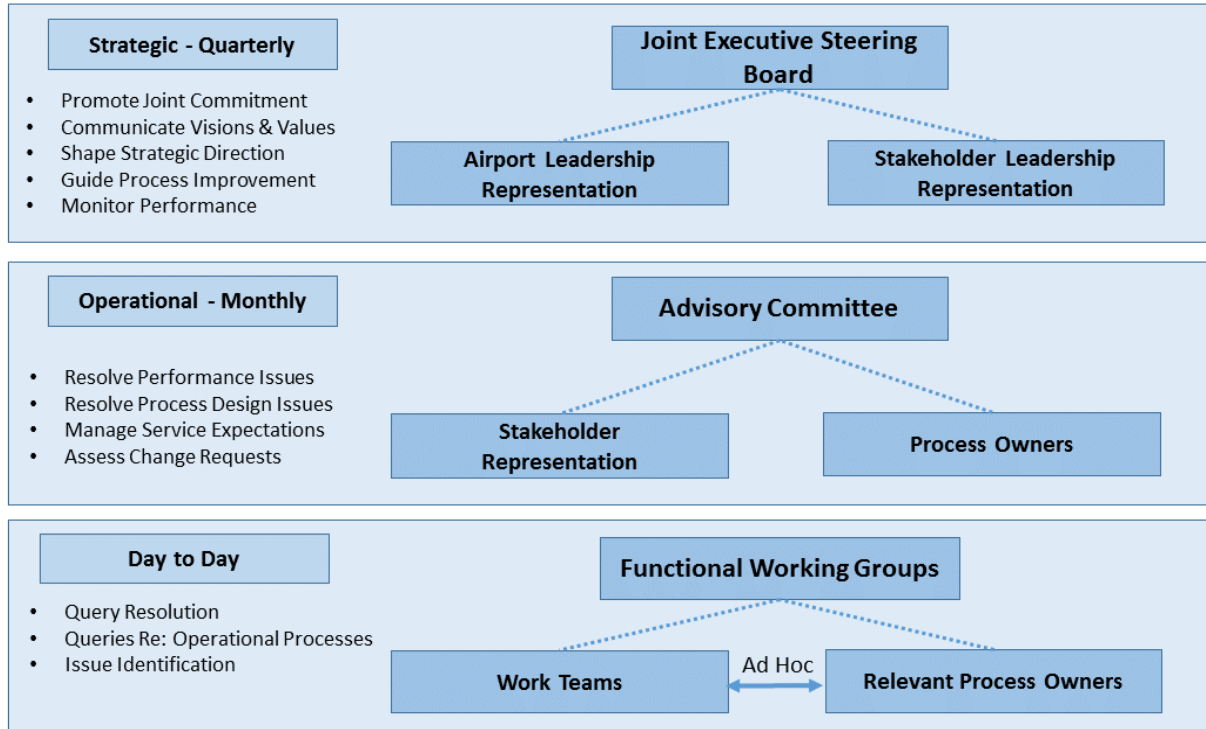
The Functional Working Groups

The FWGs are composed of representatives from the stakeholder work teams and the process owner(s). An FWG can be formed as necessary to address a specific issue that has been identified as an opportunity for improving stakeholder C2, typically by either improving one or more existing operational processes or by adding new processes. Such working groups will remain active until they have achieved the desired objectives and outcomes. However, some may exist on a more permanent basis, if it is deemed appropriate. When a working group is active, they should meet monthly, at a minimum, and on an ad hoc basis, if needed. The purpose of the meetings is to highlight issues and offer feedback to assist in reaching solutions.

The FWGs ensure that C2 takes place in accordance with the standard operating procedures established for each process and that the targeted results are achieved. Each process owner coordinates the activities between the stakeholder work teams and ensures there are no disconnects, the appropriate information inputs and outputs are taking place, situational awareness exists among and between the work teams, and management of any required transitions in operating procedures and decision-making when moving from day-to-day operations to IROPS or to emergency events. The work teams execute the operational procedures collaboratively and are where the rubber meets the road when it comes to executing on C2.

Figure 5 adds the roles and responsibilities to the organizational framework introduced in Figure 4.

Figure 5. Roles and Responsibilities



Small Airport Modification

The Boca Raton Airport Authority compiled a working group consisting of Board members, Authority staff, and airport stakeholders, including a diverse group of pilots, administrators, tenants, business leaders, and the general public, to hold a “visioning workshop.” The goal of the workshop was to focus on how the airport could continue to drive economic development and growth in the City of Boca Raton. Several strategic initiatives and corresponding objectives were developed from the workshop. This approach brings together—in a face-to-face environment—representatives from all three organizational framework groups listed in Figure 5, above.



Airport Governance Model Example

The following is a hypothetical security-focused example of how a governance model can function at an airport.

Problem statement: An individual bolted through a security checkpoint at the airport, resulting in the closure of that checkpoint and all other checkpoints providing access to the same three concourses. In addition, because there was fear that the individual who breached the checkpoint may have been armed and, therefore, considered dangerous, airport police decided that all retail and food and beverage locations on the three affected concourses go into lock-down mode and that all boarding bridge doors on the affected gates be closed and locked. Though it was later determined that the individual in question was actually a distraught and panicky father who had lost contact with his 4-year old son, bypassing security in a frenzied state, several failures of the breach notification process came to light.

Specifically, a number of concessionaires on at least two of the three concourses received no word of the breach or any direction to lock-down. Also, at least two of the six airlines servicing the affected concourses received mixed messages about actions being directed and, rather than close and lock their

boarding bridges, quickly herded all waiting passengers and others in the area onto their aircraft for protective purposes. Finally, the Emergency Medical Technician crew from the airport Fire Department engine number 9, en route to one of the affected concourses via an apron access door in response to a slip-and-fall call, somehow missed the breach notification altogether. As a result of these communication failures, the airport's Chief Executive Officer (CEO) has directed the Board to look into this matter, fix the C2 problems, and report back to him by the end of the month.

As Chair of the Board, the Airport's COO called a joint meeting of the Board and Advisory Committee to discuss a course of action. Attending the meeting from the Board membership, in addition to the COO, were the senior local representatives from the tenant airlines, the General Managers of each of the terminal's concessionaires, senior representatives from each of the airport's mutual aid response partners, the Senior Staff of the airport, the Transportation Security Administration's (TSA) FSD, and the Director of CBP. From the Committee, the attendees were the airport's Directors of Operations, Public Safety, and Commercial Management; the concourse managers for each of the concessionaires; the ramp manager for each tenant airline as well as their Customer Service Agent Manager; and TSA's Stakeholder Representative.

The course of action selected was for the formation of a special FWG to assemble and develop Work Teams to address issues related to the disconnect in communication on the day of the event. The FWG membership for this problem statement consisted of the airport's Chief of the 911 Dispatch Center, Shift-A Fire Captain, Police Department Patrol Division Commander, the Airside and Landside Operations Managers, the Manager of Commercial Management, store managers from each of the concessionaires, and TSA's Day-Shift Screening Supervisors.

The Work Teams that are created from the FWG will review and analyze the processes and procedures that are in place and intended to ensure all who need to know and might be affected by an event receive timely notification. They will determine the cause(s) of the failures and breakdowns that occurred and will suggest changes through the Committee for approval by the Board and subsequent implementation. This will all be done in a timely manner to ensure a report is made to the CEO by the end of the month on all actions taken and recommended.

Getting Started

This section provides detailed guidance on how to define a C2 organizational structure in case your airport struggles in this area. How to establish a shared C2 vision was provided earlier in the chapter. You can find printable checklists in Appendix D.

How to Develop a C2 Organizational Structure

1. Start with a face-to-face meeting with representatives from all stakeholder groups to assess existing organizational structures, and to determine what type of overarching structure and governance model will work best for your situation.
2. Identify the roles that will be required in order for the organization to be effective and to promote participation of stakeholders at all levels.
3. Establish rules that define how formal and informal groups operate within the organization.
4. Distribute the work by establishing working groups and action committees to carry out activities needed to support the program mission.
5. Be prepared to evolve your organization as you learn from your experiences over time.



Chapter 5: Build Relationships through Face-to-Face Interactions



You will get insight into:

- *The importance of establishing relationships*
- *Why face-to-face meetings are especially important as a good starting point for establishing relationships and maintaining C2*
- *When face-to-face meetings should be used*
- *What other airports have accomplished in this area*

Importance of Establishing Relationships

While leveraging technology to communicate and share information among stakeholders can be of significant value and greatly facilitate collaboration processes, it does not replace the importance of establishing relationships in person. Communication, in general, is most effective if done in face-to-face environments. The opportunities for establishing relationships can take a variety of forms, and include both formal work settings and informal get-togethers. Formal work face-to-face settings include all types

COMMUNICATION

- ✓ Most effective in face-to-face environments
- ✓ Can involve formal meetings or training sessions
- ✓ Can be informal get-togethers such as luncheons or coffee breaks

of in-person gatherings, such as traditional meetings, workshops, training sessions, tabletop exercises, etc. Informal get-togethers may include director's luncheons, casual after-work events or coffee in the middle of the day, to mention just a few. Leadership at Portland International Airport (PDX), for example, is a proponent of these informal face-to-face opportunities; airport personnel regularly arrange "Happy Hours" with the TSA and informal lunches with airline personnel. The airport strongly believes that the more people get to know one another, the easier it is to find the right person to help in times of trouble.



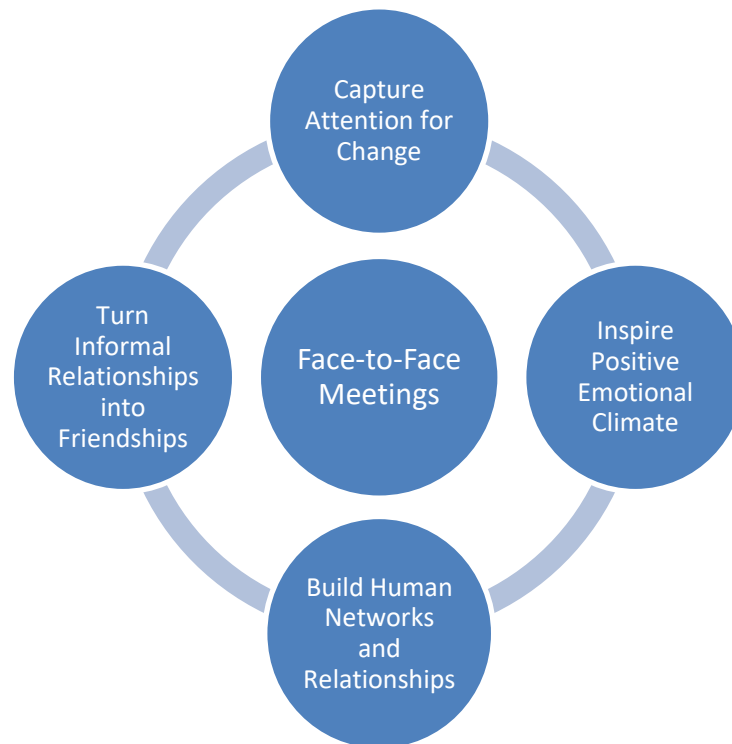
Therefore, despite a high level of automation, the enhancement of the C2 process must still follow a human-centered approach. To emphasize this point, in case of a major disaster there might not be reliable or fool-proof means to communicate, since all forms of communication (such as wired and wireless networks) could be inoperable. In such a situation, one must rely completely on face-to-face interaction, which, in turn, is more effective if the stakeholders involved have a prior relationship built upon in-person meetings during non-emergency situations.

Forms of communication other than face-to-face can also be used to establish relationships. These include, but are not limited to, conference calls, email, radio communication, social media, and others. These types of contact are typically more successful and effective when a relationship is already established and the parties involved know each other. For example, facial cues or certain types of humor, both of which are relevant parts of communication and assist in decoding meaning or placing emphasis on spoken messages, are not as effective in these types of interactions. As a result, these alternatives do not have the same impact on establishing relationships when compared to in-person meetings. They become, however, more valuable as alternative tools to strengthen and sustain existing relationships, as they allow for convenient ways to stay in touch and contribute to increasing familiarity among stakeholders. Video conferencing or chats would be better options as they allow opportunities for stakeholders to see one another, but they still cannot replace being in the same room together.

Strategic Objectives of Face-to-Face Meetings

Whether formal meetings or informal get-togethers are being considered, you should identify the strategic objectives for these meetings. Figure 6 presents a graphical representation of the objectives, followed by further explanation of each one.

Figure 6. Strategic Objectives of Face-to-Face Meetings



Capture Attention for Change

A group's full attention is needed when initiating something new or different (e.g., a new safety process that affects various internal and external stakeholders). Introducing something new involves engaging and persuading people to reach consensus. You can accomplish this much better in a face-to-face context when body language and facial expressions can often reveal true feelings. It is also necessary that you ensure people are not distracted by technology or other multitasking interruptions when new concepts are discussed.

Inspire a Positive Emotional Climate

Inspiration and motivation are important drivers for running airports successfully. When you want to invigorate and encourage people to make a change or take a risk, face-to-face meetings are best. Humans generate and thrive off an energy that can only be produced by engaging in person-to-person contact.

Build Human Networks and Relationships

While sharing information and resources can assist you with getting work done efficiently and successfully, equally important is the value that comes from building personal relationships and networks through face-to-face dialog. Strong working relationships and networks are characterized by high levels of trust, reciprocity, and a sense of community that can only come from spending time together in the same place. Face-to-face meetings can help bond your teams together, help people feel inspired, engage people in the process, result in breakthrough thinking, dispel myths and rumors, and build stronger business relationships. Through this process, your formal work connections can even be transformed into informal relationships, which, in turn, can enhance effective C2 even more.

FACE-TO-FACE MEETINGS

- ✓ Help bond teams together
- ✓ Help people feel inspired
- ✓ Engage people in the process
- ✓ Result in break-through thinking
- ✓ Build stronger business relationships.

Turn Informal Relationships into Friendships

Casual or informal face-to-face opportunities, such as director’s luncheons or an informal after work get-together, help you form lasting ties. Friendly relationships are important to good working relationships, and you can more easily develop them outside of the normal work environment. Familiarity breeds trust and respect, both of which are critical to strong, productive partnerships. This objective of face-to-face meetings is discussed in more detail in *Chapter 11 – Review and Refine for Sustainability and Continuous Improvement*.

When to Use Face-to-Face Meetings

Table 2 provides practical applications correlated to the strategic objectives using face-to-face meetings.

Table 2. Practical Applications for Face-to-Face Meetings

Strategic Objective	Practical Application
Capture Attention for Change	<ul style="list-style-type: none"> • Initiate a new strategic direction for the airport • Launch a new airport service • Renew focus and attention on an existing airport strategy • Merge leadership strategies into a new culture • Introduce critical airport training (e.g., emergency management drills, IROPS tabletops or Aviation Management Hackathons) to hone skills and identify areas for continuous improvement, all of which can involve multiple internal and external stakeholders
Inspire a Positive Emotional Climate	<ul style="list-style-type: none"> • Annual or quarterly meetings to energize people around the airport’s vision, mission, and values statements • Recognition events to celebrate completion of new construction or implementing of new services • Celebration events that mark important milestones

Strategic Objective	Practical Application
Build Human Networks and Relationships	<ul style="list-style-type: none"> • Annual or quarterly meetings with varied topics to enable cultural cohesion and relationship-building • A regular rhythm of face-to-face meetings to build trust and effective working relationships for dispersed workforces (e.g., evening shifts) • Dynamic knowledge sharing and innovation labs
Turn Informal Relationships into Friendships	<ul style="list-style-type: none"> • Luncheons or potlucks • After-hours gatherings (e.g., picnics) • Team-building outings (e.g., going to a ball game)

These objectives were the focus at Rochester International Airport (RST), between October 2013 and January 2014, when airport leadership embarked on a stakeholder engagement initiative to seek competitive insights to understand what stakeholders considered to be RST’s strengths, opportunities, aspirations, and expectations for the future. A multitude of face-to-face meetings and workshops were conducted, including:

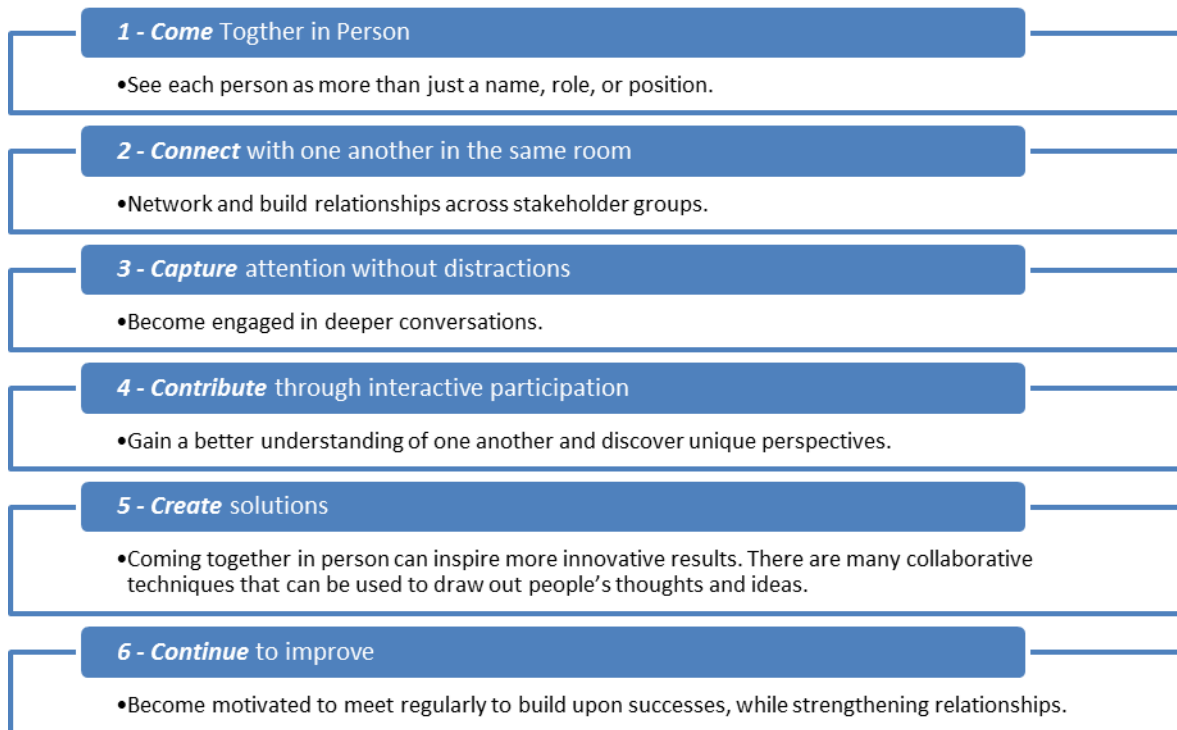
- Airport Staff & Onsite Service Providers Workshop
- General Aviation Pilots Forum
- Travel Managers Focus Group
- Airport Staff Vision and Mission Workshop
- Typical Traveler Workshop

Out of this stakeholder engagement process, some core values were identified, which were then incorporated into a refocused strategic direction and also captured in this airport mission statement: “To provide a sustainable community asset that places the customer first, acts with agility and accountability, is responsive to stakeholders, empowers staff, and embeds safety and security in all we do” (Rochester International Airport, 2014).

An Approach to Face-to-Face Meetings

Figure 7 depicts a 6-step approach to face-to-face meetings and the benefits of each step. This approach was successfully utilized during Aviation Management Hackathons, conducted as a part of the research and development of this Guidebook. The Management Hackathons were conducted at a large airport (DEN) and a small airport (BUR) to provide a cross-section of perspectives, yielding very positive results and feedback from all participating stakeholders. Appendix E provides valuable summaries of these Management Hackathons.

Figure 7. 6-Step Approach to Face-to-Face Meeting and Its Benefits



The Management Hackathon at BUR, which focused on earthquake planning and response, was a success because of the good relationships and cooperation that already existed between the airport and its various stakeholders. This is often a trademark at smaller airports, and provides them with a solid relationship foundation that is often missing at larger airports. Since there are fewer group dynamics obstacles to overcome when positive relationships already exist, face-to-face meetings in a suitable environment generally produce very positive outcomes. The Management Hackathon concluded with plans and specific action items for all participating stakeholders to address.



The Management Hackathon at DEN, which focused on improving aircraft deicing operations, was also considered a success. Even though the stakeholder participants did not walk away with specific tasks and plans, the C2 Champion was, nevertheless, provided with many ideas to consider and corrective action options to investigate as he brings the momentum created by this workshop into future follow-on face-to-face meetings. Also, this Management Hackathon served its primary intended purpose, which was to break down barriers to information sharing and to bring all affected stakeholders onto the same page moving forward.



Getting Started

If you want to improve your efforts regarding building relationships through face-to-face meetings, you could consider the following (you can find a printable checklist in Appendix D):

1. Be alert for opportunities for relationship development in informal settings, both on the job and away from the workplace.
2. Identify those frequently occurring events (e.g., construction activities, weather events, VIP arrivals) that could negatively impact internal and external stakeholder operations.
3. List the response partners and potentially impacted stakeholders for all identified events.
4. Create informal discussions around each topic to draw out wants and needs regarding response activities (e.g., what is not getting done during such events).

5. Create cross-functional, interagency teams to develop drafts of corrective-action plans for all outstanding issues/concerns.
6. Reconvene all stakeholders and response partners to review and comment on the draft plans and suggested courses of action.
7. Build the results of this input/feedback into Standard Operating Procedures (SOP) for future events.
8. Apply this same procedure to all extraordinary events, such as IROPS events, aircraft emergencies and natural disasters, and incorporate the resulting modifications into the existing formal plans (e.g., IROPS Plan, Airport Emergency Plan, and Hazardous Weather Plan).
9. Celebrate milestone successes with casual events and get-togethers to acknowledge the work that has been done jointly, and to expand and strengthen the relationships that have been developed in the process.
10. Be alert for continued opportunities for relationship development in all types of formal and informal settings.

Chapter 6: Identify Information Sharing and Documenting Requirements



You will get insights into:

- *Why it is important to identify information sharing requirements early in the C2 Program Life Cycle*
- *Some of the barriers that negatively affect information sharing among stakeholders*
- *A useful approach to identify information sharing requirements*
- *Some possible ways to document information sharing requirements effectively*
- *What other airports have accomplished in this area*

Importance of Information Sharing and Identifying Requirements

Information sharing relates to the exchange of information among individuals or groups for the purpose of providing data to others. This can be accomplished as a matter of routine or on an ad-hoc basis, either proactively or upon request. Information sharing is vital to a collaborative work environment, turning individuals into teams with members focused on a common cause. According to the Airport CDM (Collaborative Decision Making) Implementation Manual (Eurocontrol, 2012), when considering the elements of CDM: “Information Sharing is essential in that it forms the foundation for all the other elements and must be implemented first.”

Information sharing requirements define when, where, why, and how information is needed. Therefore, defining information requirements properly becomes a critical factor as an Airport Operator is engaging with its various internal and external stakeholders in an effort to enhance C2.

For information sharing to be effective, a corporate culture of openness is necessary, allowing for information to be freely shared for everyone’s benefit. This openness has, of course, limits and barriers, especially in the area of airports. As such, it is important for the Airport Operator to understand the sensitivity requirements of information upfront. This can ensure that appropriate controls are in place to protect sensitive data while maintaining a sufficiently open environment. This is needed so that information can readily get into the hands of those stakeholders who have the appropriate authority and “need to know” to support their respective roles and responsibilities. Notwithstanding the need to protect sensitive data, Airport Operators and stakeholders benefit greatly from a more open information sharing environment, as long

INFORMATION SHARING

- ✓ Identifies the when, where, why, and how information is needed
- ✓ A corporate culture of “openness” is necessary for information to be freely shared for everyone’s benefit

as related requirements are clearly identified and documented, and associated processes are developed and implemented.

At Phoenix Sky Harbor International Airport (PHX), for example, executive management implemented efforts to be as inclusive as possible and openly share information. The Technology Department developed a document portal, available through the public website, to house the Airport Emergency Plan and other contingency plans, as well as other emergency- and disaster-related plans and documents. To restrict private and/or sensitive information, access to the portal or to certain documentation is controlled by password-protected user accounts. Otherwise, the Airport Operator shares openly with its stakeholders.



In an emergency situation, it becomes critical that information is shared to support crisis decision-making. During a major incident, multiple stakeholders are collecting, collating, and communicating information to help determine how to allocate resources, with the goal of minimizing operational impacts. For a coordinated and effective response, especially in safety or security related events, stakeholders need information about the event's scope, location, and resource availability.

During the Management Hackathon conducted at BUR, for example, the importance of information sharing became apparent. Collaborative earthquake planning is critical to BUR, as it has been designated as the Disaster Command Center for Southern California, and will be the base for all post-earthquake coordination among first responders, including FEMA (Federal Emergency Management Agency) and Cal EMA (California Emergency Management Agency). One of the major results from this face-to-face workshop, which was attended by a variety of airport and non-airport stakeholders, was the realization that much useful information was not shared between stakeholders, information that would be crucial for a timely response to such a disaster. The limited airport resources at a small airport such as BUR requires Airport Operators to closely coordinate with available resources from other stakeholders, such as the airlines. At the end of the Management Hackathon, every stakeholder present had action items, such as sharing communication plans, taking resource inventories, and training, all of which will contribute to improved information sharing. (Refer to Appendix E for the Summary Report.)



Barriers to Information Sharing

There are barriers to information sharing that limit and even hinder effective communication between stakeholders. One of the barriers is invisible obstacles, such as security protocols, politics, regulations, and management decisions that may limit what information can be shared. Withholding of information as an act of power and personal influence also limits communications. In addition, a perceived threat of losing competitive advantage or concerns about diverting or overloading employees' work-related attention constitutes another barrier. A lack of common understanding of terminology, acronyms, and symbols can greatly hinder effective communication between parties.

Furthermore, the failure to appreciate or understand the sensitivity of information being shared can be a hindrance. The misinterpretation of information shared electronically due to the absence of visual cues, such as facial expressions or hand gestures, causes communication to be misunderstood. And, finally, the erroneous belief of individuals that they have shared information effectively is another barrier.

How to Identify Information Sharing Requirements

Information sharing requirements define when, where, why, and how information is needed among airport stakeholders. Information sharing requirements are often assessed on a case-by-case basis

without a formal or structured approach. In such cases, the Airport Operator often determines the requirements initially; therefore, the requirements are based on an operational need to know, dependent upon specific events. Since Operations personnel are usually involved, they generally have the responsibility of reporting to management and stakeholders. Consequently, the information shared by the Airport Operator enables management to make more informed decisions and keeps other stakeholders abreast of developing conditions.

This approach has been useful in addressing information sharing requirements for specific events. To enhance C2 on a broader scale, however, a systematic airport-wide program is needed. A more comprehensive approach will lead to identifying information overlaps that exist when different stakeholders require the same type of information. Investigating and documenting these requirements, as well as understanding any restrictions or limitations to information sharing, is crucial to the success of an enhanced C2 Program.

INFORMATION SHARING

Oversharing is better than the risk of leaving out important details

When it comes to information sharing, oversharing is better than missing someone who needs to know. This is especially true for high priority information, such as that related to protecting human life. Airport leadership and local office holders must be kept informed, since unexpected changes in situations can be difficult to explain after the fact. In this regard, having the airport's Public Affairs personnel tied in closely with Operations greatly facilitates the effective flow of information to all appropriate parties.

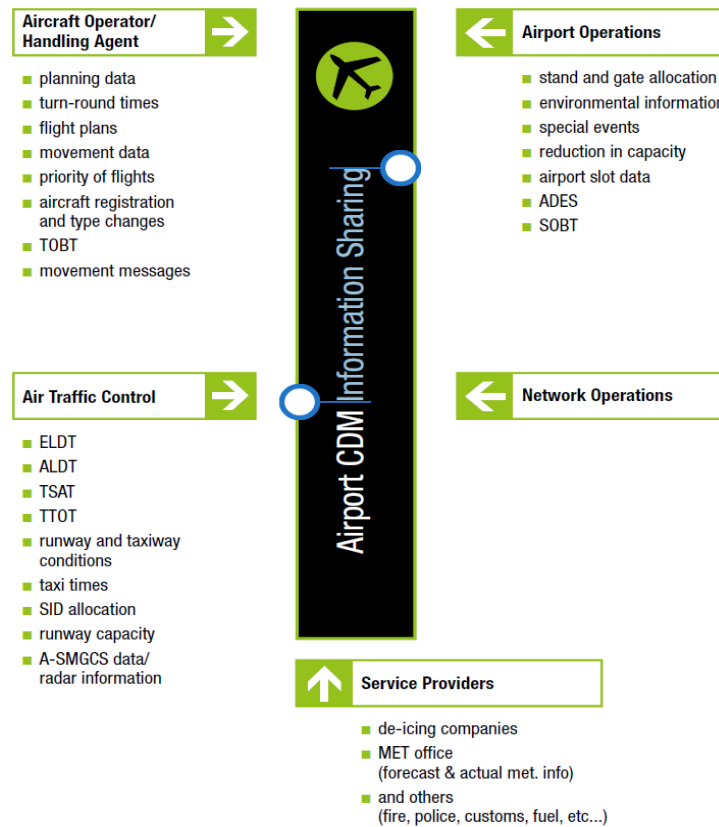
The effort of identifying and documenting information sharing requirements is also the foundational work required to establish common data standards across the airport. Consider, for example, the importance of common data standards to Airport CDM (Eurocontrol, 2012): "Airport CDM Information Sharing requires that shared information is available through a common system, connected via proper interfacing to all partners' systems and databases." For more information related to common data standards, refer to "How Can Technology Help You," in Part III of this Guidebook.

With the vast number of operational functions, identifying the information sharing requirements can be a daunting task. To help with this task, here are a few recommend steps:

1. Get management buy-in. Remember how you put together your C2 shared vision statement? Now put together a similar statement (i.e., a problem statement) for management that:
 - a. Describes the issues and possible consequences related to failing to identify information sharing requirements
 - b. Provides explanations on how identifying information sharing requirements can improve C2, and
 - c. Emphasizes the alignment with the shared C2 vision.
2. Break down your information sharing requirements for each operational objective (e.g., improving on-time departures). Do not try to address the entire airport at once.
3. Prepare a few basic charts, identifying the primary stakeholders and the information to be shared by these stakeholders. Figure 8 shows an example of how to present this information.
4. Consider performing an as-is internal assessment to discover all processes, procedures, and information flows (formal and informal) in use by the information owners, to include type, frequency, usefulness, mode, and distribution, in order to identify overlaps, gaps, obstacles, and opportunities. The help of a good Business Analyst can help in logically presenting this type of information.

5. Hold a face-to-face meeting with at least the set of identified stakeholders. In this meeting, confirm and refine the problem statement, the information to be shared, and the risks and opportunities. It is important to discuss and understand the risks to business continuity and airfield operations that may arise if stakeholders do not share information. This is also the opportunity to note any systems used, where the information resides, and who creates and maintains the information.
6. Conduct tabletop exercises and leverage event debriefing opportunities to assess the appropriateness and effectiveness of information flow (e.g., Did all stakeholders receive the information they needed and on a timely basis?) Also, note why certain information was not communicated and identify the constraints, if applicable.
7. Create a spreadsheet tool and other documentation, which is discussed in the next section, capturing the information requirements collected during these discovery efforts.

Figure 8. Airport CDM – Information Sharing



Source: Eurocontrol. 2012. Airport CDM Implementation – The Manual.” European Organisation for the Safety of Air Navigation, p. 3–10

Documenting Information Sharing Requirements

Capturing, analyzing, and documenting the multitude of stakeholder information requirements is an important activity, as it allows for proper monitoring and control. This section provides some insights into effectively documenting the collected information sharing requirements utilizing an Information Sharing Matrix (*Matrix*), Information Sharing Plan (*Plan*), and Information Sharing Flow Diagrams (*Diagrams*). A combination of these is recommended, as they are conceptually tied together. The Matrix provides you with the foundation for developing the Plan as well as the information needed for creating the Diagrams.

The Diagrams, in turn, provide you with a useful tool to graphically represent the data in the Matrix and the associated processes described in the Plan.

INFORMATION SHARING

Capturing, analyzing, and documenting info requirements is important for proper monitoring and control

Information Sharing Matrix

Based on the discovery efforts results outlined above, consider developing an Information Sharing Matrix, which is a spreadsheet containing detailed information sharing requirements, including but not limited to:

- ID (a unique identifier for that information)
- Name (What information is it?—a phrase or a one-line title)
- Subject Matter Expert (SME)—(Who is the SME?—that person decides if information is complete and accurate)
- Source (Who has it?—who is the information owner)
- Source Purpose (Why is it needed by the owner?)
- Source Format (What format is it in?—e.g., spreadsheet, GPS coordinates, maps, photographs, voice, symbols, written text, etc.)
- Source Mode (What mode is it?—routine, ad hoc, or emergency)
- Recipients (Who needs it?)
- Recipient Purpose (Why is it needed by the recipient?)
- Recipient Format (In which format does each recipient need it?)
- Risks (Are there any risks associated with holding and sharing the information?)
- Location (Where is it?—e.g., database, system, paper records, etc.)
- Event/Situation (When is it needed?)
- Legal Gateways (Details of the regulations/guidelines used to support the sharing or collecting of the information, including whether consent from the data subject is required and granted)
- Related Documentation (Relevant information sharing protocols, agreements, process flows, procedural documents, etc.)

It should be noted that not every piece of information tracked in this matrix requires all fields to be identified. You should make adjustments as needed, determined often by the information mode. For emergency related information, for instance, it might become difficult to identify the information source (owner) as bad things could simply happen anywhere at any time. As is often the case, information sharing requirements will evolve or additional sharing requirements will emerge over time. You should, therefore, update the Matrix and keep it current to reflect changes as they occur. You should then share the completed Matrix with all relevant stakeholders. Clicking the tool icon on the right will open up a sample Information Sharing Matrix for your use.



Information Sharing Plan

Many airports have communications plans and, oftentimes, airport projects will have their own communication plan specific to the project's scope. Considering the topic of this Guidebook, however, you might want to think about developing an Information Sharing Plan: a communication plan-type document specifically developed to address the information sharing requirements, as well as related procedures, processes, information flows, and chains of escalation. If such a plan exists, or if an existing communication plan addresses these specific information sharing elements, you might want to consider updating it with the information gathered during the discovery phase. Such a plan will also identify key performance indicators to be communicated and monitored, as discussed in *Chapter 8 – Develop Key Performance Indicators*.

During the BUR Management Hackathon, the airline representatives walked away with a joint willingness to review their existing communications plans in light of the information discovered during the workshop sessions. They committed to sharing the revised plans, and were in favor of having follow-on face-to-face meetings with each other, the Airport Operator, and other relevant stakeholders to discuss what everybody would be expected to do if an earthquake were to hit the region. The intentions were not only to inform each other but to also collaboratively work on identifying any overlaps, communication barriers, opportunities for support and alignments, and resource allocation efficiencies in regard to information sharing. A jointly developed airport-wide Information Sharing Plan was a logical outcome from these collaborative discussions.



Information Sharing Flow Diagrams

Graphical representations have always been helpful in showing relationships and processes. This holds especially true for situations where time is of the essence, such as responses to emergency situations. Information Sharing Flow Diagrams can be as simple as a call tree, which is used frequently by the Executive Director of Centennial Airport, identifying who needs to be informed during which type of event. Or, they can be created as detailed process flow charts, incorporating “swim lanes” to designate the parties responsible for the various process steps, and including annotations to explain the process steps and information requirement details. Again, you should determine to what extent these tools will need to be developed. (Formal documents, such as SOPs in conjunction with the related process workflow diagrams, have been successfully shared with and used by external stakeholders of organizations in the oil and gas industry.)



You should consider continuously evaluating all documentation related to information sharing requirements and procedures; this can be effectively accomplished by incorporating lessons learned from the experiences of implementing the processes described in the Information Sharing Plan. You can identify lessons learned during post-event hot washes, emergency or security/safety drills, tabletop exercises, and similar meetings. Also, customer service–centric meetings can be as a good source of information. Chapters 10 and 11 provide details regarding training and sustainability considerations of enhancing C2 among stakeholders.



Getting Started

If your Airport is struggling with identifying and/or documenting information sharing requirements, you could consider the recommended steps discussed earlier. You can find a printable checklist in Appendix D.

Chapter 7: Establish and Revise Policies and Procedures



You will get insights into:

- *The benefits of having written policies and procedures that govern any aspect of C2*
- *The importance of making it a practice to document/codify operational practices with policy or procedural guidance*
- *How to create operational procedures that will engage all affected stakeholders*
- *Why standardizing, reviewing, and revising operational procedures is so important to good C2*
- *What other airports have accomplished in this area*

What Are Policies and Procedures

Policies and procedures are defined as:

- *Policy* – a direct link between an Airport Operator’s vision and the day-to-day operations. Policies identify key activities and guide decision-makers as issues arise by establishing limits and a choice of options. With the understanding of an organizational framework as described in Chapter 4, the Joint Executive Steering Board takes on the responsibility of setting policies for C2.
- *Procedures* – a series of consecutive action steps related to a policy that specify how a particular process should be completed. Procedures include information on who, what, when, and where of the policy. The ultimate goal of every procedure is to provide a clear and easily understood plan of action to implement a policy. The most common type of procedure document is an SOP, which is discussed in more detail in the next chapter. Again, with the organizational framework described in Chapter 4, the Advisory Committee takes on the responsibility of preparing operating procedures, in line with the C2 policies. Depending on the airport size, this activity may be augmented by the FWGs.

Importance and Benefits of Policies and Procedures

Policies and procedures seek to further an Airport Operator’s vision; promote consistency, efficiency, and effectiveness; and mitigate or manage risk. Well-written policies and procedures allow airport employees to clearly understand their roles and responsibilities within predefined activities. They also help transition new personnel and lessen the impacts of employee turnover. Basically, policies and procedures allow management to guide operations without constant management intervention. This is important because constant intervention equates to increased operating expenses that ultimately detract from an organization’s profitability. At DFW, executive level staff developed, among other documentation, a Board Policy specifically for Emergency Management. It defines detailed requirements for knowledge and skills that each internal staff position must possess.



POLICIES & PROCEDURES

- ✓ Allow employees to understand their roles & responsibilities
- ✓ Help transition new personnel and lessen the impacts of employee turnover
- ✓ Allow management to guide operations without constant management intervention
- ✓ Constant intervention equates to increased operating expenses
- ✓ Increased operating expenses ultimately detract from your Organization’s profitability

Some airports interviewed mentioned the following items as positive results of effective policy setting and procedure development:

- Increased level of trust and respect among stakeholders
- Improved alignment of stakeholder initiatives
- Strengthened strategic alliances with stakeholders
- Increased public awareness
- Improved flow of accurate and timely communication
- Reduced expenses due to inaccurate or incomplete information
- Improved staff morale due to a reduction in hearsay
- Increased employee involvement

As an example, easy-to-read and easy-to-understand handbooks (simplified versions of SOPs using a more conventional, everyday vernacular), in both hard- and soft-copy formats, have shown success for many internal stakeholders of

organizations in the oil and gas industry (Wipro Limited, 2016).

Documenting Policies and Procedures

Chapter 4 of this Guidebook covers the importance of developing a shared C2 vision, establishing a C2 organizational structure, and defining roles and responsibilities of the key internal and external stakeholders. The next step is to document those roles and responsibilities in a cohesive set of policies and procedures governing C2.

Preparing the C2 Policy

Developing C2 policies is important to establish boundaries and set expectations within the stakeholder community. Boundaries include such key issues as truthfulness and ethics, while expectations include issues such as how each stakeholder will be held accountable for the effectiveness of his or her own communications. It is through the established policies that voice and authority is given to the operational departments, which ultimately manage and operate the collaborative processes. Regardless of the format, the key issue is to develop C2 policies that establish and govern teams on the airport’s vision, goals, priorities, and objectives.

For example, at Gulfport-Biloxi International Airport (GPT), as a result of evaluating Hurricane Katrina disaster response efforts, some new policies needed to be established to enable the airport to donate and otherwise provide assets, materials, and other aid to various stakeholders. This not only resulted in additional related procedural documentation that is periodically updated, but also ultimately contributed to the development of the required Airport Emergency Plan.



Preparing the C2 Procedures

With C2 policies in place, the Advisory Committee can begin to prepare and direct C2 procedures needed for specific work practices. Effective C2 procedures enable you to keep all your stakeholders, staff, and management informed and up to date in a logical and timely manner. Without them, you risk creating resentment over constant interruptions as well as being overwhelmed and disorganized. For example, at General Mitchell International Airport (MKE), clear IROPS procedures were developed detailing when airlines and the Airport Operator should complete which tasks. Then, during an IROPS event, the airport's Operations division is responsible for ensuring that airlines follow the procedures, and that any required assistance is coordinated between the two parties.



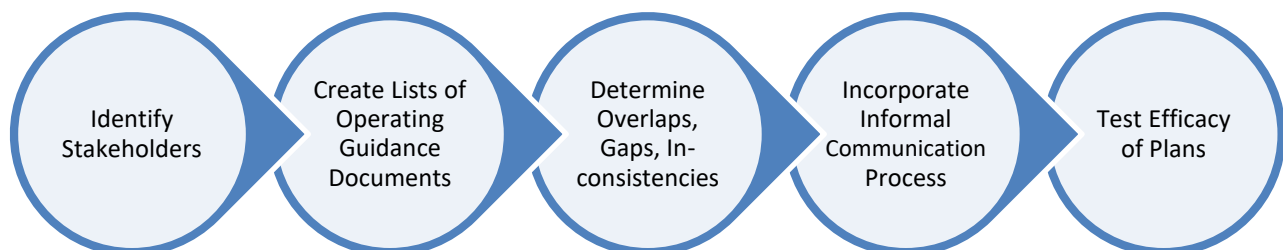
Because of the many competing priorities at an airport, it is important to create an interactive, cross-functional process to set priorities and evaluate trade-offs that acknowledge conflicts, provide for resolutions, and set expectations for results among the stakeholders. As part of your procedures, you should consider assigning levels of authority for approvals related to project authorizations and change management.

When preparing C2 procedures, you should take care in deciding what situations require formal communication and when communication can be more informal. Furthermore, your procedures should ensure sensitive information is released in all appropriate locations, simultaneously, and identify who has authorized its release. Also, consider stipulating how historical perspective and lessons learned can provide context for decisions. Furthermore, a commitment to confirm communication through a feedback loop is relevant; this can improve effectiveness by encouraging questions and demand clarification of roles and responsibilities of the team members to eliminate redundancies and improve efficiency. Finally, to ensure continuity in the workplace, you could provide communication training to staff.

Approach for Establishing Effective Procedures

When working to create significant improvement in stakeholder C2 activities and processes you should consider the step-by-step process shown in Figure 9. This process applies equally to establishing new SOPs or revising and updating an existing set.

Figure 9. Approach for Establishing Effective Standard Operating Procedures



STEP 1 – IDENTIFY STAKEHOLDERS

You can augment the sample stakeholder list provided in Chapter 3 as necessary to ensure you have incorporated all departments, businesses and agencies with which your Airport Operator interacts during normal operations, as well as in unusual circumstances, such as IROPS or emergency events. This listing will likely include a bulk of the tenants on airport property, including federal agencies, as well as off-airport mutual aid response organizations. To be on the safe side, it is better to overload this list than to underload it. If you determine that some entities on that list are not to be stakeholders, they should then be removed.

STAKEHOLDER LIST

- ✓ Overloading is better than underloading
- ✓ Easy to remove stakeholders
- ✓ Very difficult to add new ones without creating confusion and work

STEP 2 – CREATE LIST OF OPERATING GUIDANCE DOCUMENTS

The list of current airport operating guidance documents, such as departmental SOPs, inter-organizational/interagency operating agreements or formalized understandings, organizational policies, and all others should be made available to the appropriate Work Teams. Then, as your Airport Operator’s staff works with each stakeholder, you should create additional lists of those documents that govern each of their operations. For example, at DEN an airport-wide CONOPS was compiled, listing and defining, in one volume, all operational procedures and how they relate to each other.



The importance of face-to-face meetings, as discussed in Chapter 5, will be evident as this document collection process gets underway. It will be of even greater importance as the difficult work of reviewing and “harmonizing” plans and procedures occurs.

STEP 3 – DETERMINE OVERLAPS, GAPS, AND INCONSISTENCIES

The best way to approach this task is to establish a Work Team responsible for reviewing and summarizing planning documents for each organization. In the organization structure defined in Figure 4 (Chapter 4), the responsibilities of this team are covered by the FWG. Once briefed, the team reviews and revises existing plans and procedures (captured in the lists created in Step 2). The goal is to ensure the efficiency and effectiveness of day-to-day operational activities and responses to IROPS and emergency situations at the airport. At DFW, for example, a tool was developed that included various SOP checklists relating to specific types of incidents (e.g., loss of baggage system). Each checklist clearly spells out who (which department/ division/section) does what during that incident (e.g., fix the FIDS or communicate with passengers).



The following hypothetical examples also show how this harmonizing process might look for other situations:

- **Example 1** – Airside Operations may have an SOP regarding the contacts to be notified when preparing the Airport Operator for an impending winter storm; however, that contact list may be heavily focused on tenant airlines. When that SOP is reviewed with a more holistic mindset, it may become evident that there are many tenants who would benefit from advanced warning of an impending storm. For instance, concessionaires may need to know how to adjust work schedules and concession hours of operation to handle the potential influx of stranded passengers. Following this more inclusive review, it could be concluded that incorporating the food and beverage providers into the SOP, as well as the airport staff who work most closely with those concessionaires, may be a critical operational enhancement.

- **Example 2** – The Airport Operator’s National Incident Management Structure (NIMS) / Incident Command System (ICS) protocols may require all public safety elements to respond to a specific perimeter gate on the north side of the field for deployment onto the scene by the Incident Commander. In reviewing the response plan of a mutual aid fire department, however, the Airport Operator discovers that it is planning on responding to a gate in the perimeter fence on the south side of the airport. This is a problem easily corrected; but if not for the harmonizing initiative, this disconnect may not be discovered until an actual emergency event occurs.

STEP 4 – INCORPORATE INFORMAL COMMUNICATION PROCESSES

Not all operational activities at an airport will require formal guidance documents. For example, a regular morning bridge call among stakeholders interested in airfield status updates may not require anything more than an understanding among the parties and knowledge of the call-in number. However, referencing this call as a means to keep all stakeholders abreast of daily airfield status could be accomplished by codifying it in some fashion. This way, the purpose and value of the call can be identified and extended into the future as staff turnover occurs. Therefore, you should identify these types of communications, although informal, and review them for viability in the process of harmonizing operational procedures among both internal and external stakeholders.

STEP 5 – TEST THE EFFICACY OF PLANS

When conducting tabletops or other joint exercise activities, Airport Operators should create exercise scenarios to test for viability during normal operations, IROPS events, and emergency situations. It is a good idea to use the FWGs to establish Work Teams to conduct these tests over time in such a way as to maintain momentum of the initiative, but not so often that complacency or burn-out sets in. Therefore, you should consider performing these tests no more frequently than on a quarterly basis, which should be sufficient to test the plans iteratively.

Importance of Updating and Standardizing Operational Procedures

Written procedures provide the foundation for control of conduct that the stakeholders of any collaborative process need and should expect. This is because SOPs are about decreasing variability in a process. As Airport Operators decrease procedural variability, they increase process control. That is, they standardize small parts (the individual components of procedures as appropriate) to control the big picture (the overall process).

Efforts on harmonizing and updating existing documentation, as well as identifying documentation gaps and areas of improvement, has greatly advanced at San Diego International Airport (SAN). Airport Operator staff embraces a culture of lessons learned, and all are open to constructive feedback. This has added an internal quality control mechanism leading to greatly improved and up-to-date documentation.



Therefore, SOPs that help stakeholders to control C2 processes and their outputs via internal quality control serve two key purposes:

- Functionally – in everyday operational terms, SOPs standardize procedural performance
- Strategically – SOPs operate as a compliance tool

TWO KEY PURPOSES OF SOPS

- ✓ Functionally - standardizes procedural performance
- ✓ Strategically - operates as a compliance tool

Functionally, SOPs enable stakeholders to:

- Capture (retain and transfer) organizational knowledge. This means that the sponsors for stakeholder C2 can decrease training time and/or increase training efficacy across the stakeholder community.
- Standardize performance and increase consistency, which means that the likelihood of achieving high quality operational results is increased through consistent performance of specified tasks.

Strategically, SOPs enable stakeholders to:

- Fulfill compliance requirements
- Communicate effectiveness measures
- Decrease error rate and improve quality
- Reduce unnecessary duplication of effort and control information growth



Getting Started

If you want to establish new and/or revise any existing C2 policies (and procedures), you could consider the following process to get started. (You can find a printable checklist in Appendix D.)

1. Identify a champion who is responsible for leading group discussions and drafting or revising a C2 policy.
2. Identify to the Board the need for policy development/revision for approval of the work process.
3. The C2 Champion establishes a Policy Work Team and selects diverse team members to garner input on what should be covered in a C2 policy.
4. Face-to-face meeting(s) are held to discuss ideas, which the C2 Champion documents in a written draft.
5. The draft is circulated to team members for edits, and a revised draft is created based on team members' input and feedback.
6. The revised draft is coordinated through the Board for additional feedback to create a final draft.
7. The final draft is then shared with airport executive management as necessary to comply with policy formulation (i.e., Board services manager, Human Resources (HR), Public Affairs, etc.).
8. The final draft is executed as policy. The policy is communicated to Airport Operator staff, and added to any policy manuals. In addition, it is posted on the airport website, intranet, or other communication means as applicable to your airport.

The C2 Champion revisits the policy on an annual basis, and updates it as needed with assistance from the Policy Work Team.

Chapter 8: Develop Key Performance Indicators



You will get insights into:

- *The value of developing and tracking KPIs*
- *The benefits and risks of applying C2 contributions to KPIs*
- *The positive effect of applying C2 contributions to KPI measuring*
- *How to make KPI monitoring a part of your C2 governance*
- *What other airports are accomplishing in this area*

Importance of Key Performance Indicators

One of the most important C2 principles for the Airport Operator is open and transparent collaboration. This principle must also extend to measurement of performance indicators used for tracking and improving results. Therefore, there must be accurate and open disclosure of results, whether positive or negative. Improvements will only happen when a no-blame culture is developed, where problems are revealed with the sole purpose of reducing them and enabling others to learn from them.

To achieve this level of open communications and improved results that are valuable to all stakeholders, the following should take place:

- Validate your business-case against performance
- Make decisions to add further elements of C2
- Ensure the measurement of success is an iterative process, and that feedback is an integral part of the process
- Ensure success is measured across operational areas and cost benefits
- Identify further improvements via periodic performance reviews

Although your airport management may endorse the benefit of validating and measuring, many Airport Operators find that there are no formal mechanisms in place to actually measure results. Therefore, in order to continuously improve operational efficiencies and demonstrate return on investment (ROI) there is a need to develop and implement KPIs. Understanding how C2 performs across all KPIs will allow you to track and improve C2.

KPIs enable Airport Operators to measure the effectiveness of current programs and analyze areas for improvement. For the Airport Operator, typically the greatest challenge is knowing how to start and

manage a KPI monitoring program. To help with understanding how to establish and apply KPIs, you could consider reviewing some of the resources already produced related to airport KPIs. Two such references are ACRP Report 19A and the Airport CDM Implementation Manual. ACRP Report 19A provides guidance in establishing KPIs across all airport operational areas, and provides a listing of general KPIs currently in use at airports. The Airport CDM Implementation Manual provides a very good discussion and listing of KPIs related to Airfield Operations. These resources can be used by the Airport Operator or Functional Working Groups when establishing the base set of KPIs.

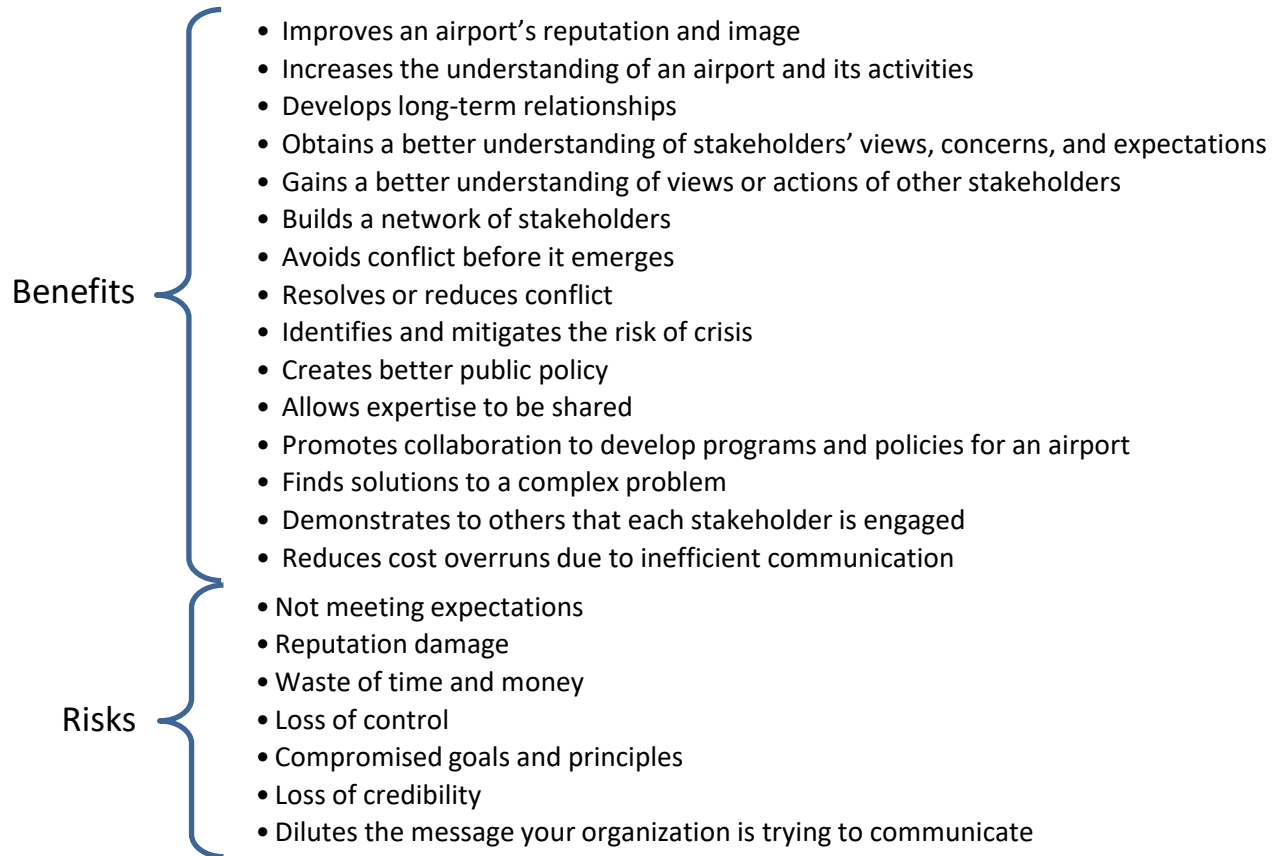
Key Contributions of C2 Effectiveness

The C2 key contributions listed below can be expected with a successfully implemented and sustained C2 Program. They are the results of the efforts centered on identifying information sharing requirements in Chapter 6, and can apply to daily operations performance measurements for specific incidents.

1. Well-informed key stakeholders
2. A clear understanding of all stakeholders' expectations
3. Community-wide agreement on issues of mutual interest and concern
4. Regular communication with relevant parties
5. Stakeholder input into airport decision-making processes
6. Integration of airport and stakeholder concerns
7. Positive attitude on the part of all key players

Airport Operators should determine how to apply each of these C2 contributions across all areas of the C2 Program. Further guidance on this topic can be found in Chapter 11 of this Guidebook.

When applying C2 requirements for KPIs, you could consider these C2 contribution areas. When incorporated properly, several long lasting benefits can be expected. Figure 10 provides a list of benefits your airport may experience when effectively relating C2 contributions to KPIs (Aviation Innovation, 2016). It also lists some risks associated with failing to identify appropriate KPIs.

Figure 10. Benefits and Risk Applying C2 Contributions to KPIs

Source: Aviation Innovation (2016). “C3 Communication Processes”

Applying the C2 Key Contributions to KPI Measuring

With every KPI, it is important to understand the contribution of C2. At DEN, for example, the measuring of actual off-block time depends on the near immediate communication from the airline departing from that gate. So if airline communication of the actual time is delayed, the quality of the KPI will be affected.

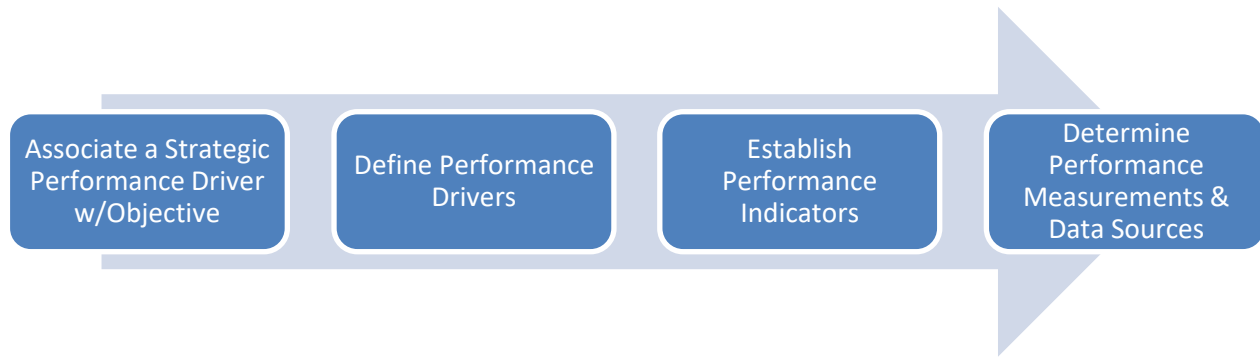


Whether it is in measuring daily operations by tracking KPI performance via dashboards, for example, or by identifying issues for planning for specific events, such as an earthquake, each KPI relies on effective C2. At BUR, the importance of ensuring all stakeholders meeting at a prescribed command center location, and at a prescribed time after the potential significant event of an earthquake, has led to the importance of C2 across all relevant stakeholders. As such, simulation testing and measuring of this post earthquake KPI can actually show the effectiveness of C2 planning for this KPI.



Daily Operations

Developing an effective KPI program to measure the performance of daily activities requires a structured approach. One such approach is presented in the Airport CDM Implementation Manual (Eurocontrol, 2012), which can be applied against each specific strategic objective. Figure 11 summarizes these steps.

Figure 11. Approach to Developing Effective KPI Program to Measure KPI Performance**C2: Contributions:**

Using this flow chart, an example where the strategic objective is “Reducing Environmental Nuisance” breaks down into the following elements:

- Strategic Objective: “Reducing Environmental Nuisance”
- Strategic Performance Driver (KPI): “Reduce Engine Time”
- Performance Driver: “Reduce Noise on Ground” and “Reduce Emission from Engines on Ground”
- Performance Indicator (an index; what you get from the measurement): “Noise on the Ground” and “Emissions from Engines on Ground”
- Performance Measurement (a method; how you measure each indicator): “Estimated Taxi-in Time vs. Actual Taxi-in Time” and “Estimated Taxi-out Time vs. Actual Taxi-out Time”

Communication between stakeholders throughout the operational day, as in this example, must be identified. This is best accomplished through face-to-face meetings during which the information in the Information Sharing Matrix and Information Sharing/Communications Plan is used to associate specific C2 contributions with each KPI. For this example, a key C2 contribution would be: “well-informed stakeholders.” Since the Information Matrix, as discussed in Chapter 6, breaks down the “who needs to know what and when,” you are in position to greatly improve the information sharing among the affected stakeholders. That, in turn, leads to stakeholders being well informed. These C2 contributions are then tracked and monitored along with the tracking and monitoring of the KPIs themselves.

Planning for Specific Events

While identifying, tracking, and measuring daily activities through KPIs may be more obvious than doing the same for events that may or may not occur, it is important to also establish a KPI program for event management as well. Once KPIs (and associated C2 contributions) are established, the Airport Operator can then prepare test scenarios to simulate and measure performance.

The same approach of applying C2 contributions to specific KPIs can be extended to measuring event-based performance indicators, such as during planning for a major earthquake. In this case, it is of utmost importance that all C2 requirements are identified, as the security of the area and the safety of people are at stake. The second Aviation Management Hackathon (see Appendix E for a summary report), conducted at BUR, shed much light on the necessity to not only identify KPIs but also the C2 contributions.



The Management Hackathon was a 4-hour face-to-face meeting with the purpose of identifying KPIs based on stakeholder expectations of how to respond to a major earthquake, leaving BUR the only

operational airport in the region. Various stakeholder groups were present. Throughout the meeting, a KPI was identified: “how many minutes after the earthquake struck must assigned stakeholders meet at the command post?” It became apparent that some important stakeholders were not present during the Management Hackathon. That led to defined action to improve C2 by identifying all stakeholders and communicating with them, as well as identifying their specific and much-needed roles and responsibilities if an earthquake strikes while they are on duty.

Common KPIs that are agreed upon by all the airport partners have to be used in order to have a clear picture of the quality of a C2 Program implementation. In order to measure the effects of C2, the post-implementation performance needs to be compared against the same performance indicators that will be utilized before implementation. For the BUR example above, the ultimate result—being that the Airport Authority can then plan for a simulation run—is to test how quickly all stakeholder leaders meet at the command post. Through these tests, C2 contributions can be monitored and improved upon until the KPI criteria is met.

KPI Monitoring and C2 Governance

Airport operations, whether related to daily management, IROPS, or emergency situations, is ongoing and complex. Measuring stakeholder engagement and partnering efforts can also be time consuming and multifaceted. Stakeholder evaluation should not be a one-time event, but rather continuous and embedded within the overall airport operation to track progress in meeting planned goals. This means evaluations should occur regularly, especially during and after IROPS or emergency events, with adjustments made throughout the process, as needed. Joint review of KPIs is helpful in monitoring stakeholder behavior and interests, and will help ensure communication mechanisms are effective. Including stakeholders in collaboratively identifying the issues and agreeing on goals and solutions is crucial to effectively managing and continuously improving KPIs.

It is important to ensure that the KPI monitoring program contributions become an integral part of your C2 governance. Using the criteria established in Chapter 4 of this Guidebook, it is the responsibility of the FWGs to establish KPIs and C2 contributions. Through the FWGs, the KPIs will be monitored and measured. The C2 Joint Executive Steering Board should have access to performance reviews, either through on-line dashboards or some other formal means of reporting.

Further discussion regarding sustaining an overall C2 Program can be found in Chapter 11 of this Guidebook.



Getting Started

If your airport is struggling with identifying and measuring KPIs and applying C2 contributions to performance indicators, you could consider the following. (You can find a printable checklist in Appendix D.)

1. Make sure that you have support with building a culture around a completely open and transparent means of C2. Having this in place will help to make a successful program for the measurement of KPIs. You should ensure full management support and, if possible, include the concept of open and transparent C2 in your policies and procedures.
2. Do you have a formal means of tracking KPIs? If yes, then review the KPIs that impact your area, and identify for each KPI how C2 should contribute to the benefit of that KPI.
3. If you do not have a formal set of KPIs, start one by reviewing the standard lists included in ACRP Report 19A, and pull out the KPIs that apply to your process. Then review the KPIs that impact your area, and identify for each KPI how C2 should contribute to the benefit of that KPI.

4. Once you have documented your opinion of C2 contributions to the relevant KPIs, call for a face-to-face meeting with the key stakeholders to review and discuss the list. Use the seven (7) points of “Key Contributions of C2 Effectiveness” shown at the beginning of this chapter as a discussion guide during the meeting. Remember to start simple. Don’t try to conquer all the KPIs at once.
5. During the meeting, identify what needs to be measured and how it will be measured for each KPI. For each measurement, associate the specific C2 requirements needed.
6. Begin to measure and track. Call for periodic face-to-face meetings to assess the success, and to adjust both the KPI and C2 contributions as required.
7. Set aside time to review KPI measurement results with your Steering Committee.
8. Assess the benefit of new technologies to help add a layer of efficiency and productivity to your KPI monitoring and measuring program.

Chapter 9: Execute Partnering/Alignment Agreements



You will get insights into:

- *Why it is important to execute partnering agreements when working to enhance communication and collaboration with stakeholders*
- *The elements/components of good partnering agreements*
- *Typical partnering agreements that can be used*
- *Appropriate handling of sensitive, proprietary, and personally identifiable information as well as intellectual property in a partnering agreement*
- *What other airports have accomplished in this area*

Importance of Executing Partnering Agreements

Effective C2 is dependent on the voluntary cooperation of stakeholders working to achieve mutual benefits, including satisfying the needs of each stakeholder group and the public in all its forms. This has been achieved quite successful at PDX by focusing on creating partnership relationships. The Airport Operator has worked with the Centers for Disease Control and Prevention (CDC) and the county health department on a Communicable Disease Response Plan, with the Regional Hospital Group for mass casualty incidents, with the medical examiner's office on the handling the deceased, and with the Red Cross for needed resources during all types of large events. In addition, PDX is a POD (Point of Dispensing Medication Center) in support of the Cities Readiness Initiative, which exists to support mass casualty accidents in other regions of the US. The Airport Operator also has a strong Family Assistance Center program to assist during emergency events.



Nonetheless, in order to ensure reliable and consistent operation, the roles and responsibilities of all stakeholders should be formalized in a comprehensive interagency agreement and, where applicable, SLAs. The latter is of particular significance when partners undertake certain services on behalf of others.

This chapter addresses best approaches for formalizing and executing agreements to align all stakeholders relative to C2 and information sharing. Focus areas include handling proprietary information or intellectual property, granting access to sensitive information, restricting information usage, and understanding regulatory requirements and indemnification.

How to Develop Partnering Agreements

Airport Operators have a variety of partnering agreements available to assist them in managing an airport. The use of these agreements can help provide a better understanding of each other's roles and responsibilities, timelines, objectives, expectations, and implementation strategies. Clearly defined and accepted partnering agreements between the Airport Operator and its stakeholders often contribute to a more efficient and secure airport. These agreements are important C2 documents. Therefore, there is a need for them to be living documents that are periodically reviewed, updated, and incorporated into the human-centered, relationship-based approach of the C2 Life Cycle.

According to *Business Dictionary.com* (2016), a Partnering Agreement is usually a written agreement between parties or entities to work together to establish a stated goal or provide a designated service. There are different types of partnering agreements that deal with distinct issues and situations. However, according to Todd Spear (2014):

In all cases, a basic strategic partnership agreement should include the following:

- The parties involved in the agreement
- The services to be performed by each partner
- The terms of the agreement (percentages of profit, method of billing, etc.)
- The reporting structure, person of contact, etc.
- The duration of the agreement
- The signatures of company officers or their designees

In your effort to develop new agreements or enhance existing ones, you should identify the stakeholder representatives by name, office, and title, and should fully understand their organization's responsibilities by spelling them out in the agreement. Preferably, they will have been involved in the development of the agreement.

You should clearly define and express the roles and responsibilities of each stakeholder, including the Airport Operator. This allows each party to have an understanding of what to expect from others. Mutual understanding facilitates cooperation and coordination toward common goals and objectives.

Also, you should define objectives and goals of the agreement and include them in the document. At BUR, the Airport Operator has included such language in each of the primary stakeholder agreements to help define roles and responsibilities in the event of a major earthquake. An agreement may also identify the problem or issue it is designed to address to help keep the parties focused specifically on that issue. If appropriate, you could build into the agreement timelines or timeframes that stipulate when something is required to be completed (e.g., law enforcement response time, delivery of goods, etc.) Some agreements include a discussion of workload and how often a task will be performed.



Financing and funding are also critical requirements in some agreements. You should clearly identify the parties responsible for providing funding, and include the payment schedules and milestones, if applicable. In addition, there should be a clear understanding of the consequences if payments and milestones are not met.

In addition, you should identify the reporting structure of the offices, departments, and agencies involved, as well as the persons to contact. Chain-of-command and how decisions will be made and when are also important factors to include in the document. Frequent and open communication between the stakeholders and the airport can help improve working relationships, especially since the threat of

IROPS or emergency events is ever present in aviation. Those situations leave no time for personal introductions.

A SUCCESSFUL AGREEMENT

- ✓ The right people involved maintaining a sufficient level of energy and support
- ✓ Senior leadership backing
- ✓ Right level of signatories enhances and highlights relevance of agreement

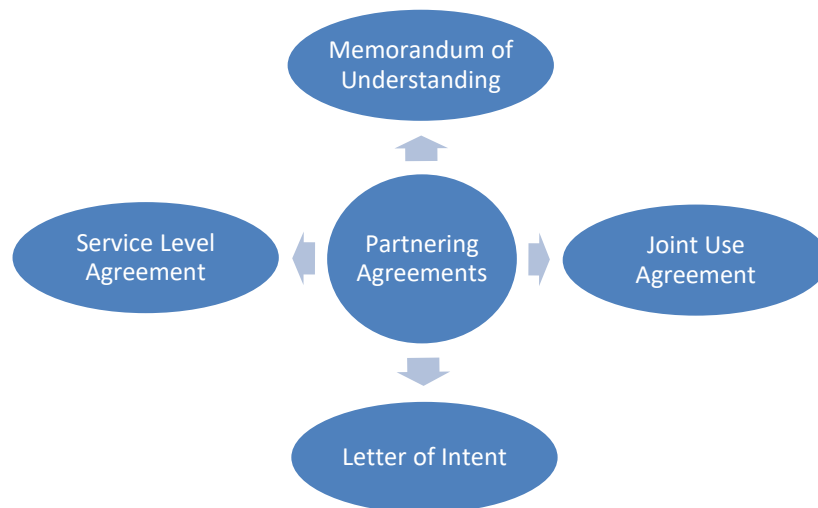
The duration of the agreement should be clear. This provides the stakeholders the opportunity to plan and budget resources for the work.

Keys to a successful agreement are having the right people involved and maintaining a sufficient level of energy and support around it. The backing of senior leadership and the right level of signatories will enhance and highlight the importance of the agreement. In addition to these elements, you should detail the relationship, contributions, and obligations of each stakeholder in the agreement. Well written agreements help settle conflicts and misunderstandings, as well as identify gaps in service(s) provided.

What Are Some Typical Partnering Agreements That Can Be Used?

Within the context of a C2 Program between airports and stakeholders, Figure 12 presents four commonly used types of partnering agreements, which are described in the following sections.

Figure 12. Types of Partnering Agreements



Memorandum of Understanding

A Memorandum of Understanding (MOU), sometimes called Interagency Agreement, is a formal agreement between two or more parties. An Airport Operator can use MOUs to establish official partnerships with its stakeholders. MOUs are not legally binding, but they carry a degree of seriousness and mutual respect (WhatIs.com, 2016). An MOU can be procedural, resource-specific, or project-specific. Many government agencies use MOUs to define a relationship between various departments and agencies. Some city-owned airports, such as PHX, have MOUs with other city departments and external entities, such as mutual aid providers. The use of MOUs is recommended, especially for emergency situations and IROPS. It builds teamwork and fosters collaboration.



Letter of Intent

A Letter of Intent (LOI) is a formal document outlining one or more agreements between two or more parties before the agreements are finalized. For example, in 2003, Congress authorized the TSA to reimburse airports up to 75% of the cost to install explosive detection systems by exercising an LOI (GAO, 2007). The FAA also uses an LOI for certain airport development projects when available funding will not meet the airport sponsor's timing for a particular project. Their LOI is a formal document issued by the Airports District Office that states an intention to provide future funding (using appropriate entitlements or apportionments, discretionary funds, or funds from the small airport fund). The LOI is limited to airport development projects at primary and reliever airports. It is further limited to projects that enhance or preserve capacity.

At SFO, for example, the Airport Operator has a strong emphasis on written agreements, including, among other agreements, an LOI with the Air Traffic Control Tower (ATCT) as well as MOUs with various regulators.



Joint Use Agreement

A Joint Use Agreement is a formal agreement between two separate government entities that sets forth the terms and conditions for shared use of public property or facilities (ChangeLabSolutions, 2016). Some airports have joint use agreements with military organizations, such as the National Guard. According to ChangeLabSolutions.com (2013):

“In the context of joint use agreements, an MOU is often used to define the expectations and responsibilities of each of the parties. These MOUs typically address issues such as: (1) who bears responsibility for the costs of maintenance and repairs, (2) insurance and liability, (3) staffing and communications, and (4) conflict resolution. Whether the terms of these agreements are legally enforceable as a contract ultimately turns on the intent of the parties. Therefore, parties to a joint use agreement should address the legal status of their agreement early in the negotiation process.”

Service Level Agreement

An SLA, according to Wikipedia (2016a), is an agreement between two or more parties where one is the customer and the other(s) are service providers. This can be a legally binding formal contract or an informal arrangement (e.g., internal department relationships). The agreement may involve separate organizations or different teams within one organization, and usually covers the level of service expected between the end-user and service provider. Sometimes, airports owned by a municipality have SLAs with other departments in the same municipality, where services are provided by one department for another. For example, at PHX, the city's Enterprise IT Department has an SLA with the Aviation Department (airport) where the city provides certain IT services to the airport under a Shared IT Services Program.



Sensitive/Proprietary Information and Intellectual Property

The distribution and dissemination of sensitive or proprietary information and the protection of intellectual property is a critical component in any type of stakeholder agreement. There are access issues, information usage issues, regulatory requirements, intellectual property considerations, commercial proprietary concerns, personally identifiable information (PII), and indemnification ramifications to be considered. The best course of action to ensure compliance with the sharing of

anything that could be construed as sensitive information is to engage the Airport Operator’s legal staff or advisor for a determination on how best to handle the issue.

Access to Sensitive or Proprietary Information (SSI)

Sensitive Security Information (SSI) is information described in the 49 CFR §1520.5 (Code of Federal Regulation, 2016), as follows:

“...obtained or developed in the conduct of security activities, including research and development, the disclosure of which TSA has determined would (1) constitute an unwarranted invasion of privacy (including, but not limited to, information contained in any personnel, medical, or similar file); (2) reveal trade secrets or privileged or confidential information obtained from any person; or (3) be detrimental to the security of transportation.”

This information includes, among other things, security programs and contingency plans, security directives and advisory circulars, performance specifications, vulnerability assessments, security inspections and investigative information, threat information, security measures, and training information.

Release of this information could potentially lead to a breach of the aviation security system and have significant consequences. Because of this, in the agreement you should be clear about who has access to sensitive information and how SSI is to be handled between the parties.

SENSITIVE INFORMATION IN AGREEMENTS

- ✓ Who has access to sensitive information
- ✓ How SSI is to be handled between the parties

Information Usage – Who Can Have It and Who Cannot

MOUs and Interagency Agreements probably will involve the exchange of data and information. Some of this may be sensitive, restricted, law enforcement sensitive, or require limited distribution. If so, you might want to consider identifying the following in the agreements:

- The type of information to be used and collected
- The purpose of the information
- How it will be disseminated and to whom
- Who will maintain it and for how long
- Any restrictions on its use

Law enforcement sensitive data requires special conditions and disclosures. Therefore, make sure the agreement addresses privacy issues of handling data within each organization/agency, and at each level of usage.

Regulatory Requirements

Another consideration in developing partnering agreements is the regulatory requirements imposed upon the work or project at the airport. These requirements may come from federal (TSA, FAA, CBP, and Agriculture, among others), state, and/or local entities with various standards, statutes, and regulations that necessitate compliance. Increasingly, the public is calling for transparency in governmental and company transactions. You should carefully review regulatory requirements to ensure there are no imposed limitations for effective and transparent C2.

Data retention is a part of regulatory compliance that is proving to be an ever-increasing challenge. Data retention laws and regulations ask data owners and other service providers to retain extensive records of user activity beyond the time necessary for normal business operations. These requirements have been called into question by privacy rights advocates.

Intellectual Property

Intellectual property is any product of the human intellect that the law protects from unauthorized use by others (Legalnet.com, 2016). Intellectual property traditionally comprises four categories: patent, copyright, trademark, and trade secrets. Applied to the topic of this Guidebook, intellectual property more specifically encompasses intangible products/assets of creative effort, such as technical information, software, data and databases, designs, models, methods, and literary works, among others.

As information is shared with internal and external stakeholders, it becomes especially vital for an Airport Operator to protect its intellectual property, which can include strategic, business, or IT plans; operational and security/safety-related data housed in databases or used in business analytics solutions; proprietary software and systems developed by internal IT departments; and Computer Aided Design drawings of the airport property and locations of viable assets, such as utility lines, and others. You should address intellectual property concerns in the stakeholder agreements to avoid potential misuses or loss of proprietary property.

Indemnification

As mentioned above, an MOU is not a legal document, although they have been upheld successfully in a few court cases. As a precautionary measure, some Airport Operators include an indemnification clause or provision to identify who assumes liability for certain actions, to include actions of employees or representatives. If there is a history of an adversarial relationship with a given organization, consider including an indemnification clause with the agreement. No statement regarding liability is necessary in an MOU; however, you should consult an attorney if there are questions or concerns.

Another critical element of an MOU is a description of who will bear the risk in case of a mishap. What if something goes wrong? What if the partnership's activities result in injury, death, or financial loss? An important tenet of risk management is that an organization should never assume responsibility for something that it does not control. For example, an Airport Operator allows a local charitable organization to hold an event on airport property. The public is invited to attend and there is an accident and someone gets hurt. A formal MOU may include an indemnification provision, promising that Organization A will pay for losses suffered by or caused by Organization B. Ideally, indemnification provisions should be mutual in that each party will be responsible for its own negligent acts or omissions. It is important to remember, however, that an organization's agreement to indemnify another organization without the financial resources (including insurance) to meet this responsibility is a hollow promise. It is recommended that you make certain the partner is not only willing but also able to pay for losses it causes.

Getting Started



If you want to create new agreements or improve existing ones, you could consider the following. (You can find a printable checklist in Appendix D.)

1. Hold a series of face-to-face meetings with the appropriate stakeholders in the room to develop an agreement that includes the following:
 - a. Stakeholders involved in the agreement are identified by name, office, and title.
 - b. Roles and responsibilities of each stakeholder are clearly defined and expressed.
 - c. Contributions and obligations of each stakeholder are plainly identified.
 - d. Objectives and goals are defined and included in the document.
 - e. Timelines and assignment of tasks are built in to the agreement.
 - f. When financing is applicable, the parties responsible for providing funding are stated. Payment schedules and milestones are included, as well as consequences if payment and milestones are not met.
 - g. Chain of command and the decision making process is outlined.
 - h. Your agreement(s) have senior leadership support and backing.
 - i. Address how PII will be handled, who has access to sensitive information, and the ramifications to the stakeholder that does not adhere to these standards.
 - j. Information usage is addressed. Specifically, the type of information to be used and collected; purpose of the information; how it will be disseminated and to whom; which party will maintain it and for how long; and restrictions on information use.
 - k. References to regulatory requirements are included in the agreement, as applicable.
 - l. Intellectual property concerns are addressed.
 - m. Indemnification clauses are included to identify who assumes liability for certain actions, including actions of employees or representatives.
 - n. Contact information is included for the stakeholders who are party to the agreement.
 - o. Clearly state the duration of the agreement, including beginning and expiration dates. If extensions of the agreement are applicable, be sure to include the length and number of times the agreement can be extended with all parties' consent.

Chapter 10: Ensure Staff and Stakeholder Training



You will get insights into:

- *Why multi-faceted training of internal and external stakeholders is so important for enhancing C2 for operational activities*
- *The types of training that will enable you to create a strong foundation for a C2-centered environment airport-wide and with external stakeholders*
- *What other airports have accomplished in this area*

An effective training program is an important element of enhancing C2. All C2 Programs should include training for ensuring the Program's success. Through training, new personnel are quickly brought up to speed. Training also provides refresher courses to those needing it, and develops a forum to reinforce the important elements of C2. In addition, improved processes can be introduced through training. If done properly, training also allows for insightful discussions on real-world versus the theoretical way of doing things.

In establishing a training program, you should not overlook the value of properly identifying the most appropriate and beneficial types of training for reaching your intended objectives. In regard to improving C2 in the areas of airport operations (normal day-to-day, IROPS, and emergency events), the objectives are many and are not limited to specific examples, such as how to reduce emergency call response time. The combination of achieving the varying objectives, as addressed in the following sections, will ultimately lead to ensuring a positive and effective response to current activities and events by all responsible parties.

Training Categories

When it comes to training, the old adage "one size fits all" does not apply. At the highest level, training can be segmented into the following three categories: initial training, recurring training, and event-specific training:

IMPORTANCE OF TRAINING

- ✓ Valuable to properly identify the most appropriate and beneficial types of training
- ✓ Will lead to ensuring a positive and effective response to current activities and events

Initial Training

As new staff comes on board, whether internal to the Airport Operator or within a mutual aid organization, it is important that basic training be provided early to familiarize the newcomers with the practices, procedures, and players involved, and to set the expectations for performance. This training may take several forms, but is best conducted in a classroom setting and provided by a highly knowledgeable instructor. Whatever response protocols and procedures the Airport Operator has in place for its personnel, they need to be thoroughly presented and discussed in this forum. It is also vital that the Airport Operator staff ensure that new personnel entering any mutual aid partner be adequately trained on the procedures associated with their partnering relationship with the airport. For example, at MIA, the Airport Operator provides, as part of the new hire process, behavior detection training in addition to customer service training. This is established in an MOU that details that the airport Police Department provides a 45-minute classroom training session to teach new hires how to be able to detect odd behavior in airport customers.



Good relationships in existence between the Airport Operator and the mutual aid agencies will facilitate this training requirement. Further, the Airport Operator should be willing to open its doors to its partner agencies and provide airport-specific training to all new mutual aid employees to create the early mind-set of C2.

This basic training would include things such as types of communication equipment in use and available, terminology and phraseology that may be airport specific, a classroom tour of the airport to include designated response locations and airfield entry points, aircraft operations orientation, winter ice and snow control procedures, and anything else that fits under the heading of basic C2 imperatives. The purpose of this training is to set the stage for expanded learning and skill-set development in the area of C2, and to provide a stepping-stone for follow-on training opportunities, both on-the-job and in formalized settings.

Recurring Training

Recurring training provides expanded emphasis on any specific aspect(s) of C2 as well as introductory training on new systems, procedures, and agreements. Some examples of recurring training might be:

1. The Airport Operator is joining the county-wide 800 MHz radio system, and training on this system would be necessary. All potential users of the 800 MHz system should be expected to attend, perhaps requiring multiple sessions.
2. Training might be needed for corrective action to operational failures that were experienced in a previous event response or in other training or exercises.
3. Recurring training could act as refresher training for NIMS procedures and protocols, and should be implemented to address any changes to processes or procedures as detailed in updates to any partnering/alignment agreements;
4. The Airport Operator may be sponsoring an Airport Community Emergency Response Team (A-CERT) and associated procedures training needs to be accomplished. Although recurring training sessions can be created on an ad hoc basis, it is best to set a regular time and place for this training to ensure maximum participation (Smith, 2014).

Event-Specific Training

This training addresses one topic and covers it thoroughly, normally in a tabletop setting for hands-on participation. Types of topics would include the airport's FAA mandated triennial exercise, airline

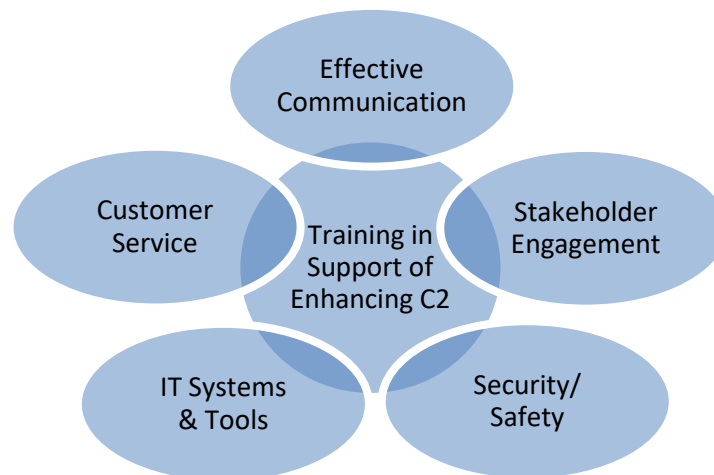
IROPS response, active shooter response, etc. This training will evaluate an Airport Operator's ability to respond effectively, along with its partner agencies, to events of significant proportion that pose the potential for massive operational interruptions or, worst case, mass casualties. At SFO, for example, executive management brought in a specialized third-party vendor to help the Airport Operator with an airport-wide active shooter training in the aftermath of the Los Angeles International Airport (LAX) incident.



C2 Subject Matter Training

There are certain key elements of C2 that should be continually reinforced. Depending on the airport culture or size, these elements may vary somewhat. Figure 13 provides subject matter classifications seen at many of the airports interviewed. Integrating training subjects shown and discussed in the following sections can considerably improve C2 among all training participants, internal as well as external stakeholders.

Figure 13. Training in Support of Enhancing C2



Independent of the type of training, the identification of the appropriate stakeholders is important. Not all stakeholders will be relevant for every training effort. Therefore, you should consider including those stakeholders that influence the outcome and are essential for the success of your C2 training effort. Depending on your management's goals and objectives, you could perform a more comprehensive stakeholder analysis.

Stakeholder analysis entails two elements. First, it identifies those groups or individuals who may be affected by the C2 initiative and/or who share a common business need. Second, it determines the impact for each stakeholder and an appropriate communication plan to ensure the C2 Program is delivered and accepted. Such an approach, however, requires substantial resources, and is therefore not feasible for every Airport Operator. Nevertheless, no training effort should be undertaken without first identifying all relevant stakeholders.

There are professional courses available for some of the types of training covered in this chapter. Alternatively, your Airport Operator might have such training in-house or have resources capable of providing the training. If not, or if the funds for such courses are limited, you could consider a train-the-trainer approach.

Effective Communication

Since stakeholders can have very different communication styles or preferences, this type of training deals with improving general communication skills as well as how to better communicate with others in a collaborative environment. This type of training covers all of the various aspects of communication, including verbal in-person communications, body-language and facial expressions, telephone or radio, and email or text communications.

This training is especially needed when dealing with individuals from the many stakeholder groups identified in this Guidebook. Considering the varying industries, backgrounds, and areas of expertise, communication is usually very specific to each group, including the use of unique terminology. Even within the same stakeholder group, individuals holding different positions within the organizational structure tend to communicate differently. For example, a member of the Airport Operator's executive management team usually communicates differently than an Airport Police patrol officer. This is often due to the requirements of respective job responsibilities. In addition, some individuals can have a difficult time communicating or connecting with others.

For C2 to improve, it is critical that all stakeholders involved are knowledgeable and trained about the communication styles and preferences of others. Based on improved understanding, well-trained stakeholders can also be flexible to adapt to varying types of communications, as required by a situation. This will allow your stakeholders to be more unified, as misunderstandings based on communication styles and preferences will decrease. A unified team is easier to lead effectively and will be more supportive of your C2 effort. Furthermore, reducing the obstacle of varying communication styles through training is the foundation for unifying conflicting needs and objectives. This aspect is discussed in more detail in the Stakeholder Engagement section below.

Often, effective communication training, can be combined with other stakeholder engagement training efforts as discussed below.

Stakeholder Engagement

In implementing a C2 Program and instilling a C2 culture, one of your goals will be to develop a secure collaboration environment encompassing all stakeholders. It ensures that staff will have the necessary skills and strategies to connect and advance their relationships with those stakeholders that can influence your airport's operations. This often leads to improved stakeholder loyalty and trust.

This type of training covers a broad spectrum of areas. As a whole, the intended results are to get stakeholders effectively involved and actively participating. This can indeed be challenging since, for example, there are those stakeholders that are strong-willed or those that are rather opinionated with the tendency to be less agreeable. Dealing with this issue makes stakeholder engagement training very beneficial. In a sense, it is a continuation of the effective communications training discussed above. However, stakeholder engagement goes beyond communication styles and dives into the following areas:

STAKEHOLDER ENGAGEMENT

- ✓ Ensures staff will have the necessary skills and strategies to connect and advance their relationships with stakeholders
- ✓ Will help build stakeholders loyalty and trust
- ✓ Existing staff will greatly benefit from the new training

- How to develop buy-in and collaboration from essential stakeholders within the group
- How to gather stakeholder information more effectively
- How to read others and adjust your responses
- How to evaluate stakeholders and comprehend the varying, sometime opposing interests
- How to overcome objections/concerns, while managing stakeholders' emotional states
- How to eliminate difficulties to proceed
- How to prepare for stakeholder meetings, and manage time and arrange resources efficiently
- How to conduct effective virtual meetings
- How to enhance communication and influencing skills
- How to distinguish the difference between influence, persuasion, and negotiation
- How to use influencing and negotiation strategies to foster creativity and engage

Stakeholder engagement training often extends into monitoring and controlling stakeholder relationships. It can include creating a strategic plan for stakeholder involvement, analyzing the involvement through a stakeholder assessment matrix, and developing an appropriate stakeholder communication plan. These are discussed in Chapter 11 as part of the importance of training in relation to sustaining C2 over the long term.

Security/Safety

In aviation terminology, the term *security* refers to all that is done to protect the public from events caused by individuals meaning to do harm. *Safety*, however, refers to protecting the public from all hazards, whether acts of human error or acts of nature. But from the public perspective, the terms are interchangeable because, if you are not secure in your environment you do not feel safe, and if you are not safe in your environment, you no longer feel secure.

So, for the purposes of training for safety and security, it serves little purpose to dwell on the distinctions between the two. Additionally, since those who will respond to security incidents will be the same as those who will respond to safety incidents, with minor variations, the important thing is to identify all potential response elements (agencies, organizations, etc.) and build a training program that focuses on getting the right people to the right place at the right time with the right information. The exact nature of the response (i.e., to a security incident or a safety incident) will be dictated by the incident itself and, if all elements are appropriately trained, will evolve effectively.

NIMS TRAINING

- ✓ Should be at the top of the list if not yet completed
- ✓ Provides standards for effective C2 that all agencies adhere to in response to all emergency events
- ✓ Helps ensure a smooth and coordinated response to events

In that vein, adherence to NIMS protocols should be considered mandatory for all internal and external responders. If this training has not already been accomplished, it should be at the top of your list, since NIMS provides standards for effective C2 that all agencies adhere to in response to all emergency events. Further, you can apply aspects of NIMS to the more mundane incidents that occur from time to time. Application of NIMS protocols to those events not only helps you to ensure a smooth, coordinated response, scalable as necessary, but also firmly roots the NIMS procedures into the way of doing business on a regular basis, making a transition to emergency response much more fluid.

CUSTOMER SERVICE

Stakeholders trained in

Customer Service:

- ✓ Can diffuse a difficult or dangerous situation
- ✓ Contribute to smooth airport operations
- ✓ Provide helpful guidance
- ✓ Help stressed passengers to relax

At PDX, for example, the Airport Operator focuses on NIMS and uses the ICS process for most responses, regardless of how small. Escalation decisions are made by the initial Incident Command, who very often will be an operations specialist on the airfield. For longer term events, and those that would require the Public Information Officer to respond, the Emergency Operations Center (EOC) would generally be formed and all information flow decisions would be made by emergency management in the EOC at that point.



IT Systems and Tools

Your Airport Operator has existing IT systems used for C2 activities. It is important that all internal stakeholders that need to know how to use a certain system, either as part of their daily work or as designated during an IROPS or emergency event, are well trained on that system. It is also important that key external stakeholders are familiar with the systems at

the airport. This is especially beneficial during IROPS and emergency events, as a lack of such skills could be detrimental to response efforts. The more stakeholders know how to use a system, the better.

There could be situations, such as a disaster or events after hours, when the assigned staff to operate a system is unavailable. It will be helpful to have other staff that can fill in the role and take on the responsibility. In essence, cross-training on various pertinent systems is providing the resource skills and staff coverage needed to be able to respond effectively to all types of incidents. Training on existing systems is best done in-house by a power-user. This staff is an expert on the system's functionalities and can provide very effective training for internal and external stakeholders.

Since new systems and tools are continuously being introduced, recurring training is a valuable means of ensuring that the appropriate internal staff and external stakeholders are well versed on the various uses of these new systems and tools. Training is also important if an existing system has a major update that includes changes to functionalities, for example. Often, the vendor provides such training as part of system implementation. If sufficient funds are not available, as is the case for many smaller Airport Operators, a train-the-trainer option is a good solution.

IT-related training is often done in an IT Training Lab setting using workstations that have the system installed. Other training methods include online video courses and "how-to" webinars. In case of training related to systems used during emergency events, it is very beneficial to let assigned staff use the systems during drills and exercises. This sharpens the necessary skills as the use of the system is practiced under simulated conditions, which are generally subject to pressure and stress.

Customer Service

Just as customers are vital to a company, travelers/passengers are critical to an Airport Operator. Without either there would be no business. Of course, all Airport Operators are aware of this, yet not all have implemented customer service-centric training programs. As there are staff from virtually all airport divisions with daily customer contact, it is a good practice to provide customer service training to all airport staff and stakeholders. For example, many of the customers who come in contact with security personnel are people who have a problem and are searching for a solution.

According to Walker (2006), good security divisions train their officers in security-related specialties, but exceptional security services provide their officers with instruction that allows them to effectively

communicate with customers and provide appropriate services. Effectively communicating with the passenger contributes to smoother operations, especially during IROPS and emergency events. In those situations, any stakeholder personnel can help defuse difficult or even dangerous situations if properly trained in customer service C2. Providing information about the situation, other helpful guidance such as giving directions or simply helping a stressed passenger to relax are important elements to assist an Airport Operator in returning more quickly to normal operations.

At Orlando International Airport (MCO), the Airport Operator undertook a rather large effort to improve its customer service. They engaged an outside consultant and included all airport concessionaires to establish a customer service improvement plan and to train all airport employees on customer service. In addition, the Airport Operator is holding community meetings. The Airport Operator also has a standing Customer Service Steering Committee to specifically address customer-related issues and to brainstorm innovative ideas for improving customer service. Airport staff also engaged in outreach efforts by using software to monitor social media, such as Twitter and Facebook, to assess what people were saying about their experiences at the airport. This collaborative initiative led to increased levels of customer satisfaction as evidenced by customer satisfaction surveys.



Getting Started

If your Airport is struggling to get training related to C2 off-the-ground or improved, you could consider the following. (You can find a printable checklist in Appendix D.)

1. Start with an internal face-to-face C2 training kick-off meeting. Include, among others, HR staff in charge of training, IT representatives knowledgeable about C2 related systems, customer service management staff, operations/security/safety management, and the members of the Advisory Committee to:
 - a. Assess at a high level the current training status
 - b. Identify training gaps
 - c. Identify stakeholders that require training
 - d. Discuss training approaches
 - e. Designate a C2 Training Champion to lead the effort and report back to executive management
2. Hold a series of face-to-face meetings using Work Teams for divisions or functional areas (should include external stakeholders, as deemed appropriate) with all necessary stakeholders to fill in the gaps identified in Step 1.
 - a. Evaluate in detail the current training needs, including who (internal and external stakeholders) needs to be trained on which systems/tools, for example.
 - b. Establish levels of competencies that currently exist in all other training areas discussed in this chapter.
 - c. Identify any staff member(s) who can function as trainer(s) for a possible train-the-trainer approach.
3. Based on the detailed analysis in Step 2, develop a stakeholder C2 training matrix.

The C2 Training Champion reports back to the Advisory Committee to present stakeholder C2 training matrix, discuss identified training priorities, and develop an action plan.

Chapter 11: Review and Refine for Sustainability and Continuous Improvement



You will get insights into:

- *Why sustaining stakeholder involvement is so important*
- *Some strategies on how to keep stakeholder involvement high*
- *The significance of a formal approach to sustaining and continuously improving a C2 Program and initiatives*
- *Specific steps on how to monitor, report, and assess next steps to make sure C2 will continue to enhance over the long term*

The Importance of Sustainability

Sustained, visible support from executive management can help the early success of a C2 Program, as inevitable challenges occur. Although there will be immediate successes, the sustained success in enhancing C2 is a long-term effort. In the context of this Guidebook, *Sustainability* refers to the continuation of a program's or initiative's goals, principles, and efforts to achieve desired outcomes; it is to make sure that the goals of the program or initiative continue to be met in the future through various activities.

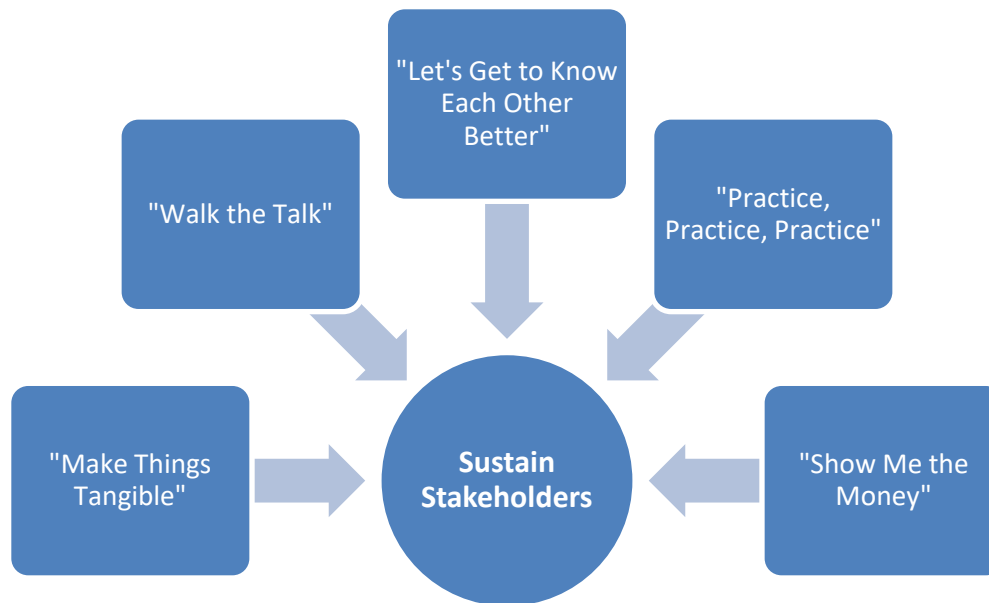
A well-conceived and thoroughly justified C2 Program can, however, quickly lose support as a result of a single poorly implemented initiative. It is, therefore, critical to make sure actions are taken that sustain stakeholders' support of and involvement in the C2 Program. This includes continued training to improve skill sets that lead to enhanced C2.

The following sections discuss the importance of sustaining a C2 Program, and provide recommendations for sustaining stakeholders. This aspect, which includes ongoing training, is a major contribution to the continuing success of a C2 Program, and cannot be underestimated. In addition, a formalized approach with specific action steps is provided on how to monitor and report on your C2 Program and related initiatives to ensure continuous improvements in C2 activities. This approach offers insights into how to assess next steps for your C2 Program as a whole, to help you make your C2 efforts sustainable for the long term.

Sustaining Stakeholders

The success of a C2 Program at an airport is, of course, subject to the extent of meaningful participation of its various stakeholders in the C2 processes. Without their willingness to contribute, a C2 Program will be fruitless. Chapter 5 discussed the importance of establishing and building relationships with stakeholders early in the process through the use of face-to-face meetings. Once a program is established, Airport Operators should consider how to maintain stakeholder involvement beyond the planning and implementation phases of a single C2 initiative. Such sustainability efforts should be planned early in the process, since it will be important to include sustainability into the overall Program on a continuing basis. Figure 14 shows some recommended concepts that will help you to keep stakeholders motivated and engaged in C2 initiatives and the overall Program, with the ultimate goal of enhancing C2 among all parties involved.

Figure 14. 5 Ways to Sustain Stakeholder Involvement



“Make Things Tangible”

It is generally acknowledged that if people are involved in the decision-making and problem-solving process, they are more invested and will take pride and ownership in the results. Making people an integral part of the process makes the issue somewhat personal and tangible.

At SFO, the Aviation Department has a culture of making things tangible for their employees and stakeholders. For example, to solve a recent ground transportation problem, they invited a broad spectrum of stakeholders to form a working group, laying out the specifics of the problem and defining the challenges. In working toward a solution, the words “can’t” and “no” were unacceptable. In other words, failure was not an option. This setup led to a strong involvement from all participants. It made their efforts count, as a solution was basically guaranteed.



At SMF, the Aviation Department encourages all stakeholders to offer their opinions and suggestions before the airport makes a decision that will affect those stakeholders. This process, in and of itself, has engendered a more trusting environment and has encouraged even greater participation by stakeholders. As a result, better decisions are made and the early participation has created a buy-in that facilitates employment of the decision.



“Walk the Talk”

There is a well-known saying, “actions speak louder than words.” This relates to the fact that if an airport wants to sustain C2 with and among its stakeholders, the execution of C2 activities and processes as part of daily operations is even more important than having a good plan and an inspiring vision.

At MSP, for example, the leadership is aware that a key method in gaining and maintaining positive stakeholder relationships lies in the need for all staff to interact with all stakeholders in accordance with the vision and program objectives. This will achieve stakeholder trust and gain respect, leading to stronger and longer-lasting relationships and partnerships. MSP leadership is also working on having all staff fully trained, knowledgeable, and consistent and reliable in their performance. If staff members promise, for example, that they are going to do something, they need to be able to do it within the timeframe promised. If this level of performance does not exist, relationships will not be strong and sustaining a C2 Program will be difficult to accomplish.



“Let’s Get to Know Each Other Better”

Chapter 5 discussed in detail the tremendous value of face-to-face meetings in establishing relationships. In regard to working towards making the C2 Program a sustainable success, the strategic objectives of face-to-face meetings introduced there are pertinent. Face-to-face meetings can help bond teams together, help people feel inspired, engage people in the process, result in breakthrough thinking, dispel myths and rumors, and build stronger business relationships. Strong working relationships and networks are characterized by high levels of trust, reciprocity, and a sense of community that can only come from spending time together in the same place. Through this process, you can transform formal work connections into informal relationships, which, in turn, can enhance effective C2 and foster sustainability.

Casual or informal face-to-face opportunities, such as luncheons or an after work get-together, help people form lasting ties with one another. Friendly relationships are important to good working relationships, and can often be more easily developed outside of the normal work environment. Familiarity can build trust and respect, both of which are critical to strong, productive partnerships.

For example, as GPT went through major terminal renovations, airport management held a banquet, invited airlines and concessionaires, and gave out t-shirts and other gifts. Airport management considered this effort a success as participants shared stories and built comradery.



“Practice, Practice, Practice”

To build on the training discussions in the previous chapter, training provides for the sustainability of processes, procedures, and plans into the future as individual actors change and the stakeholder mix transitions. At MCO, for example, the Airport Authority provided computer training to all stakeholders affected by the implementation of a new badging process for access control.



To have an effect on sustainability, training needs to go beyond the skills required for a specific job function. The most effective training to ensure continuous improvement and sustainability of a C2 Program is characterized by stakeholders developing skills that are often not directly related to their daily job requirements. This kind of cross-training can provide a C2 synergy between stakeholders. This is especially advantageous in the areas of security and safety operations. For example, the report of the LAX active shooter incident “... called for training airport police in tactical medicine so they can help

the injured before paramedics arrive, and for training paramedics to enter more dangerous zones earlier with law enforcement protection” (FoxNews, 2014).

Other training beneficial to support a C2 Program sustainability effort makes sure that the learning and good work of the past is not lost to future participants; it is critical to the continued success of operational activities. To that extent, training in the form of post-event debriefs, for example, is crucial to enhancing C2 among stakeholders involved in an event. Another important aspect of effective training is using appropriate and relevant documentation. There are many examples of beneficial C2-related training programs; the following highlight efforts at PDX:

- To ensure problems are discovered, documented, and corrected, airport operations staff and external stakeholders do hot washes after medium-sized events. For larger events, they create an After Action Report (AAR) and an Improvement Plan to ensure status gets updated along determined timelines.
- The airport is compliant with FEMA’s Homeland Security Exercise and Evaluation Program, which requires an agenda, workshops, and AARs in a formalized training/evaluation process.
- The airport employs Plan Based Exercises for training. They will pick a specific plan, such as the Communicable Disease Response Plan or the Power Outage Plan, and engage in an exercise or a Functional Workshop around that plan to ensure everyone is up to speed on their responsibilities.



“Show Me the Money”

For any program or initiative to be considered successful, some benefit or result needs to be achieved. Without any positive outcomes, it becomes very difficult to continue to engage stakeholders in the C2 processes, which makes sustaining a C2 Program a major challenge. Stakeholders get motivated, however, by seeing results. In that case, they are more likely to continue to contribute, as they have seen the fruits of their labor.

At DEN, the efforts of the C2 Champion have led to achieving some measurable results as part of the Aviation Department’s effort to address issues with its deicing-operations. The implementation of some of the guidance suggested in this Guidebook enabled the formed working group (with its many diverse stakeholders) to come up with solutions that ultimately reduced idle time of aircraft waiting to be deiced, thereby achieving substantial cost savings annually. Due to that success, the stakeholders bought into the structured C2 process applied to this situation. So, when the C2 Champion reached out again to the same stakeholders to address some remaining deicing problems, the stakeholders were very willing to participate again. The C2 Champion had also gained executive support to invest additional time and staff resources into the next phase.



Positive results are necessary as the Airport Operator is working toward sustaining stakeholders’ involvement and continuously improving of C2 efforts.

A Formalized Approach to Sustaining the C2 Program and Initiatives

After the significant investment of resource time in strategy development, program planning, and the deployment of actual C2 initiatives, additional commitment is needed to continuously monitor and report on the progress of each initiative. Monitoring and reporting the C2 contributions to defined KPIs is necessary to ensure that either adjustments can be made that further the progress toward achieving the stated objectives, or that initiatives can be halted before further resources are wasted. This is a critical component of the quality management process. Issues such as these are why it is so important that a strong shared C2 vision is adopted and supported from the highest level of Airport Management.

As initiatives are closed out and transitioned to steady-state operations, the focus cycles back to the planning steps where data is analyzed, objectives are tweaked, KPIs are adjusted, and corrective actions are taken. Each component of the C2 Program will continue to be modified as fundamental impacts shift, new factors for consideration emerge, perspectives evolve, key contributors change, and the stakeholder mix transitions.

C2 PROGRAM MODIFICATION

- ✓ When fundamental impacts shift, new factors emerge, perspectives evolve, key contributors change, or the stakeholders mix transitions
- ✓ As the C2 initiatives are phased out into steady-state operations, data should be reevaluated and the proper actions taken

Monitor and Report

Monitoring and reporting should be considered with regard to the benefit of the C2 Program and not just the individual initiatives. With that in mind, as these initiatives close out, the C2 Joint Executive Steering Board (*Board*) must engage to evaluate the initiative's performance against the C2 Program objectives, as well as the individual initiative's objectives. While it is the responsibility of each FWG to identify and measure KPIs, the Board will also oversee the establishment of ongoing monitoring measures to support the KPI reviews and C2 contributions.

Performance Measurement

Performance measurement involves collecting, validating, and evaluating performance data related to the C2 contributions. You should monitor each process to ensure that it is performing in accordance with agreed-upon KPI targets, and provide systematic and timely reporting to enable accountability. For additional discussion on KPIs, refer to Chapter 8 of this Guidebook.

Collect and Process Performance and Conformance Data – Collect and process timely and accurate data according to the C2 Program performance measurement methodology, which covers:

1. Collecting data from defined processes (automate data collection where possible).
2. Assessing efficiency (effort in relation to insight provided) and appropriateness (usefulness and meaning), as well as validate integrity (accuracy and completeness) of collected data.
3. Aggregating data to support measurement of KPIs.
4. Aligning aggregated data to the C2 Program reporting approach and objectives.
5. Using suitable tools and systems for the processing and format of data for analysis.

Analyze and Report Performance – Periodically review and report performance against targets, using a method that provides a succinct all-around view of C2 Program performance and fits within the C2 Program monitoring system. To analyze and report performance:

1. Design process performance reports that are concise, easy to understand, and tailored to various management needs and audiences.
2. Facilitate effective, timely decision making, and ensure that the cause and effect between goals and KPIs are communicated in an understandable manner.
3. Compare the performance values to KPI targets and benchmarks and, where possible, to external benchmarks (industry and key competitors).
4. Recommend changes to the KPI targets, where appropriate.
5. Distribute reports to the relevant stakeholders.
6. Analyze the cause(s) of deviations from targets, initiate remedial actions, assign responsibilities for remediation, and follow up. At an appropriate time, review all deviations and search for root causes, where necessary. Document the issues for further guidance if the problem recurs.
Document results.

Ensure the Implementation of Corrective Actions – Assist stakeholders in identifying, initiating, and tracking corrective actions to address anomalies by:

1. Reviewing Board responses, options, and recommendations to address issues and major deviations.
2. Ensuring that the assignment of responsibility for corrective action is maintained.
3. Tracking the results of actions committed.
4. Reporting the results to the stakeholders.

Internal Control Measurement

Internal control measurement involves continuously monitoring and evaluating the C2 Program control environment, including self-assessments and independent assurance reviews. Internal control measurement enables the Board to identify control deficiencies and inefficiencies, and to initiate improvement actions. It is necessary to plan, organize, and maintain standards for internal control assessment and assurance activities such as the following:

- **Monitor Internal Controls** – Continuously monitor, benchmark, and improve the C2 Program control environment and control framework to meet organizational objectives.
- **Review the Effectiveness of C2 Program Process Controls** – Review the operation of controls, including a review of monitoring and test evidence, to ensure that controls within C2 Program processes operate effectively. Include activities to maintain evidence of the effective operation of controls through mechanisms such as periodic testing of controls, continuous controls monitoring, independent assessments, command and control centers, and network operations centers. Such activities provide the Board with the assurance of control effectiveness in meeting requirements related to C2 Program and regulatory responsibilities.
- **Perform Control Self-Assessments** – Encourage the Board and process owners to take positive ownership of control improvement through a continuing program of self-assessment to evaluate the completeness and effectiveness of the Board's control over processes, policies, and agreements.
- **Identify and Report Control Deficiencies** – Identify control deficiencies and analyze and determine their root causes. Escalate control deficiencies and report to stakeholders.
- **Ensure that Assurance Providers are Independent and Qualified** – Ensure that the entities performing assurance are independent from the functions, groups, or organizations responsible for the work. The entities performing assurance should demonstrate an appropriate attitude and appearance, competence in the skills and knowledge necessary to perform assurance, and adherence to codes of ethics and professional standards.

- **Plan Assurance Initiatives** – Plan assurance initiatives based on C2 Program objectives and strategic priorities, inherent risk, resource constraints, and sufficient knowledge of the airport.
- **Scope Assurance Initiatives** – Define and come to agreement with the Board on the scope of the assurance initiative, based on the assurance objectives.
- **Execute Assurance Initiatives** – Execute the planned assurance initiative. Report on identified findings. Provide positive assurance opinions, where appropriate, and recommendations for improvement relating to identified operational performance, external compliance, and internal control system residual risk.

Monitor, Evaluate, and Assess Compliance with External Requirements

The Board needs to ensure that C2 Program processes and IT-supported C2 processes are compliant with laws, regulations, agreements, and contractual requirements. Obtain assurance that the requirements have been identified and addressed, and integrate C2 Program compliance with overall airport compliance through the following:

- **Identifying External Compliance Requirements** – On a continuous basis, identify and monitor for changes in local, state, federal, and international laws; regulations; and other external requirements that must be met from a C2 Program perspective.
- **Optimizing Response to External Requirements** – Review and adjust policies, principles, standards, procedures, and methodologies to ensure that legal, regulatory, and contractual requirements are addressed and communicated. Consider industry standards, codes of good practice, and best practice guidance for adoption and adaptation.
- **Confirming External Compliance** – Confirm compliance of policies, principles, standards, procedures, and methodologies with legal, regulatory, and contractual requirements.
- **Obtaining Assurance of External Compliance** – Obtain and report assurance of compliance and adherence with policies, principles, standards, procedures, and methodologies. Confirm that corrective actions are taken to address compliance gaps in a timely manner.

Assess Next Steps

At this point, the process is in place to facilitate the evaluation of individual C2 initiatives for achievement against the C2 Program objectives. However, it is necessary to go beyond assessing KPIs on a regular basis to ensure that the C2 Program is moving along according to the original plan. The ever-changing nature of the C2 Program environment necessitates an ongoing effort to assess the direction of the C2 Program itself.

NEXT STEPS OF C2 PROGRAM

The ever changing nature of the C2 Program environment necessitates an ongoing effort to assess the direction of the program

Continually Reassess the Direction of the C2 Program

As each initiative is completed, the overall environment changes. For example, as queue times lessen and passenger flows shift on the landside, new bottlenecks at security and capacity issues in

holdrooms could emerge. Some of the changes may have been adequately anticipated and mitigated, and others may not. In addition, as time passes, new technologies enable new ways to collaborate and communicate, and the industry associations continue to make process advancements. This continual change makes the C2 vision a progressive movement, not an end result. The continually changing nature of a C2 Program means that the direction of the C2 Program must be continually reassessed.

Establish a Schedule of Consistent C2 Program Reevaluation

The Board must establish a schedule for consistent reevaluation of the C2 Program itself. On a regular basis, at least annually, the Board reassesses the results of completed initiatives and changes in the overall environment that may impact the C2 Program objectives. After that, the Board should move through the remainder of the Roadmap in preparation for the implementation of the next initiative. This includes the following:

- Reevaluation of the list of planned initiatives and redefining the initiatives as required
- Assessment of KPIs and their targets for the value they provide in measuring the current C2 Program objectives
- Evaluation of the performance measurement system for opportunities to improve
- Review of industry benchmarks
- Evaluation of key factors for consideration
- Addressing fundamental impacts

On a less frequent schedule—such as every 3 to 5 years or as significant changes in Airport Operator strategy or executive leadership occur—the Board should continue with reassessing the C2 vision. The Board should validate the Airport Operator’s perspective, confirm or attain management support, and redefine the C2 Program stakeholder involvement and program objectives. There may not be significant changes; however, if changes are needed, moving forward without addressing needed adjustments could result in wasted resources or failed initiatives, and ultimately loss of support for the C2 Program. The risk of this kind of failure is not worth the time and effort saved by foregoing this process under the assumption that all is well. If executed thoroughly, consistently, and with transparency, this assessment will build the trust and support of the executive management team and the stakeholders, as well as ensure that the C2 Program is constantly working in the best interests of the airport and all of its stakeholders.



Getting Started

If your airport is struggling in setting up a process to monitor, report, and assess next steps, refer to the “A Formalized Approach to Sustaining the C2 Program and Initiatives” section above, and to Appendix D, for a printable checklist.

PART III: HOW CAN TECHNOLOGY HELP YOU?

Introduction

The purpose of Part III of the Guidebook is to assist airport IT managers and personnel in understanding how to manage IT resources effectively in order to capture the full benefits of technology innovation, and to increase the role of IT in enhancing stakeholder communications and collaboration. Although Part III of this Guidebook is targeted primarily to the airport IT audience, it is strategically important for the Airport Operator to have an awareness of the concepts and guidelines presented herein relative to IT. In the digital age, IT can significantly facilitate the business of running an airport. As innovation in the IT industry continues to yield dividends to all businesses, Airport Operators will rely increasingly on IT solutions to improve the productivity and efficiency of their airport's business operations through effective C2 among stakeholders.

IT becomes significantly more important as the size and complexity of an airport's operations increases. In the case of large hub airports, the range of IT solutions is similar to and can exceed the breadth of technology needed to run an entire city. Moreover, the size and complexity of the IT landscape for a large airport can become a challenge when attempting to communicate and share information across its stakeholder community with both speed and accuracy. This is especially true if the data and underlying technology are not managed effectively to enable interoperability across multiple technology platforms.

For smaller airports, the type of technology necessary to optimize C2 may take on a different form. While smaller airports may benefit from a more tightly knit airport community with shorter communication streams and greater face-to-face familiarity, they may also suffer from budgetary and staffing constraints, limiting access to costly technology solutions and dedicated IT staff. Many Airport Operators of smaller and GA airports rely mostly on desktop productivity tools, such as email, for their stakeholder C2. In fact, when asked during an interview whether there was a need to integrate disparate technology to improve the sharing of digital data among stakeholders, the Airport Operator of one small airport responded that it was not a problem for them because "there wasn't much information technology to worry about."

With such broad differences in the IT landscape as you move from very small to very large airports, it becomes increasingly clear that the Airport Operators of larger airports need to manage their technology assets differently from smaller airports. Larger airports have many more technology components, with data stored in multiple computer platforms distributed across the larger airport enterprise. Improved management of IT resources is strategically important in order to optimize stakeholder C2. As a result, this section of the Guidebook is geared more toward larger airports where the opportunities to take advantage of IT solutions are greater, and the systems integration and interoperability challenges can become much more critical to establishing a collaborative environment among stakeholders. As appropriate, those opportunities will be highlighted where Airport Operators of smaller airports can either leverage technology to enhance stakeholder C2 or adopt best management practices that will help them avoid some of the technology integration pitfalls as the size of their operations grows.

The following section is not intended to suggest that social media is a source of technology to be used primarily by smaller airports. In fact, research suggests that larger airports are currently using social media much more extensively than small airports in North America and Europe. Nonetheless, social media is where smaller airports can best leverage IT to enhance stakeholder C2, given the limitations in the size of their IT budgets and staffing levels. Larger airports, especially those who have yet to utilize social media, can also take advantage of the concepts discussed in this section.

Use of Social Media by Small Airports

Although smaller airports may not have the budgets and resources for sophisticated and costly IT solutions, and rely heavily on desktop productivity tools, they are using their websites (internet and intranet), and many are looking into establishing presences on social media, such as Facebook or Twitter, for public notices. It is in this arena that smaller airports might find effective technology solutions and the highest potential for C2 enhancement. Social media can be defined as a means of personal and public communication through the use of networking software and websites. By design, it is created to bring individuals closer to one another. In organizations, it is used to build a community for employees and business partners to work together collaboratively for decision-making processes.

Social media sites can provide an airport with inexpensive and easily scalable connectivity with its many audiences, including its stakeholders, both internal and external. An Airport Operator can simply select an appropriate social media option (i.e., one without restrictions on the length of communication) and encourage stakeholders to sign up for an account. Stakeholder groups can then be created for the purpose of communicating and interacting on various airport operational issues or situations. In a similar fashion, an Airport Operator can use its website or a separate social media option to transmit information to the public regarding situations or events developing at the airport. This could include everything from the airport status during a storm event to a security threat unfolding at the airport. In this way, airports can stay ahead of the communication and miscommunication frenzy that always occurs in the absence of official factual information.

Fort Lauderdale-Hollywood International Airport (FLL), for example, uses Geofeedia, a location-based social media monitoring platform that extends the value of social media by enabling organizations to predict, analyze, and act based on real-time conversations, reports, and check-ins. FLL's designated social media personnel specifically use this solution for creating a virtual boundary around a location to centrally monitor all social media within it. This solution is also integrated with Everbridge, making it a valuable tool for enhancing situational awareness and incident response by sharing the information with any stakeholder connected to the system.



The potential operational benefits that stand to be gained by connecting stakeholders via a social intranet or internet, optimized with communication, collaboration, and sharing tools, are extensive. For example, an Airport Operator can establish a Twitter Information Display Screen, in view at the airport, that allows travelers and flight operators or pilots and others to tweet any issues that need attention. The airport's responses to the issues can also be displayed.

Small airports can also use social media for research and development (e.g., surveying stakeholder satisfaction and/or opinions regarding opportunities for improving airport operations). This means that a small airport's social media community can be an asset when discussing different ways to make airport operations more effective.

Since small airports do not always have the IT budgets or staff to purchase or support on-premises solutions for using social media, a cheaper entry solution can be obtained using Software as a Service (SaaS) options that run on a vendor's secure servers in the cloud (a type of computing where services such as servers, applications, and data storage are delivered to an organization's desktop computers via the internet). SaaS solutions for social media enable the following benefits:

- Immediate ramp-up without requiring a large capital investment
- Solutions regularly upgraded with new functionality, and that are supported and maintained by the on-demand application vendor
- For many small airports, SaaS may be the only viable way to leverage rich social collaboration functionality on their websites (intranet/internet)

The different categories of social media are described in Table 3.

Table 3. Social Media Categories

Categories	Description	Examples
Social Networking	<u>Social Networking</u> Online service, platform or site that allows users to develop social networks with other users that share common interests or activities.	Facebook, Hyves, Google+
	<u>Location-based Networking</u> Information or entertainment service that is accessed via mobile devices and allows users, for example, to check in at venue.	Yelp, Foursquare, Gowalla, SCVNGR, Qype Eglad
Blog	<u>Blog</u> Part of a website that is updated with regular entries that provide commentary, descriptions of events or content such as photos or video.	Airports own blog or discussion forum
	<u>Microblog</u> Online service, platform or site that allows users to exchange small elements of content such as short sentences or links.	Twitter, Tumblr, Blip
Professional Business Networking	Same principle as social networking, but for business-related networking.	LinkedIn, XING
Content Community	Online service, platform, or site that allows users to share multimedia such as photos, music, videos or presentations.	YouTube, Flickr, Instagram, Scribd, ISSUU, Podcast, Internet TV

Transforming typical static, and oftentimes underused, websites to a social internet/intranet requires the airport and all stakeholders to develop a blueprint that draws on top-down strategic objectives, key performance indicators, business processes, and the social platforms and tools that align with departmental functions, and the organization's operational imperatives. The goals of such an initiative should include:

- Improved collaboration and knowledge-sharing
- Increased employee engagement
- Improved vertical and horizontal communication
- Increased stakeholder collaboration
- Increased commitment to knowledge management activities
- An increasingly comprehensive knowledge ecosystem

Best practices for Airport Operators include:

- Identify the right social media platforms for their stakeholder base as well as their specific departmental functions, and determine which types of social media are best suited for specific C2 objectives.
- Map processes that enable stakeholder visitors to the site to identify the right personnel or stakeholder group for assistance.
- Provide tools that enable the airport to field, parse, and route social messaging that requests information and collaboration on operational issues, situations or events.
- Manage institutional risk through procedures and policies that address, among other guidelines, the appropriate use of social media channels.
- Determine whether to require that front-facing staff interact with external stakeholders in a strictly defined organizational voice or give them some autonomy in their social media interactions.

With well-enforced usage policies, personnel authorizations, and response parameters (covering who, what, and why of internal and external social messaging), organizations will see significant ROI from enabling their employees to interact with each other and with their stakeholder base through social channels.

Manage Data as an Enterprise Resource

Any attempt to improve airport services through more effective C2 will eventually require the sharing of information between different groups that are involved in either executing routine operational processes or responding to irregular operations or emergency events. Effective information sharing necessitates the management of data as a critical enterprise resource of an airport. A strategic management role for any business is deciding how best to use its assets and resources to either produce goods or provide services. Data should be treated no differently than any other vital corporate asset of an airport. There are established disciplines and frameworks in IT for managing data as an enterprise resource. To maximize the speed and accuracy by which data is exchanged for use by stakeholders, Airport Operators need to make investments in frameworks and disciplines for organizing both airport IT and business personnel into a program for managing data in partnership. The focus should be on:

- Assigning data stewards who are responsible for data maintenance, accuracy, and quality
- Defining data format standards to facilitate data transfer among different stakeholder systems
- Implementing data security systems and practices
- Establishing data governance for enforcing data standards and ensuring the availability, usability, integrity, and security of data
- Designing data architectures that will facilitate efficient data storage, access, and retrieval

Design and Implement a Systems Integration Platform

Most large airports have invested heavily in technology solutions to support mission-critical business operations. Examples include multigenerational surveillance cameras, video recording technologies, security management systems, emergency notification systems, parking revenue and control systems, ground transportation management systems, and communications networks and associated devices. Many of these IT investments were made as individual projects designed for a single purpose and implemented in piecemeal fashion, resulting in multiple vendor systems ranging from on-premises solutions, web-based solutions, and cloud-based services to mobile applications. As a result, it can be a challenge to get all of these systems to work together so that essential data can be integrated to create a common view and support information sharing requirements across a diverse mix of stakeholders.

If your airport matches this scenario and you want to leverage IT to enhance stakeholder communication and collaboration, you need a strategy for a systems integration architecture and technical platform that will maximize interoperability between multiple vendor systems. One such strategy is through the deployment of a Service-Oriented Architecture (SOA). An SOA, using standard components and open IT standards, is a strategic approach that will enable Airport Operators to integrate information without regard to its source, thereby protecting your existing investments in technology while improving interoperability between heterogeneous systems. An SOA is essentially a collection of IT services that facilitate accurate and reliable communications between these heterogeneous systems. The communication can involve either simple data passing, or it could involve two or more services coordinating some airport activity or operation. An SOA will help reduce costs for both development and maintenance of your information access and sharing solutions. The core of the SOA infrastructure solution is an enterprise service bus (ESB), which is a technical software solution that provides connectivity between the various systems and databases.

The design and implementation of the SOA requires a change in the typical approach used by airports for rolling out business applications and IT services. It requires both airport IT and business personnel working closely together to understand the current IT systems architecture, design a new integration architecture and technical platform that will expedite stakeholders' access to data, and develop a plan for transitioning to the new architecture. Airport Operators at both DEN and MCO have taken such an approach, each with differing levels of maturity, but both working towards the goal of effective information sharing across all technology platforms.



Because SOA is a new paradigm, it's important to phase in the transition and avoid starting out with a project that is too large in scope. Rather, start with something that is important to your airport's vision for enhancing stakeholder C2 so the effort will be noticed and the value fully understood. Other considerations include:

- Focusing on organizational factors first by providing training for your personnel and ensuring you have the proper skills in place for a successful SOA transition
- Taking the time to evaluate, select, and acquire the appropriate tools for building your airport's systems integration platform
- Ensuring the scalability of your airport's systems integration platform
- Enhancing your communications systems infrastructure to provide for secure sharing of information to a variety of stakeholders both within and outside the airport

Establish Data Display Strategies

Once you have some of the critical components of your enterprise data management framework in place, and you have established an adequate integration technology platform for sharing information from disparate sources among airport stakeholders, it is necessary to consider strategies on how key information will be delivered and displayed for stakeholders. The delivery and display of information must be tailored to support the specific roles of each stakeholder for his or her specific airport operation or mission. Given the proliferation of computer devices in use today, ranging from smartphones, tablets, laptops, and desktops to large video display walls, airports can find it challenging to share digital data among internal and external stakeholders across this multi-device landscape. Developing an effective multi-platform, multi-device strategy for data delivery and display becomes imperative.

The opportunities and challenges presented above are further discussed in the chapters that follow.

Chapter 12: Establish an Enterprise Data Management (EDM) Strategy

You will get insights into:

- *The benefits and importance of EDM*
 - *The six key components of the EDM framework and how they relate to each other*
 - *The significance of a sound data governance program and a well-developed data architecture*
-

Data is a vital asset of an airport. As data flows between processes, systems, and both internal and external stakeholders, it carries the ability to make Airport Operators smarter and more effective in handling normal operations or in responding to irregular operations (IROPS) and emergency events. Data can extend situational awareness and assist in coordinating cooperative actions among stakeholders to facilitate an effective response to situations impacting airport operations.

Although data is a critical resource, Airport Operators are not always able to easily integrate and effectively retrieve data for both internal and external communication and collaboration. This is not always a result of lacking information technology. Many Airport Operators use technology applications extensively in some form to support a broad spectrum of operations. A few examples include surface management, passenger processing, weather detection, security surveillance, flight status and tracking, ground transportation management, safety management, and physical access control. But often those technology solutions have been procured without an enterprise-wide view that considers where and how the data within these systems might be used by other stakeholders to support other critical airport operations. As a result, data can reside in different systems that have not been designed to communicate with other systems; in a variety of data formats; in separate and independently secured databases; in legacy systems; or even on message queues or in flat files. Data is also often obscured in unstructured documents, like spreadsheet applications, or it is released to cloud computing and business process outsourcing vendors.

This creates a situation where it is difficult to get the right data to the right stakeholder when they need it most, and in a format they can use for effective decision making and response. An enterprise data management (EDM) strategy makes it easier to create, share, and integrate data from various sources.

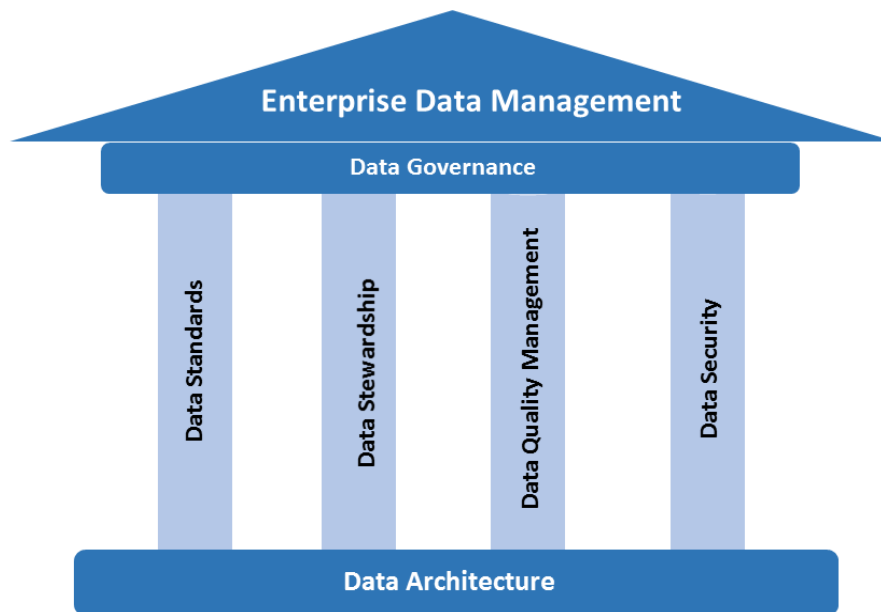
This Chapter provides guidelines and best practices for leveraging EDM to facilitate information sharing among stakeholders, regardless of any differences in technology systems and platforms. It is important to emphasize that establishing a fully mature EDM will not happen overnight, but, if you want to capture the full power of your airport's data assets to enhance stakeholder C2, it is an important area that will help you get the most out of your IT investments. Figure 15 on the following page identifies the key components of an EDM. Keep in mind that there is also no required sequence for addressing all of the key components reflected in Figure 15. Moreover, all of the components do not have to be in place all at once in order to realize important benefits. It is best to phase in the implementation of your EDM strategy. Start with the easiest tasks in order to achieve early wins, or focus first on those areas that are causing your airport the most challenges or barriers to effective C2.

What Are the Key Components of EDM and Why Is It Important?

EDM ensures consistency of information, supports all operations, and enhances decision-making capabilities by helping Airport Operators migrate from disparate data silos to an integrated, enterprise-wide data environment. Some key benefits of an effective EDM strategy include:

- Ensuring that common data is consistent across all airport and stakeholder systems
- Improving data quality across the airport stakeholder community
- Reducing the complexity of sharing information across multiple stakeholder technology platforms
- Meeting the data needs of any initiating airport IT project while being able to extend data across the wider airport enterprise and stakeholder community
- Avoiding inflexible systems and being locked in to specific technologies that are not common to all airport stakeholders
- Enabling on-demand extraction of ad hoc operational reports to satisfy multiple stakeholder requirements
- Providing a single, accurate view of end-to-end data for all airport stakeholders

Figure 15. EDM Framework Components



Adapted from: Sivaprakasam, S.R., 2011 "Enterprise Data Management: A Comprehensive Data Approach for CSPs, Infosys Limited, Bangalore, India.

Data Governance

Data governance refers to the overall management of the availability, usability, integrity, and security of the data employed at an airport. Governance is necessary to develop the principles of managing data-related processes and enforcing them across the airport enterprise and stakeholder community. The focus is on people, process, and technology to optimize accessibility, availability, quality, consistency, and security for all airport stakeholders who will use the data.

A sound data governance program includes a governing body, a defined set of procedures, some technical resources, and a plan to execute those procedures. The governing body can be readily established within the organization structure and governance model described in Chapter 4 of this Guidebook. The Executive Steering Committee must be responsible for nominating work groups for managing the other critical components of the EDM framework, such as data stewardship, data quality management, data standards and metadata, data architecture, and data security. Data governance plans can be framed by an established work group and approved by the Executive Steering Committee to ensure that data assets are managed effectively across the airport enterprise.

According to Sivaprakasam (2011), key roles and responsibilities of the data governance committee include the following:

- **Executive Steering Committee** – Articulate the vision, establish appropriate work groups, and arrange any necessary funds for the data governance initiative.
- **Source Data Owners and Data Stewards** – Prioritize and execute data management and address issues in data quality and standards, such as the merger or deletion of data, data enrichment, etc. Data stewards must ideally be from the business side of the airport.
- **Data Architect(s)** – Help data stewards access, integrate, and manipulate data with their technical expertise; typically will be associated with the airport technology division.

The initial steps in the implementation of a data governance program involve the following:

1. Designate the stewards or owners of the data assets across the stakeholder community. The data stewards would come from the business units who are responsible for the creation and modification of the data resources.
2. Establish an enterprise data architect role to help guide the data stewards in the design, creation, deployment, and management of the organization's data models and data architecture. This will facilitate the integration of data from different, unrelated sources, and is a key objective of data governance.
3. Develop a policy specifying who is accountable for various portions or aspects of the data, including its accuracy, accessibility, consistency, completeness, and updating. The data architect, working with the data stewards, can develop the policy for review and approval by the Executive Steering Committee.

Data Standards

Data standards are the rules by which data is described and recorded to ensure consistency across multiple sources. As more information is exchanged in different technical operating environments, the

DATA STANDARDS

- ✓ Minimize impact on sending and receiving systems
- ✓ Reduce cost and delivery time

need for defined data standards becomes more acute. If different stakeholder groups are using different data standards, combining data from multiple sources is difficult, if not impossible. In order to share, exchange, and understand data, it is important to standardize the format as well as the meaning of the data. This ensures a clear understanding of how data is represented and that the data one receives is in a form that is expected and usable. Without data standards and data quality, future interoperability between systems will be challenging. To ensure interoperability

among airport stakeholders and the ability to share and exchange data, data fields and the content of those fields need to be standardized using documented agreements on representation, format, definition, structuring, tagging, transmission, manipulation, use, and management of data.

Having data standards minimizes impacts to both the sending and receiving systems, and also reduces cost and delivery time. For example, at MCO, the IT Director is able to keep mistakes and issues to a minimum because of the data standards that are in place. This saves the airport time and money and allows investments into other projects instead of fixing data exchange issues.



A good starting point for embarking on the development and documentation of data standards is to cross check with existing standards bodies and regulatory agencies governing data standards, and make every effort to conform to them as appropriate to avoid unnecessary and conflicting duplications. For example,

the FAA has its Airports Geographic Information System (GIS) Program, which defines the FAA process for the collection and maintenance of airport and aeronautical data to meet the demands of the Next Generation National Airspace System (NextGen). The International Air Transport Association (IATA) has also established the Aviation Information Data Exchange, which is the global XML messaging standard for exchanging flight data between airlines, airports, and any third party consuming the data. XML, or Extensible Markup Language, defines a set of rules for encoding documents in a format that is both human- and machine-readable. Another example is the Accredited Standards Committee, chartered by the American National Standards Institute (ANSI).

Data Stewardship

Data Stewardship is a key function of EDM where the data assets of an airport are managed by stakeholder groups that are the designated business owners of certain data because they actually create and maintain the data.

The data stewards perform the following roles:

- Develop and manage rules for quality and exception validation of data elements
- Review and ensure data validity
- Mitigate exceptions raised by the quality management team
- Coordinate between airport business units and IT teams to improve data accuracy and reliability
- Address data requirements for collaborative business operations
- Ensure best practices are adopted across the airport enterprise and stakeholder community on policy related to data management, data security, and data retention requirements

DATA STEWARD

- ✓ Responsible for establishing data standards and formats
- ✓ Provide governance and oversight to data management

Data Quality Management

Data Quality Management is a key process within the EDM framework for handling issues in the quality of data and resolving exceptions in data elements. Within the life cycle of a data element, its quality may be impacted by a variety of data management operations. The impacts on quality typically occur during operations such as data entry, data migration from legacy systems, or other such data manipulations.

Available data management tools can be used for profiling and standardizing data, matching and merging data, monitoring quality, and tracking and addressing issues in data quality. Data quality tools are used to address various aspects of the data quality problem:

- Parsing and standardization
- Generalized “cleansing”
- Matching
- Profiling
- Monitoring
- Enrichment

Such tools would be used by technology organizations within the airport for internal deployment in the airport’s IT infrastructure, although hosted data quality solutions continue to emerge. The tools are increasingly implemented in support of general data quality improvement initiatives, as well as within critical business applications.

Data Security

Due to the increased emphasis on protecting data, airports and airlines deploy robust strategies to ensure data security is addressed. Examples include protecting data about the movements of specific flights, as well as airline operators' commercially sensitive information. There is also the need to protect personally identifiable information (PII), which business enterprises in all industry sectors have an obligation to manage. One small airport admitted that it unplugs certain devices at certain times since the security is questionable.

According to Sivaprakasam (2011), leveraging the data governance process, rules and regulations such as these must be established by the airport to address these security concerns:

- Manage and authorize changes to the data structure for sensitive data; frequent changes lead to an unstable business and multiple versions of the business entities
- Enhance the confidentiality and availability of data in hard and soft copy
- Protect data from unauthorized access, modification, and destruction
- Prevent improper disclosure of data
- Avoid security breach of information and related risks to security and legal implications, etc.

DATA SECURITY

- ✓ Use of protected databases
- ✓ Use of encryption
- ✓ Use of firewalls and other off the shelf security products
- ✓ Should be under the guidance of the data architects and stewards

The data security strategy involves the data stewards within the airport stakeholder community who are designated for all data sources. It authorizes them to regulate data access rights, establish documentation on those who are authorized to access data, and perform all other necessary activities to maintain the accuracy of data. Data stewards must prevent the unnecessary duplication of data unless there is a legitimate business requirement; when data is allowed to be duplicated, it must be managed and controlled across the enterprise. Protection of the data inside airport software applications will also need to be ensured. Protected databases, encryption, firewalls, and other commercial-off-the-shelf security products should be considered as ways to ensure the appropriate protection of sensitive data, and should be implemented by the airport's technology organization under the guidance and direction of the data architects and data stewards.

Once the sensitivity status of data elements is understood and documented in the security policy and rules, access to such data must be protected by the Human Machine Interface (HMI). It is recommended that this is best achieved by the use of user profiles.

Data Architecture

It is not within the scope of this Guidebook to delve deeply into the technical details of enterprise data architecture. The airport's technology organization should lead the development of an encompassing data architecture, or utilize outside contractors or consultants to do so. Data architecture describes how the enterprise data stores at the airport are organized and accessed. Simply put, a data store is a repository for persistently storing and managing collections of data, which include not just databases, but also simpler store types such as file systems, spreadsheets, emails, etc. Airports should have an "as-is" data architecture that represents the current state of its data, and a planned architecture to show the direction of the state of its data over the next one to five years.

As you explore the state of your airport's existing data architecture, you will probably find that data is likely to be highly dispersed, often without adequate controls on quality. Moreover, you may also discover that most data is duplicated across a number of systems, with significant variations in quality, format, and meaning, especially when evaluating across the multiple internal and external stakeholder organizations you depend upon to support airport operations. In addition, you most likely will find organizational and business process conflicts across your stakeholder community.

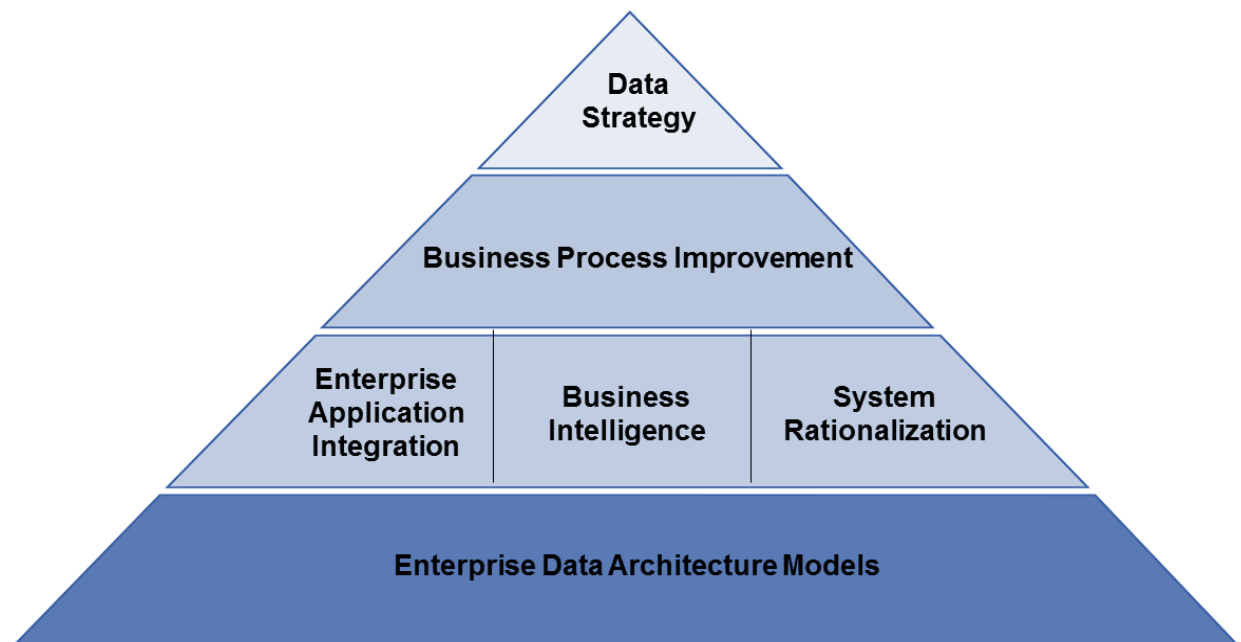
According to IBM (2003), and as shown in Figure 16, data architecture is a layered set of models that provides a solid foundation for strategic initiatives such as:

- A data strategy, outlining the airport's aims and objectives for improved collection and use of information
- Airport business process improvements
- Decisions on the future of new and changed airport systems
- Data integration, data warehousing, and reporting initiatives

A typical data architecture consists of diagrams or models that show how aspects of your airport business operations relate to one another. For example, an organizational chart is a model of how business units within the airport and stakeholder community relate to each other. In general, the data architecture is defined primarily by models at four levels:

- High-Level Data Models
- Realization Overviews
- Data Source and Consumer Models
- Data Transportation and Transformation Models

Figure 16. Enterprise Data Architecture



Getting Started

Consider the following to establish an airport-wide EDM strategy. A printable checklist is provided in Appendix D.

1. Establish a working group within your C2 organization led by a data architect
2. Leverage your systems integration strategy to identify the appropriate approvers, resources, participants, and stakeholder representatives
3. Provide appropriate training for both non-technical and technical personnel
4. Engage external consultants to assist with the transition (optional)
5. Evaluate and select ESB technology that best fits
6. Define initial data standards and management procedures
7. Evaluate and select new technologies if necessary
8. Implement foundational components of your EDM strategy
9. Execute your EDM roadmap for selected areas and pilot projects
10. Define a transition plan, including implementation and change management procedures
11. Communicate the EDM Strategy and the C2 value achieved in the pilots, as well as the challenges and lessons learned

Chapter 13: Enhance Communications Systems

You will get insights into:

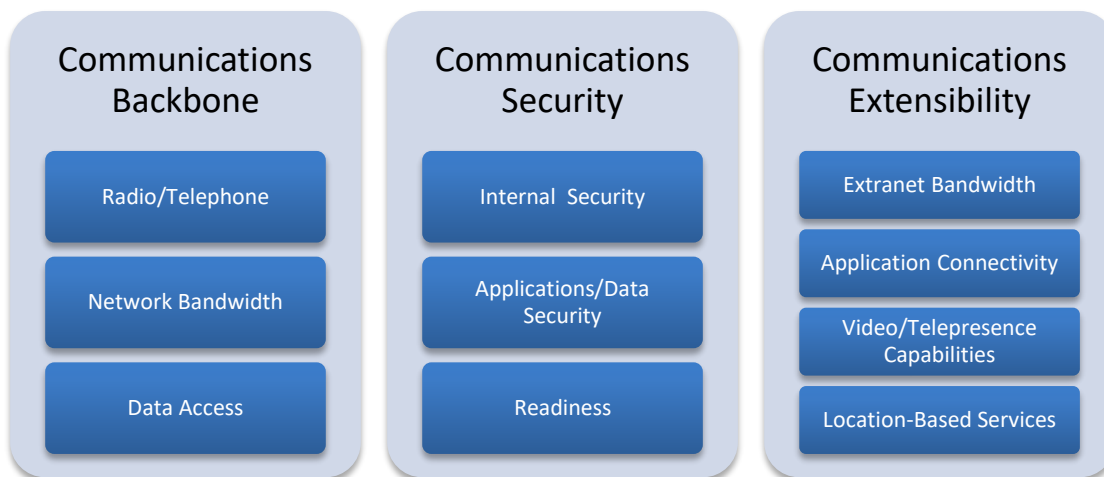
- *The importance of a communications technology backbone*
- *Securing your communications technologies*
- *Extending the communications network for new modalities*

Communications technologies have facilitated an exchange of information among stakeholders during both regular and irregular operations since the advent of telephone and radio. More recent technologies include the secure digital TCP/IP network backbone. Cellular and WiFi services have fostered the proliferation of smartphones, tablets, and other personal devices. All of these technologies will need to be a part of your communications architecture in order to facilitate collaborative communications during any operational scenario. This will provide a communication foundation that serves all other capabilities such as Data Collection and Management, and Information Presentation and Feedback.

An organization's communications systems should enable all stakeholders to alert one another, input information about an incident, and follow the incident from initiation to closure. Older communications methods such as a phone call tree, speakers, sirens, email, and text are inadequate in themselves to deal with modern crises and the sophisticated stakeholder user community. As you use this Guidebook to review and improve collaborative communications among stakeholders, your organization will discover which existing communication technologies work well, and which will need improvement in order to optimize your C2 capabilities.

This Guidebook cannot detail the communication system requirements shown in Figure 17—and indeed the technologies that are used to achieve these capabilities change quickly—but they are pointed out here so that your communications and network engineering teams can foresee potential stresses on their existing architecture. In addition, physical security of the communications infrastructure—telecom Intermediate Distribution Frame/Main Distribution Frame (IDF/MDF) badged door access, server administrative passwords, proper patching, and updates of the communication core—are all expected to be incorporated through the implementation of proper ITIL (Information Technology Infrastructure Library) governance procedures, which are out of scope for this Guidebook.

Figure 17. Communication System Requirements



Communications Backbone

The Communications Backbone is the foundation for all communications during both regular and irregular operations, and during significant incidents. This includes the telephone network; the IP-based network of fiber and copper, switches and routers; and the following:

- **Radio/Telephone** – These are still the most fundamental communications methods, and should be a foundation of your communications infrastructure evaluation and planning.
 - Determine whether and how all stakeholders will communicate with the Incident Commander before and during any incident.
 - Can all stakeholders, especially police, fire, operations and security, communicate on the same or available radio frequencies?
 - When a major incident occurs, both the public and all incident stakeholders are likely to stress the existing cellular network. Consider having stand-by cellular capabilities, either inherent to your cellular contracts or a separate (such as mobile) cellular tower, to be activated as necessary for a specific user community.
 - Anticipate the need for cellular and cellular data communications to switch to your distributed antenna system (DAS).
- **Network Bandwidth** – This encompasses both your enterprise’s fiber/copper network capacity as well as its wireless (WiFi) capacity.
 - Your internal network will experience increased utilization demands during an incident. The Technology team should verify that the communications infrastructure of fiber, copper, and routing/switching has sufficient bandwidth and/or a Quality of Service protocol and other provisions to ensure the most critical users will have access to their data and distribution systems at all times.
 - The stakeholders’ as well as the public’s reliance on mobile personal communication devices, such as smartphones and tablets, will add significant demands to your WiFi bandwidth, and is likely to stress the WiFi infrastructure to its limits.
 - Be sure to address both ends of your WiFi capacity: the Wireless Access Point distribution and coverage, and the bandwidth of the pipe that connects the WiFi to the Internet.
 - Consider either expanding the WiFi capacity at all times or having an emergency capacity available that can be quickly activated when necessary.
- **Data Access**
 - According to NIST, until 2033 there will be a planned transition of public safety data, video, and eventually voice communications from the Land Mobile Radio environment that many airports rely on today to a nationwide Long Term Evolution broadband network called the Nationwide Public Safety Broadband Network. Airports would be wise to follow these developments and grant opportunities to ensure they are engaged with technologies that will best facilitate collaborative communications with all other public safety entities (Broadband.gov, 2016; Department of Homeland Security, 2012).
 - The Public Safety Communications Research program initiated a research and development (R&D) planning effort in 2013 to determine what technology R&D investments are

THE COMMUNICATIONS BACKBONE

- ✓ This backbone is essential to every system’s operation and communications.
- ✓ Radio, telephone, text, and email are inadequate in themselves in facilitating C2.
- ✓ Individual airports will have specific technical requirements depending on the vendors on site, but the principles of a communication backbone remain the same.

necessary to execute this change. Their research determined that Location Based Services allow public safety to fulfill its mission more efficiently and effectively (U.S. Department of Commerce, 2015).

Communications Security

This area covers internal security, applications/data security, and readiness.

- **Internal Security**
 - Just as your EDM framework requires data security (as noted in Chapter 12), so do your communication systems. A robust and secure communication backbone is the foundation of a secure data enterprise. These communication systems need to be secure from malicious challenges within the local area network (LAN) as well as the external (wide-area) network. These network systems also need to be scalable and able to integrate with a variety of existing and new data and applications platforms across the airport.
 - Determine in your incident planning phases the level of network or IP security desired for your communications systems. Perhaps you will want to differentiate the security requirements of your core backbone and wired LANs from the security requirements of your WiFi and/or cellular networks.
- **Applications/Data Security** – Conduct application security audits, especially for applications that will be used by people from other networks and beyond your network structure (e.g., over cellular and WiFi systems).
- **Readiness** – Ensure your communications network is ready for collaborative communications.
 - Your technology team should participate in the organization’s exercises and trial runs to ensure the communications infrastructure is also ready to facilitate collaborative communications. This will help to assure all stakeholders are well versed in the procedures and technologies of your collaborative communications program.
 - Your IT Service Desk should verify Incident Command Center (ICC) facilities and functionality on a weekly basis. This will verify that all IT and communications systems in the ICC are operational, to avoid any failures in the heat of an incident. Some IT organizations even dispatch a support team member to the ICC 24x7 when an Incident Commander activates the ICC.

Communications Extensibility

This area covers extranet and cloud bandwidth, application connectivity, video and telepresence capabilities, and location-based services.

- **Extranet and Cloud Bandwidth**
 - As your collaborative community expands beyond the airport to the greater communities that surround it, these security and extensibility requirements become more complex as your infrastructure is exposed to new outside security threats.
 - Anticipate new requirements for allowing the interoperability of heterogeneous networks. These might be networks within the airport campus that historically have been owned and operated by independent entities such as the airport administration, public safety, fire, individual airlines and concessions, and the FAA.
- **Application Connectivity**
 - Technology teams will need to extend networks and security to allow stakeholders within and external to the operational network to use applications to communicate with one another during an incident.

- Also consider having a mobile cell and/or WiFi capability that can be activated and sent into the affected areas of an incident, since not all incidents will occur within your coverage areas.
- **Video and Telepresence Capabilities** – Live face-to-face communications is becoming an important aspect of incident management. The organization needs to determine during its incident planning stages whether its stakeholders will rely on public (cellular) video conferencing, such as Skype or Face Time, or will design its own secure telepresence capabilities, such as those offered by major network companies (Horak, 2010).
- **Location-Based Services** – These capabilities can enhance the organization’s ability to identify the locations of its key staff and critical physical assets/equipment at any point during the incident. The Public Safety Communications Research programs are anticipating these future communications needs and ought to be considered for inclusion in your Program.



Getting Started

Consider the following to establish communication system strategies. A printable checklist is provided in Appendix D.

1. Ensure your network architects and administrators participate in the IT department’s formal change management process. Establish one if it does not exist.
2. Ensure your network team participates in the airport’s IT project management governance.
3. Network design is complex. Ensure your network team works closely with your technology vendor(s) to secure training and craft secure and extensible solutions that the vendor can support.
4. Incorporate twice-yearly (optimally) network security audits using both internal and external audit organizations and/or contracts.
5. Participate in the C2 practice sessions.
6. Consider deploying a Mobile Command Post that can be used to extend your communications network and key Incident Command staff into the arena during extended incidents.
7. Monitor the government- and industry-led initiatives to develop new communications standards and adjust your plans accordingly.

Chapter 14: Establish Data Display Strategies

You will get insights into:

- *The secure delivery and display of data on multiple devices*
- *The key elements of technology solutions on how to enhance situational awareness for IROPS or emergency events*
- *The advantages of data virtualization*
- *Different approaches to use mobile devices for information sharing with stakeholders*

Once you have some of the critical components of your EDM framework in place, it is necessary to consider strategies for how key information will be delivered and displayed to stakeholders to best support their specific roles in any given airport operation or mission. The important guiding principles here are:

1. Provide any data, any time, to any airport stakeholder who has a legitimate right to know
2. Present the data to any device in a format that stakeholders can best apply the information

This Guidebook will not give specific solutions for displaying shared data among airport stakeholders. However, a number of guidelines are provided in order to ensure that the various local implementations across airports address common best practices. While these guidelines may be subject to local adaptation, many of the data display strategies discussed here are generally applicable regardless of the location.

Deliver Data While Controlling Access Privileges

As stated in Chapter 12, some of the information processed for sharing among stakeholders may be commercially sensitive or may not be freely disclosed for security or privacy reasons. Such data or the results of the calculations derived from the data must be protected by the User Interface (UI) or the

USER DATA PROFILE

- ✓ Contains user permissions and access settings
- ✓ Enable an airport to control what stakeholders can do with shared data

Human-Machine Interface (HMI). This is best done via User Profiles that control access privileges through the application. What the user sees on the computer screen or device, and the files, applications, and directories they can access are determined by the User Profile. The UI/HMI will allow only those with the appropriate privileges to access and view certain data and, for those who have a right to view the data, will only allow them to make inputs or changes to the data in accordance with the access rights embedded in their User Profile.

The City of Minneapolis Office of Emergency Management uses a federal tool called the National Homeland Information Network. It is a SharePoint site with Adobe Connect built into it, and functions as a primary point of contact on a day-to-day basis with all associated key stakeholders. It allows incidents, status reports, and even general information to be posted to the site for access by all appropriate personnel. Access is controlled by assigned privileges.



Enable the Delivery and Display of the Same Data to Multiple Devices

Faced with the proliferation of computer devices ranging from smartphones, tablets, laptops, desktops to large video display walls, it can be challenging to share digital data among internal and external stakeholders across such a multi-device landscape. Gulfport-Biloxi International Airport (GPT), for example, is evaluating a cloud-based solution, possibly a smartphone app, that will push out typed messages simultaneously to different previously defined stakeholder groups. These stakeholder groups use a variety of different devices and include tenants or simply operations staff on the airfield.



It is imperative that an airport develop an effective multi-platform, multi-device strategy for data delivery and display. Content must be rendered so it can be viewed and used by stakeholders having a range of screen sizes, from smartphones to the widest flat-screen monitors.

DATA SHARING ON MULTIPLE DEVICES

- ✓ Stakeholders access data from an increasing number of devices
- ✓ Devices used depend on job and location
- ✓ Important to develop an effective strategy to target a diverse range of devices and screen sizes

A good strategy is to determine the various scenarios in which your shared information will be used within your stakeholder community, and to design a user experience that works best for each of those scenarios and is focused on the target device. Assess the critical information and processes users of a specific device will be performing relative to an airport operation, and deliver the data and functions that optimizes their requirements on the specific device they will be using.

Another strategy is to evaluate the interactions and functionality associated with your information-sharing and collaboration initiative, and create alternative application scenarios that are tailored for the different devices used by your stakeholder community. The user interface for each scenario should organize the elements of your content commensurately with the relevant device requirements. If you are targeting for mobile applications, it should accommodate the needs of the mobile stakeholders. A mobile website should use a different navigation strategy than a desktop website.

It is also a good idea to create a scalable reference design for each group. Once you have identified the features to be supported for each group of device types, develop a design framework that contains the essential components of the airport application that can be ported across the range of screen sizes and types of devices. Ensure the design framework conforms to a set of guidelines and fulfills the requirements for the full range of orientations that will be required by the various user devices.

You may also want to design for mobile first versus starting with a PC. Historically, applications are typically designed for PCs or desktops and then ported to mobile devices. With PCs, you have a lot of screen space available to you as compared to a mobile device. As a result, PC application often include more information and functions than are really necessary to support the collaborative airport operation, and it can then become a problem when the same data and functions are ported over to a mobile device. When you begin with a mobile device in mind, you must determine what is critical for all devices. This avoids overdesigning the application, and avoids the downstream problems this can cause when porting the data and functionality to devices with different screen sizes.

Get the Details Right

There are complex details that can get overlooked when developing approaches for displaying data on several device platforms. Those details must be fully explored so that each group gets the information

they need, and so that it is tailored to the device they will be using. A thorough understanding of the capabilities for each relevant device is needed in order to maximize the experience for the consumer of the information being shared. Some items to consider include:

- User posture (will users be working upright on the airfield, sitting at a desk in an administrative office, relying on a large wall monitor in an operations command center, etc.)
- The different input and display features for each device that may be used across the airport stakeholder community

The unique approaches for how each stakeholder group may be using the information, depending on their job responsibilities, can influence how they will navigate the information, and the order and sequence by which data is presented to them.

Focus on Enhancing Situational Awareness

Situational awareness involves understanding the relationships of events and information relative to a given stakeholder's point of interest in both time and space. Airports, in connection with ensuring safety and security, maintaining critical infrastructure, delivering good customer service, and managing effective operations, are interested in deploying innovative technology solutions that enhance situational awareness among stakeholders while fusing data from a wide range of systems, including video, audio, social media, access control, and intrusion detection. To achieve and sustain situational awareness, technology solutions for data sharing and presentation must focus on the following key elements:

- Aggregating data from multiple sources or sensors
- Enabling efficient information correlation and analysis
- Deploying rapid, rules-based alerts
- Facilitating the ability to share information easily within and across stakeholders to facilitate timely response and investigation

To get the most out of their data assets and IT infrastructure, airports require complete technology solutions to help them and their stakeholders establish and maintain situational awareness as they handle normal operations or respond to IROPS or emergency events. At Minneapolis–St. Paul International Airport (MSP), the Director of Emergency Management uses a Web Emergency Operations Center (EOC) to interact and communicate with the county. This helps the airport improve its situational awareness, and enables virtual command and control by providing real-time status of active events. In an emergency, data moves in real time. Data that is not available when a decision needs to be made is not of any use. To get the most out of your data assets, display strategies must embrace the following guidelines:



- Deliver a common operational picture to all stakeholders involved in either a routine airport operation or responding to an emergency event
- Develop with the specific business needs of all the stakeholders involved
- Provide a full-featured reporting system to include the following:
 - Access to information and information updates in real-time
 - Geospatial visualization capability
 - Data management functions
 - Integrated alerts and warnings
 - Assignment workflow capability
 - Real-time collaboration
 - Mobile access

Take Advantage of Data Visualization

Data visualization generally refers to any attempt to portray the meaning of information (data) using graphical means. These, traditionally, include charts and graphs. However, in recent years more visually appealing and meaningful graphical representations have been used, such as color-coded gauges and dials, as well as sophisticated heat maps, detailed infographics, and interactive dashboards. These depictions, or parts thereof, can be interactive (i.e., clickable) to give users additional levels of detail about specific data elements for the purpose of analysis, queries, or other means of manipulation. Sometimes, as in the case of dashboards, there are notifications, alerting the user that relevant, preconfigured data elements have changed. The main advantage of visualizing data is that it has the potential to more clearly illustrate and explain correlations, trends, and patterns in a way that written data sources simply cannot.

Since data visualization tools can help stakeholders analyze and reason about data and evidence, making complex data more accessible, understandable, and usable, such tools and approaches should be considered when developing your airport's strategy for displaying data to stakeholders. It can be difficult to make sense of raw data alone. By adding visualization to it, you get something that most people can easily digest. Not only can you make sense of it faster, but you can also observe interesting patterns that would not be apparent from looking only at raw data. There are dozens of data visualization tools available that have strengths and weaknesses depending on your objectives. It is highly recommended that you work with your airport IT organization for assistance in selecting the appropriate set of tools that will best satisfy your requirements.

Here are a few basic concepts to consider that can help you generate the best visuals for displaying your data:

- Understand the data your stakeholders are trying to visualize, including its size and uniqueness
- Determine what kind of information you want to communicate to your stakeholders and how it can best be visualized
- Know your targeted stakeholders and understand how they process visual information
- Use a visual that conveys the information in the best and simplest form for your stakeholders

Mobile Web vs. Native Application for Mobile Devices

Mobile devices continue to proliferate for both personnel and business uses. Airports are no exception to this and mobile devices have become an increasingly important technology platform for sharing information and collaborating among airport stakeholders. For example, the Emergency Program Manager at Portland International Airport (PDX) is trying to improve the airport's technologies by making EOC upgrades to SMART screens, and integrating iPads, iPhones, and other portable devices. Given this development, it is wise to consider the different options for using mobile devices to deliver data and services to stakeholders, and to understand what some of the important criteria are for selecting one approach over another.

There are four different approaches you can use to enable stakeholders to share and respond to information using mobile devices.

DATA VISUALIZATION

- ✓ Modern visualization that goes beyond charts and graphs on Excel spreadsheets
- ✓ Displays data in a more sophisticated way, such as infographics, dials and gauges, maps, and detailed charts
- ✓ Makes data more accessible, understandable, and usable



- **Native Application** – Mobile applications that are developed or coded with a specific programming language (ObjectiveC for Apple mobile devices and Java for Android devices). The applications are fast, reliable, and powerful, but are tied to a specific mobile device platform. That means you must duplicate them using the appropriate programming language in order to target another mobile platform, which may be required, especially when dealing with external stakeholders.
- **Hybrid Application** – Mobile applications that rely on more open and specialized development frameworks, and offer a very interesting compromise because they ensure cross-platform compatibility and can access the mobile device’s hardware (camera, GPS, user’s contacts, etc.)
- **Dedicated Web Application** – Mobile website tailored to a specific platform or form factor, like the LinkedIn web application, which was designed for either Android or Apple but not for other smartphones or feature phones.
- **Generic Mobile Web Application** – Mobile web sites designed to match every web-enabled phone. A good example is the Wikipedia Mobile Page.

Unfortunately, there is no best choice. It is all about context. At the very least, you can count on this: If your mobile application is mainly used to deliver and display information for stakeholders and enable them to interact with online content or user services, avoid the native choice. On the other hand, if your application is mainly used offline, a native application will offer a much better experience for your stakeholders.

Figure 18 provides some important attributes of the different mediums that you can use to weigh and decide what works best in certain scenarios. Other factors to consider when choosing between a Native Application vs. Mobile Web include the following:

Figure 18. Attributes of Native, Hybrid and Web Approaches for Mobile Data Delivery

	Device Access	Speed	Development Cost	App Store	Approval Process
Native	Full	Very Fast	Expensive	Available	Mandatory
Hybrid	Full	Native Speed As Necessary	Reasonable	Available	Low Overhead
Web	Partial	Fast	Reasonable	Not Available	None

Mobile Web

- **You can reach a larger audience** – Stakeholders are more likely to use a mobile browser and access the Internet from their mobile phones. The barriers to accessing a site via a mobile browser are lower than those to downloading a mobile application, even for smartphone users.
- **Lower cost and time to develop** – The biggest benefit mobile web offer is that you design once and it will run on all mobile platforms with minimal adjustments. The fragmented nature of the

mobile industry means that porting applications to different platforms costs money, especially when you include maintenance costs.

- **Instant updates** – Whatever changes you make become available instantly to all stakeholders.

Native Application

- **Connectivity** – A mobile web browser depends on constant connectivity and, in the real world, data connections can be transient. Native applications can be built to interact with stakeholders while even offline.
- **Device-based caching** – Native applications can store data persistently, reducing data usage and providing faster access to the data.
- **Richer experience** – Native applications can tap into the mobile device's functions and features, providing a richer experience and seamless integration with other native features such as the camera, address book, etc.



Getting Started

Consider the following to establish data display strategies. A printable checklist is provided in Appendix D.

1. Establish a working group to develop best practices for delivering data to internal and external stakeholders.
2. Leverage your enterprise data and systems integration strategies to determine the appropriate approvers, resources, and stakeholder representatives.
3. Determine security requirements and leverage best practices for delivering data while controlling access privileges.
4. Assess and document the goals and context for how data will be used by different people across the stakeholder community.
5. Determine the types of devices that will be used for each scenario.
6. Create a scalable reference design for each type of device.
7. Design for mobile devices first, as they have the most constraints.
8. Determine when to use mobile web applications versus native applications.
9. Focus on situational awareness.
10. Take advantage of data visualization, where appropriate.

Chapter 15: Define a Systems Integration Strategy

You will get insights into:

- *Some guidelines and best practices for designing an airport systems integration architecture*
- *The two most prominent systems integration models*
- *Some high-level process steps that can be applied to any systems integration design project*

Information sharing is a critical component of stakeholder C2. Sharing information helps to establish situational awareness, coordinate actions between airport stakeholders, and support local decision making for each participating stakeholder. This is the case for either a routine airport operation or when assisting in the response to a specific IROPS or emergency event. While utilizing information technology can facilitate information sharing, that is not always the case when Airport Operators have incorporated many technology solutions in a piecemeal fashion. It can be a substantial challenge to make disparate systems—such as multi-generational cameras, video recording, security management systems, emergency notification systems, and communications equipment—work together to create a common view and support information sharing requirements across a diverse mix of stakeholders.

This is especially true as you move from smaller General Aviation (GA) airports to large hub airports. The research for this Guidebook reflects that smaller Airport Operators with limited budgets typically have made only modest investments in technology solutions and tend to rely on a much simpler technology set to support their data management and communications requirements. They also tend to rely more heavily on face-to-face communication when collaborating with stakeholders. At medium and large hub airports, scores of different systems and technologies can operate in functional silos that are not connected to one another.

As a result, the ability to share information among stakeholders in a timely manner is often limited.

If your airport matches this scenario and you want to enhance stakeholder communication and collaboration, you need a strategy for a system's integration architecture, which gives you the big-picture view. Piloting that strategy are the business drivers of your airport stakeholder C2 goals, such as speed and working more closely and effectively with business partners. Given this picture, it is easy to understand why enterprise systems integration architecture is a strategic decision for an Airport Operator. The goal is to provide the most flexible approach to integration that will allow stakeholder organizations to readily connect applications, data, and devices, and enable fast and effective C2.

Although much is written about systems integration in the IT literature, Wikipedia (2016b) captures its essence by offering a straightforward definition: "...systems integration is the process of linking together different computing systems and software applications, physically or functionally, to act as a coordinated whole." The goal of a systems integration architecture is to maximize interoperability so that you can easily communicate, execute programs, or transfer data among different systems, enabling your stakeholders to access and combine the information they need with little or no knowledge of the unique characteristics of a specific data processing system or application.

SYSTEMS INTEGRATION STRATEGY

- ✓ The goal is to maximize interoperability
- ✓ Makes it easier to communicate, execute programs, and transfer data
- ✓ Does not require knowledge of unique or specific processing systems or applications to access and combine the data

This chapter provides some guidelines and best practices for designing an airport systems integration architecture. As in Chapter 16 in this Guidebook, which discussed Data Integration, it is not within the scope of this section to delve deeply into the technical details of designing an enterprise systems architecture. The technology organization at your airport should take the lead role in its development, utilizing either existing internal Systems Architect resources, or outside contractors or consultants. The primary audience for this section is airport IT managers and personnel, but all airport managers should have an understanding and appreciation of the general concepts and strategic importance.

Systems Integration Models

For medium and large airports, the IT landscapes tend to consist of many systems and applications, which provide the various services the Airport Operators rely on to conduct their day-to-day operations. A single large hub airport might use separate systems, either developed in-house or licensed from a third-party vendor, to manage financial management processes, security and public safety operations, ground transportation operations, customer relationships, HR, etc. This modularization is often desirable. In theory, breaking the task of running an airport into multiple, smaller functions allows for easy implementation of the best and newest technological advancements in each area, and quick adaptation to changing business needs. However, the downside is the resulting challenge of getting all these disparate systems to operate together to support stakeholder C2 across multiple internal and external organizational lines. To further exacerbate this challenge, the airport IT landscape has often evolved further into a highly fragmented ecosystem consisting of numerous cloud-based application services, Software as a Service (SaaS) and mobile application services. These applications must find a means to create connectivity with on-premises systems and databases to ensure seamless connectivity and interoperability throughout the new and continuously evolving airport enterprise.

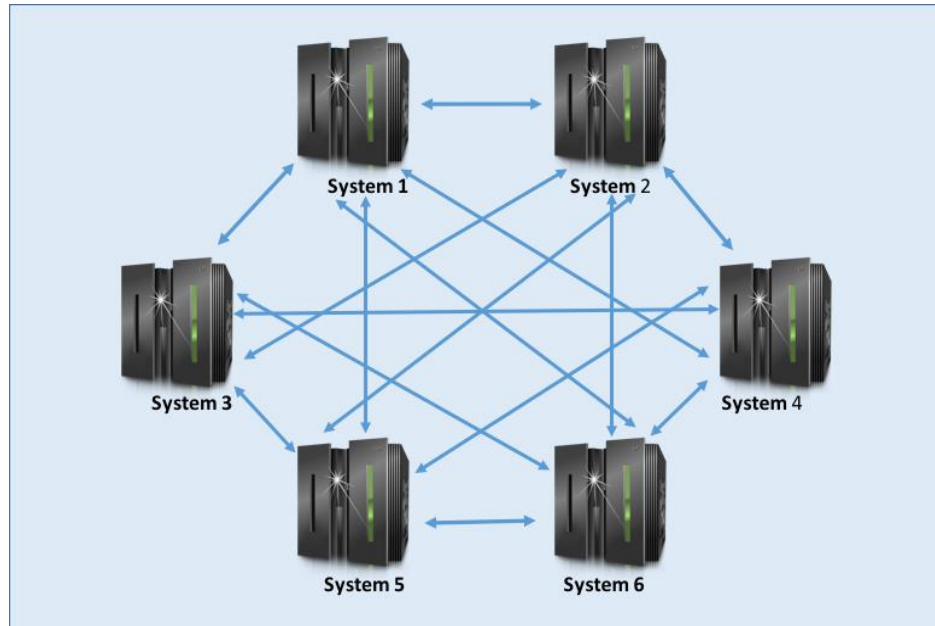
Systems integration architecture can be used as a blueprint for establishing an integration platform that will bridge the gap between disparate stakeholder systems, both internally and externally. Information sharing requires that shared information is available through a common system, connected via proper interfacing to all stakeholder's systems and databases. The integration platform, which will be discussed in more depth in Chapter 16, is the primary technical integration infrastructure that serves this purpose. The right integration architecture enables an Airport Operator to future-proof its IT ecosystem, making it easy to scale, adapt, and adjust as business requirements change and the demands for stakeholder C2 become increasingly more important.

Although a myriad of variations exist between them, there are two major approaches for establishing systems integration architecture that stand out:

- Point-to-Point Integration
- Horizontal or Message Bus Integration

Point-to-Point Integration

This method relies on experienced software developers to create custom software code and embed it within each individual endpoint (IT system or application) to create a connection that is generally between only one pair of systems at a time. In such a point-to-point integration model, a unique connector component (software code) is implemented for each pair of applications or systems that must communicate. This connector handles all data transformation, integration, and any other messaging related services that must take place between only the specific pair of components or applications it is designed to integrate. The Point-to-Point systems integration method is shown in Figure 19.

Figure 19. Point-to-Point Integration Architecture

When used with small IT infrastructures, where only two or three systems must be integrated, this model can work quite well, providing a lightweight integration solution tailor-made to the needs of the infrastructure. For a smaller airport with only one or two application systems to connect, this approach may work well. However, as components are added to an IT infrastructure, the number of point-to-point connections required to create a comprehensive integration architecture begins to increase exponentially.

For a much larger airport with numerous applications, systems, and databases that need to be integrated, this method becomes overwhelmingly difficult as each endpoint needs to be well understood before custom code can be implemented in order to establish a connection. Moreover, as the Airport Operator business evolves, the IT application ecosystem grows in complexity, requiring more and more integrations be put into place. Eventually, the IT environment begins to look like the tangled web of connections illustrated in Figure 19. Because point-to-point integration is also tightly coupled, modifying connections and endpoints becomes a grueling task, as even the slightest mistake can break the entire system. Moreover, any changes to one of the applications can break the connection with other applications such that all connections must be tested and perhaps modified to ensure that they are still operational following any modifications or changes made to one or more applications. This makes systems maintenance more complex and costly.

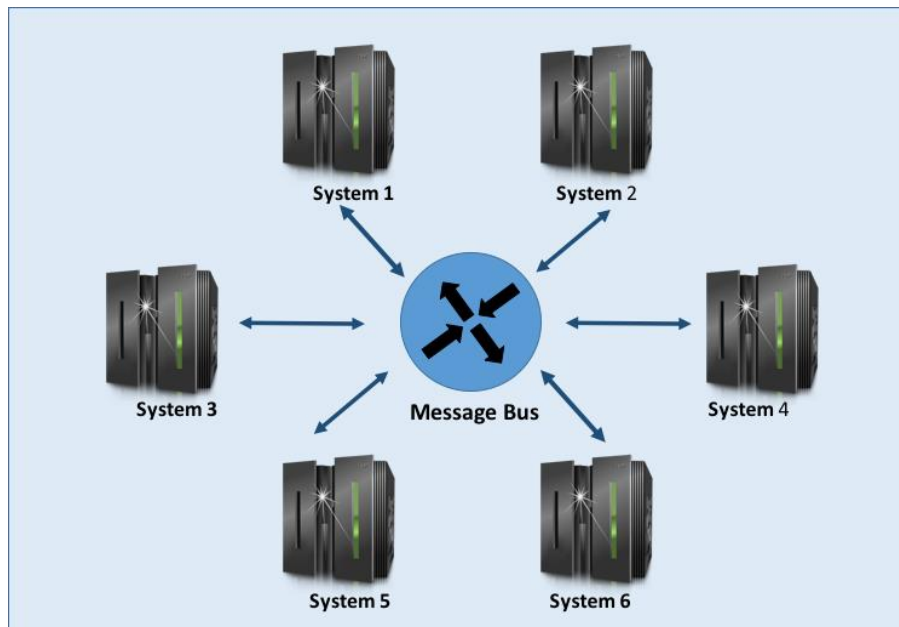
Horizontal Integration

This approach involves the creation of a unique subsystem that becomes the common interface between all other systems or subsystems. This is also known as a message bus style of systems integration. Very simply, it utilizes a central communication utility or subsystem, which mediates the transfer of data between all other systems or subsystems. Two key features are the mutual shielding of individual communication points and platform independence. It is a decentralized solution, where most of the business logic is implemented in the adapters that provide the interface between this message bus and each individual system. The bus itself ensures the transmission, scheduling, and at times reformatting of data messages.

Platform independence is achieved through this model's single interface or adapter, allowing any participating system to be "unplugged" and replaced with another that utilizes the same or similar

adapter without affecting the other connected systems. The message bus usually provides a means of connecting and disconnecting a system without affecting other systems. Adding or removing a system does not necessarily affect existing systems, because data messages are not sent to specific recipients. This method of integration is generally referred to as a loose coupling between different systems. The star topology, as shown in Figure 20, allows a significant reduction in the number of interfaces, especially when compared to the point-to-point method. A typical representative of the horizontal or message bus technology is an Enterprise Service Bus (ESB), which is currently one of the most popular methods of integration.

Figure 20. Horizontal or Message Bus Integration Style



Systems Integration Design Process

The following steps represent a high-level process that can be applied to any systems integration design project to steer its course and ensure that informed decisions are made with successful outcomes.

Step 1: Establish an Enterprise Systems Integration Architect Role or Position – This Architect will guide a team of business analysts, business managers, software developers, and systems/network engineers in defining business and technical requirements for enhancing C2 and in gathering information about your business processes and IT infrastructure stack as necessary. This will result in a design architecture for your systems integration strategy.

Step 2: Understanding the Airport Enterprise and Problem Domain – This, in effect, is similar to requirements gathering. It involves speaking to numerous people within the internal and external airport stakeholder groups, specifically heads of departments, in order to gain an understanding of what is and is not important for enhancing C2. Obtaining quality information at this stage is imperative for successful Steps 3 and 4.

Step 3: Making Sense of Airport Data – Use the Data architecture (discussed in Chapter 12 of this Guidebook) to gain an understanding of how your airport’s enterprise data stores are logically and physically organized and accessed, and the associated data management resources.

Step 4: Making Sense of the Airport Business Processes – In order to determine how to approach the Airport Operator’s business model for supporting stakeholder C2, a view of the airport at its process/method-level must be understood and documented. This involves looking at how they relate to each other and to the data architecture discussed in Step 3.

Step 5: Identifying Airport Application Interfaces – In addition to seeking common methods and data to integrate, you also need to address interfaces. This is because interfaces will differ from application to application, so you should validate all assumptions about them, and build a repository of information about what is available.

Step 6: Identifying the Airport Business Events – This looks at how one event may trigger any other event. An example event may be when an employee is hired to work at the airport and applies for a security badge online. You can capture this event and make something else happen, e.g. automatically run a security background check and, if successful, establish an email address.

Step 7: Identifying Data Schema and Content Transformation – This stage addresses how the schema and content is transformed. The need for this stems from the fact that data in one system will not make sense to another system, so it needs to be reformatted accordingly. Achieving this ensures that consistent application semantics are maintained across all systems within an enterprise. Defining, implementing, and documenting data standards as discussed in Chapter 12 will greatly facilitate this step in the process.

Step 8: Mapping Information Movement – This involves looking at where the data element or interface information originates. For example, the airport employee ID from the human resource database needs to move to the security credentialing system database. The movement of this information needs to be mapped so we know where it originated and where it is located at all times.

Step 9: Determine Systems Integration Strategy – Before making a decision about your Systems Integration Architecture strategy, in addition to taking into account what you have learned in Steps 1–8, it is important to have a good idea of how you would answer the following questions:

- How many applications or systems does your airport need to integrate?
- Will your airport need to add applications in the future?
- How many communication protocols will your airport need to use? A communication protocol is a simply a system of rules that allows two or more entities of a communications system to transmit information. These are the rules or a standard that defines the syntax, semantics, synchronization of communication, and possible error recovery methods. Protocols may be implemented by hardware, software, or a combination of both. Communicating systems use well-defined formats (protocols) for exchanging messages.
- How important is scalability to your airport enterprise?



Getting Started

The above nine process steps function as the checklist for this chapter. A printable checklist is provided in Appendix D.

Chapter 16: Establish an Integration Platform

You will get insights into:

- *The benefits of leveraging an integration platform*
 - *Some system integration platform alternatives*
 - *Process guidelines for implementing an integration platform*
-

The integration platform follows the systems integration strategy established in Chapter 15 to create the primary technical infrastructure for sharing information with all internal and external stakeholders' systems and databases. If designed and implemented properly, this platform will provide all an airport needs to establish connectivity between targeted internal and external stakeholder systems and overcome future systems integration challenges.

By leveraging the right integration platform solution, airports can spend less time and resources worrying about creating connectivity for sharing information between stakeholders and more time focusing on managing and improving mission-critical airport operations in collaboration with stakeholders. The integration platform will enable an airport to achieve the following key benefits:

- Connect airport stakeholders' different technology and data processing systems
- Serve as a technical platform for sharing information between stakeholder systems
- Deliver a single, common set of data in real time, describing the status of a routine airport operation or event
- Link local processes to the integration platform, triggered by data events or processing
- Trigger alert messages to all impacted stakeholders based on events or calculations
- Use interactive and interdependent User Displays or HMI to present critical information to stakeholders

This section of the Guidebook provides guidelines and best practices for establishing a systems integration platform that best fits the integration model you have selected. As with Chapter 15, the primary audience for this section is airport IT managers and personnel, but all airport managers should have an understanding and appreciation of the general concepts and strategic importance.

Systems Integration Platform Alternatives

The Systems Integration strategy addressed in Chapter 15 of the Guidebook should serve as the design blueprint for an airport's integration platform. Once you have completed the process of designing the systems integration strategy for your airport, you should have a good understanding of which of the two systems integration approaches will work best for your airport, and have made a decision on your integration approach.

Smaller Airports

If you are a smaller airport and do not have a complex ecosystem of disparate systems applications and databases, the point-to-point integration approach, discussed in Chapter 15, will work best or, given the simplicity of your IT infrastructure, a systems integration strategy may not even be necessary and most likely will not yield a return on investment. The main advantage of the point-to-point method is its simplicity, as long as the number of applications and databases in your IT infrastructure is small and not

very complex. A simple point-to-point integration is significantly easier and much more cost-effective when connecting only a very small set of airport business applications.

In the point-to-point approach, direct links are created among applications through a direct application program interface link, file transfer protocol, or batch interfaces. Transformation (translation) of data may take place as data is transferred across the link. Generally, point-to-point interfaces are implemented without the use of an integration product, with translation of data taking place using software code at the point of integration at one or both ends of the systems interface.

The development of the software code is straightforward and can be accomplished using existing software application developers within your IT group who have a good understanding of your applications, or by hiring outside contractors or consultants. Completing the process of designing a systems integration strategy (discussed in Chapter 15) should facilitate the interface code development when using either internal or external software developer resources.

Larger Airports

At first glance, the point-to-point systems integration approach is indeed straightforward; however, each connection has its own software logic, and if you have a large number of applications, you may get something like the “spaghetti” pattern illustrated in Figure 19. The cost and effort to maintain this approach increases exponentially as you add new systems.

This is not an optimal choice for larger airports with complex IT infrastructures, or airports that anticipate that their IT infrastructure will grow in size and complexity fairly quickly. Some form of the message bus integration approach, as depicted in Figure 20, is a better solution.

The message bus integration alternative evolved through the use of a middleware software layer to manage and route messages between applications, which are integrated using specific connectors (or adapters) installed into the middleware product to translate between applications. The next few sections will discuss some of the various approaches for achieving a message bus systems integration platform, and are intended for larger airports with multiple business applications and a more complex IT infrastructure.

As suggested in ACRP Report 13 (Stocking, 2009), there are several popular integration strategies for this general approach that can either focus on enterprise information integration or enterprise application integration. To improve airport stakeholder communication and collaboration, larger airports with more complex IT infrastructures need to link various software systems or applications to form a single, integrated system of not just data (information) but also systems and processes (applications). The focus here will be on those strategies that address both information and application integration. This allows the airport not only to share data and communicate effectively with airport stakeholders, but also to manage routine operations or respond to emergency events collaboratively with stakeholders.

Broker Model for Systems Integration

In a broker approach to systems integration, a central integration engine, called the broker, resides in the middle of the network, and provides all message transformation, routing, and any other inter-application functionality. All communication between applications must flow through the hub, allowing the hub to maintain data concurrency for the entire network. As the number of integrated applications and the weight of message traffic increases, hub-and-spoke middleware can employ a dedicated central hub middleware server connecting spoke applications that integrate through application adapters passing messages through the hub. This results in a “star” topology as depicted in Figure 20.

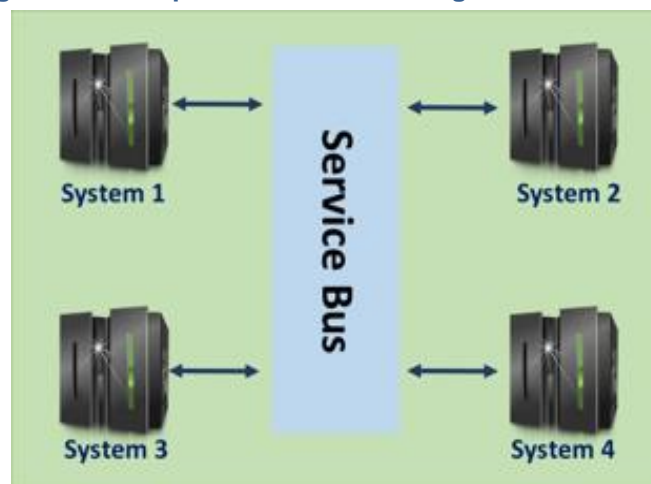
One advantage of the broker integration approach (or hub-and-spoke model, as it is sometimes called) is that it provides centralized administration and sophisticated integration and performance features. Another advantage is that it allows loose coupling between airport business applications. This means that the applications are able to communicate asynchronously (i.e., sending messages and continuing work without waiting for a response from the recipient), knowing exactly how the message will get to its endpoint, or in some cases, even knowing the endpoint of the message. This approach also allows all integration configuration to be accomplished within a central repository, which means less repetitive configuration.

However, a significant disadvantage is that when high levels of performance are required, the central hub may hinder performance. Since the broker is responsible for all concurrency between an application's data sets and states, all messages between applicants must pass through it. Under heavy load, the broker can become a message bottleneck. Like any other systems integration approach that uses a central engine, the broker can also become a single point of failure for the network. Another disadvantage is that the implementations of the broker model are often heavyweight, proprietary products aimed at supporting a specific vendor's subset of technology. This can present problems if your integration scenario involves products from several vendor solutions, internally developed systems, or legacy products that are no longer supported by the vendor.

Enterprise Service Bus for Systems Integration

In an attempt to move away from the challenges caused by a brokered hub-and-spoke approach to systems integration, a new model emerged—the ESB. Service bus integration makes use of a technology solution that manages the routing of messages among applications. While it still uses a central routing component to pass messages from system to system, as depicted in Figure 21, the ESB architecture is intended to lessen the burden of functionality placed on a single component by distributing some of the integration tasks to other parts of the network.

Figure 21. Enterprise Service Bus Integration Architecture



The ESB will also generally manage the transformation of message formats among applications. These components can then be grouped via multiple configuration files to handle any integration scenario in the most efficient way possible. Also, these components could be hosted anywhere within the airport infrastructure, or duplicated for scalability across large geographic regions. As an airport strives to bring a greater range of data and services online, integrate them together, and streamline stakeholder C2, an integration solution requires more back-end systems. It is not uncommon, for example, for an airport Communications Center operator to switch between as many as 5–10 airport business applications in

handling an emergency event or coordinating routine airport operations among multiple stakeholders. An ESB design is suitable for high levels of message traffic between large numbers of legacy and web-based applications, typically across multiple geographical locations, and scales to support the highest performance requirements.

There are a number of different ESB products marketed today. Although there are differences between products, according to MuleSoft, Inc., an integration software company, most ESBs include all or most of the core features listed below.

- **Location Transparency** – A way of centrally configuring endpoints for messages, so that a consumer application does not require information about a message producer in order to receive messages.
- **Transformation** – The ability to convert messages into a format that is usable by the consumer application.
- **Protocol Conversion** – Similar to the transformation requirement, the ESB must be able to accept messages sent in all major protocols, and convert them to the format required by the end consumer.
- **Routing** – The ability to determine the appropriate end consumer(s) based on both preconfigured rules and dynamically created requests. The ESB also can be configured to guarantee the delivery of data even when communications pathways are interrupted and restored.
- **Enhancement** – The ability to retrieve missing data in incoming messages, based on the existing message data, and append it to the message before delivery to its final destination.
- **Monitoring/Administration** – The goal of ESB is to make integration a simple task. As such, an ESB must provide an easy method of monitoring the performance of the system, the flow of messages through the ESB architecture, and a simple means of managing the system in order to deliver its proposed value to an infrastructure.
- **Security** – ESB security involves two main components: a) making sure the ESB itself handles messages in a fully secure manner, and b) negotiating between the security assurance systems used by each of the systems that are integrated.

Service-Oriented Architecture

Once an airport has established an ESB, a logical extension is to consider Service-Oriented Architecture (SOA). An SOA is an architecture an airport can use to build its business applications as a set of loosely coupled black box components, orchestrated to deliver a well-defined level of service to internal and external stakeholders by linking together business processes. Admittedly, this definition does not flow trippingly from the tongue. However, from it springs a sustainable, reusable, extensible approach to airport business and technology that is already providing huge competitive advantages to other business organizations around the globe.

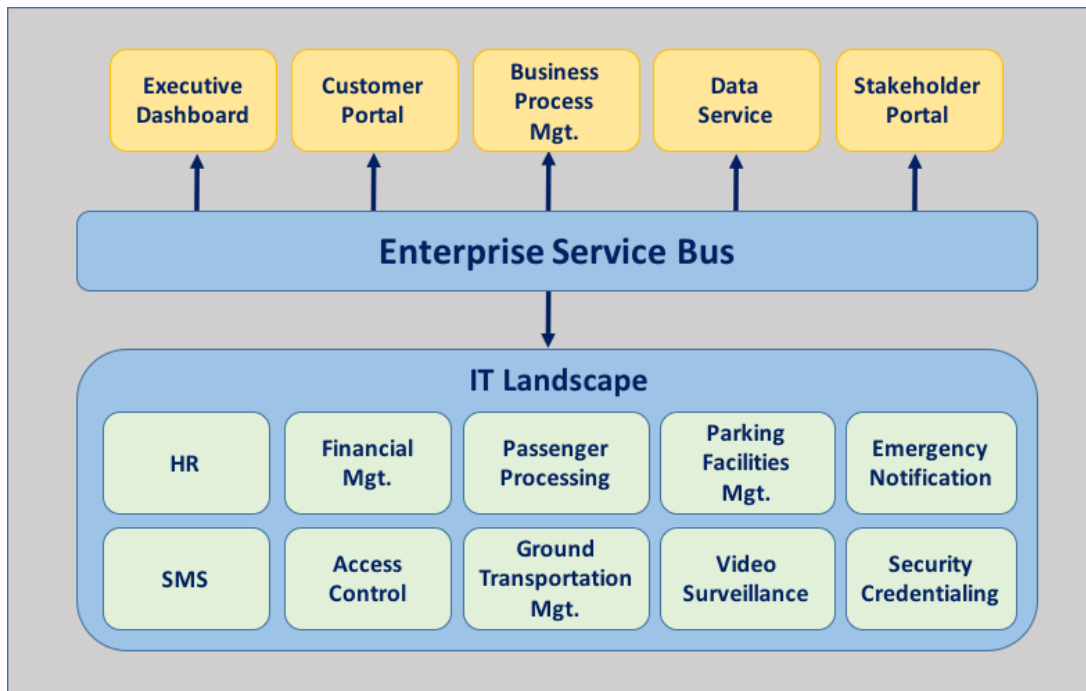
The term *loosely coupled* refers to how two software components interact within an SOA. There are two roles in SOA: a service provider and a service consumer. A software agent may play both roles. One component passes data to a second component and makes a request. The second component carries out the request and, if necessary, passes data back to the first. The emphasis is on simplicity and autonomy. Each component offers a small range of simple services to other components. A set of loosely coupled components does the same work that used to be done inside tightly structured business applications, but the components can be combined and recombined in myriad ways to support a variety of different scenarios requiring stakeholder collaboration. This makes the overall IT infrastructure much more

flexible and a far better asset for enhancing the sharing of both data and operational processes among stakeholders.

ESBs are built with SOA in mind. This means that an airport seeking to migrate towards an SOA can do so incrementally, continuing to use their existing systems while plugging in reusable services as they implement them. SOA is an architectural approach where you expose and encapsulate services in a coarse-grained manner. It does not prescribe any technical mechanism or implementation. SOA is more related to boundary/integration interaction between systems. So, if System A exposes services using an SOA, a user can interact with those services from System B.

An ESB on the other hand is a technical implementation that aids in delivering an SOA. In an SOA, services are decoupled and can interact with each other regardless of the service type. This means that a particular service can be platform- or protocol-specific, but the SOA enables such services to interact and exchange data. This data is essentially exchanged via the ESB, which forms the backbone of any SOA architecture. The central concept is that in an SOA, the ESB provides the middleware and interfaces that allow businesses to connect their applications without writing code. Figure 22 illustrates how the role of an ESB can function as a service intermediary in an airport IT SOA landscape.

Figure 22. Enterprise Service Bus Functions as a Service Intermediary in a Service-Oriented Architecture



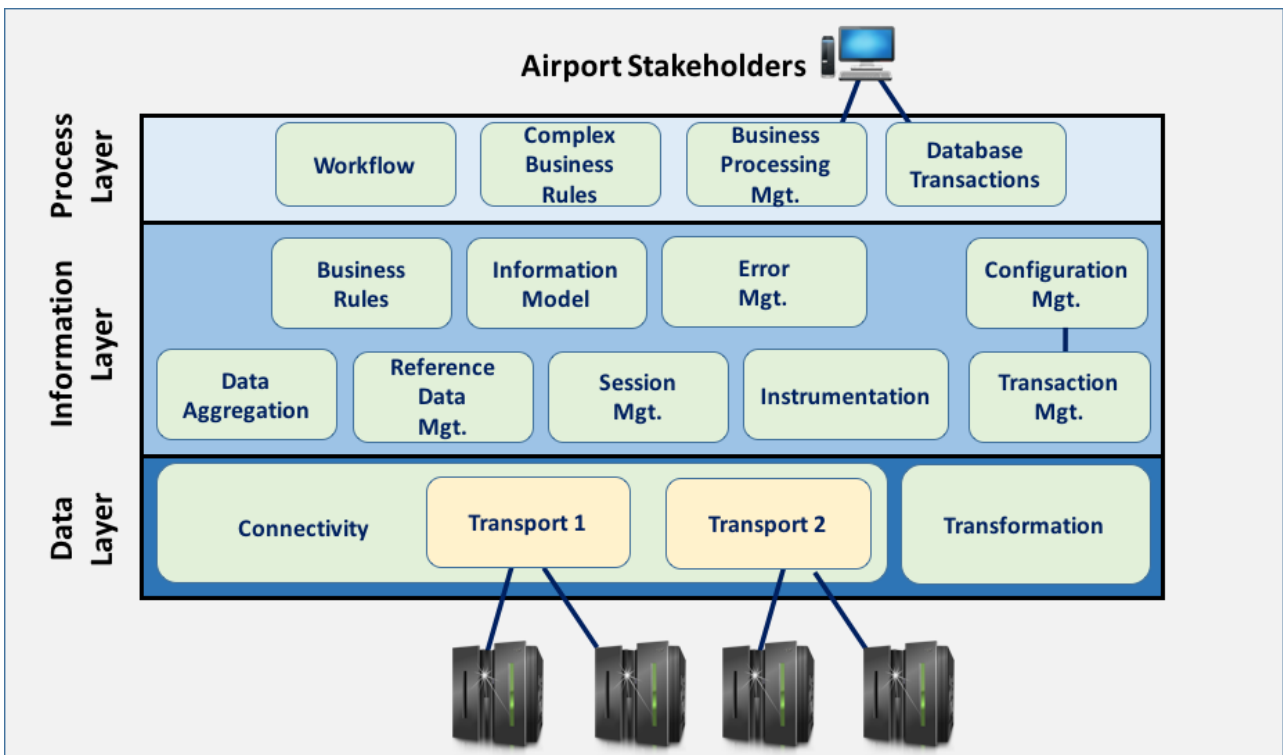
SOA is commonly heralded today as the solution for the integration issues among applications, but a number of additional capabilities are required for a truly efficient integration solution. These capabilities are grouped into following three layers of integration; the capabilities are depicted in Figure 23:

- **Data Integration** – The most basic layer, data integration generally is achieved in even the most basic integration scenarios. In this layer, data is moved among applications, with transformation taking place to allow data to be translated among applications.
- **Information Integration** – In this second layer, data and calls to applications are aggregated to enable single calls to access multiple applications, with the basic business rules in place to allow

single calls to bridge applications. The use of these techniques provides service aggregation and meets the minimal requirements to achieve an SOA implementation.

- **Process Integration** – The third layer of integration builds on top of data integration by aggregating and integrating the processes and data that are involved in executing a business process that operates across application boundaries.

Figure 23. Service-Oriented Architecture Integration Layers



Process for Implementing an Integration Platform

Implementing an Integration platform is typically wide-ranging and complex, following a grand strategic vision of how the organization should look. This view means that the reality often looks incomplete and with endless work ahead. So, how should an airport with a goal of leveraging technology to enhance stakeholder C2 approach such an undertaking? The following sections present some guidelines and suggested best practices for implementation.

Focus on Organizational Factors First

Organizational factors including culture, skills, training, teaming, organization structure, decision making, collaboration and governance are key to success. As you move toward more of an SOA for your integration platform, you will want to move away from a siloed organizational structure, which tends to limit thinking to within the scope of individual IT projects. Integrating a large number of projects with their own agendas without some central control is nearly impossible and almost always inefficient. The best place to start is to leverage and build upon the organization and governance structures discussed in Chapters 4 and 5 of this Guidebook. A best practice is to establish a design authority within your organizational and governance structure to engage technical stakeholders and promote early architecture decision making. This process is similar to establishing your enterprise data management strategy, which is addressed in Chapter 12.

You need a vision that combines an airport business perspective, a technology road map, and an organizational initiative. It is important that airport business management and IT management work together on this process. For an airport enterprise systems integration platform to be effective, it must be done from the top down. In other words, if you really want your systems integration platform to succeed, airport business management and IT must work together, and you must engage your internal and external stakeholders in the process from the very beginning. Establish a champion from the business side of the airport who understands your vision for enhancing C2 to work in partnership with a counterpart from the IT side of the house. Assign a dedicated project manager with a strong IT background who reports to them and can anticipate issues and accommodate them in a beneficial and proactive way.

C2 BUSINESS CHAMPION

- ✓ Understands your vision for enhancing C2
- ✓ Works in partnership with a counterpart from the IT side

Airport business managers tend to worry about their own division's goals and objectives as well as the performance metrics used to judge them. Enterprise systems integration involves thinking creatively about airport business processes and business measurements as they affect the airport enterprise as a whole. To appropriately identify key business processes, you need cooperation between departments and divisions across the airport's entire stakeholder community.

Implementation of the systems integration platform requires use of the latest technology tools and products, so you will need to ensure that you have the right technical resources involved in the project and provide continuous training and mentoring to reduce risk. Use of either independent consultants or vendor resources can help bridge gaps in skills sets within your own internal organization, which are almost always inevitable. According to IBM Global Services (2008), "Do not assume that your business process analysts (BA) easily understand service definitions written by software developers. Current tools are geared toward a more technical audience, so there is a knowledge gap along with a cultural difference, which means more training is needed to develop BAs."

Most IT developers are used to writing software code that lives within its own enclosed world: commonly, the point-to-point architecture discussed above. When an airport begins the movement to an SOA and enterprise systems integration platform, software developers need to start writing software adapters based on the assumption that the same adapter will be used in many different circumstances. Some developers may not necessarily see this as an intuitive approach. Part of preparing the development organization is helping them understand how the airport might use the components they will be asked to build in different ways. Software developers should be teamed with airport professionals within the airport and its stakeholder organizations to help the developers change to a more global perspective. It is also important to allow time for constituents and stakeholders to arrive at a mutual understanding of project goals.

Do Not Attempt to Do Everything at Once with Your Initial Project

Establishing the airport integration platform has a greater chance of success when the overall project is broken down into small steps that each bring demonstrable value. If you try to move your entire airport to a systems integration platform using an ESB and SOA overnight, you will likely face extreme difficulties. Initially, prove your success by starting with a project that is small, achievable in a short time, and will have a noticeable impact, and then build incrementally. Start by reviewing the business services map you developed in designing your systems integration strategy (Chapter 15) to identify your first target. Select a specific area where you can leverage existing software assets, turn them into

services, and create a plan that demonstrates the value of the flexibility you'll gain from your airport systems integration platform.

INITIAL PROJECT

- ✓ Start small
- ✓ Focus on something that is important to your vision
- ✓ Will be noticed and understood if well planned

You do not need to start with something huge. Rather, you should start with something that is important to your airport's vision for enhancing stakeholder C2 so the effort will be noticed and the value fully understood. Remember, you are proving that a systems integration strategy works in your airport and has real value. Use this as a proof of concept that will enable you to demonstrate the value, and to learn and determine any needed course adjustments before making large investments of time, money, and resources.

IBM Global Services (2008) suggests that scope creep can also be a contributing factor that leads to poor project results. You will be dealing with short time frames, challenging objectives, demanding customers, and multiple resources in various locations with different skills and ways of working. Especially with a proof of concept, where the project can be easily sidetracked because of other activities, you need laser-sharp focus through a strong project manager who can help keep things on track. IBM Global Services further recommends that a best practice is to "...have a control on the scope of exactly what is included in the pilot or proof of concept. Without this, the project can spiral out of control and not achieve the stated objectives. It is important for the project manager to encourage continual feedback along with frequent review points and demonstrations."

Choose the Right Tools for Building Your Airport Systems Integration Platform

Implementing an ESB and all of the functions listed in the three major layers of an SOA illustrated in Figure 23 will require the acquisition of a series of technical tools or products. Not all tools are the same; making sure that you fully understand what you need today and what you might need tomorrow will help you choose the most relevant ones. The process you underwent in establishing your systems integration strategy (discussed in Chapter 15) should help determine what your airport needs today and in the future. Your systems integration design strategy for the airport will serve as the basis for your requirements and the tools or products you will need for implementation.

Look for technology suppliers that have created successful ESB and SOA implementations for airports, if possible. Chances are that your SOA vendor can help you get started with a framework designed for companies like yours. Admittedly, you probably won't be able to find a single vendor that can provide you with everything you need to fully implement all of the required functional capabilities shown in Figure 23. Still, in general, you should actively look for companies that can offer you an easy-to-implement package based on established standards that you can then add pieces to (or subtract pieces from) as your implementation matures.

Third-party tools have the advantage of being optimized to deal with different vendors' technology stacks (especially those that have vendor-certified connectors and capabilities), but they are also optimized to integrate between stacks. If you are thinking of integrating technologies from multiple vendors or want to keep your options open for the future, it may be worth looking into vendor-agnostic tools as a solution for this scenario.

The combination of several frameworks or products to build your own custom airport integration suite is usually unnecessary, expensive, and leads to many additional pitfalls. Since several solutions already exist, it is strongly discouraged to create one from various pieces. “Glue code” needs to be written, testing and bug fixing have to be done, and there is no specific contact in case of problems since vendors usually just refer to the other side when a problem arises. If you try to combine an ESB with a Business Processing Management solution of another vendor, which one do you call when you have a problem? Why should you care about all of these problems if other people have already cared, and an entire stack (also open source) is already available?

SYSTEMS INTEGRATION

- ✓ Can keep your options open for future integration
- ✓ Could use multiple vendors' technology
- ✓ May be worth looking into a vendor-agnostic tools

It is difficult to create a comparison criteria matrix because the products offer far too many (often different) functionalities and concepts. Moreover, each airport will tend to have a unique set of requirements, depending on their own set of circumstances. Proprietary solutions are often very similar, and also the most used open source competitors offer similar characteristics. Therefore, it makes sense to assess whether a proprietary or an open source solution is the better choice. In order to make this decision, here are some good general criteria to use (Wähner, 2013):

- **Usability** – How complicated is the installation? How many tools are needed? Is the development environment intuitive?
- **Maintainability** – How does your airport administer the product? Is there a Graphical UI for monitoring services?
- **Community** – Are there active public forums or mailing lists? Are numerous articles, tutorials, articles, and videos available? Is the product supported by several companies?
- **Enterprise Support** – What support options are offered (e.g., business hours, 24/7 hotline vs. email vs. on-site support, etc.)? Can the required SLAs be guaranteed? Is support offered in your preferred language?
- **Functionality** – Are all the required functionalities established for your airport offered?
- **Flexibility** – Can you customize functionalities of the product to fit your airport's needs?
- **Expandability** – Is it possible to expand the product? Is the product and its interfaces based on standards?
- **Connectors** – Are adapters for all required technologies associated with your airport available? Are there adapters for business-to-business products such as SAP? How easily can you build your own adapter?
- **Cost** – What is the full cost (total cost of ownership) of the product (including maintenance, all required ancillary products, connectors, etc.)?
- **Licensing** – What licensing or subscription model is used? What happens when requirements change (more computers, switching to virtual machines, etc.)? Are upgrades free? Are downgrades possible, too?

Ensure the Scalability of Your Systems Integration Platform

The systems integration platform for an airport will most likely involve hundreds of connections. As much as you can, use known solutions products to meet reliability and performance requirements. Then design, test, and retest to confirm that your performance, scalability and interoperability requirements are met. Never deploy a solution without properly addressing and testing these nonfunctional requirements. This is primarily because once a solution has been deployed, it becomes more difficult to

resolve performance issues once you are in production. An example would be testing your solution under a different amounts of users, such as 100, 500, and then 10,000 users. This will help you evaluate if your solution is capable of coping under these different performance conditions. For planning purposes, keep in mind that given the number of variables in an airport systems integration environment, your staff may need to generate a significant number of test cases and plan for this accordingly.

When variable system requirements do not allow for formal capacity planning and server acquisition, you should utilize automation and virtualization to provision a test environment. Finally, always validate your systems integration platform implementation with a technical architecture review from an independent consultant or test lab. This validation will give you the confidence that your architecture and the products selected will operate within the expected performance parameters.



Getting Started

Consider the following to establish a systems integration platform. A printable checklist is provided in Appendix D.

1. Establish a working group within your C2 organization led by a Systems Architect.
2. Leverage your systems integration strategy to identify the appropriate approvers, resources, participants, and stakeholder representatives.
3. Provide appropriate training for both non-technical and technical personnel on systems integration architecture.
4. Engage external consultants to assist with the implementation and transition (optional).
5. Select a pilot project that is not too large in scale, but will demonstrate the C2 value.
6. Evaluate and select technology tools that best fits your systems integration strategy.
7. Train appropriate technical staff on new technology tools.
8. Implement the technical layers of your systems integration platform and execute the pilot project(s).
9. Define a transition plan, including implementation and change management procedures.
10. Communicate the results of the pilot project(s) and the C2 value achieved in the pilots, as well as the challenges and lessons learned.

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ABBREVIATIONS, ACRONYMS, INITIALISMS, AND SYMBOLS

AAR	After Action Report
A-CERT	Airport Community Emergency Response Teams
ACRP	Airport Cooperative Research Program
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
BCA	Benefit Cost Analysis
BCT	Boca Raton Airport
C2	Communication and Collaboration
CBP	Customs and Border Protection
CDM	Collaborative Decision Making
DFW	Dallas/Fort Worth International Airport
DEN	Denver International Airport
EDM	Enterprise Data Management
EOC	Emergency Operations Center
ESB	Enterprise Service Bus
FLL	Fort Lauderdale-Hollywood International Airport
FWG	Functional Working Groups
GA	General Aviation
GIS	Geographic Information System
GPT	Gulfport-Biloxi International Airport
HKIA	Hong Kong International Airport
HMI	Human Machine Interface
HR	Human Resources
IATA	International Air Transport Association
ICC	Incident Command Center
ICS	Incident Command System

IDF	Intermediate Distribution Frame
IROPS	Irregular Operations
IRR	Internal Rate of Return
JUA	Joint Use Agreement
LAX	Los Angeles International Airport
LOI	Letter of Intent
MCO	Orlando International Airport
MDF	Main Distribution Frame
MIA	Miami International Airport
MKE	General Mitchell International Airport
MSP	Minneapolis–St. Paul International Airport
NextGen	Next Generation National Airspace System
NIMS	National Incident Management Structure
NIST	National Institute of Standards and Technology
NPV	Net Present Value
OEM	Original Equipment Manufacturer
PDX	Phoenix Sky Harbor Airport
PI	Profitability Index
PII	Personally Identifiable Information
POD	Point of Dispensing (Medication Center)
PP	Payback Period
SaaS	Software as a Service
SAN	San Diego International Airport
SFO	San Francisco International Airport
SLA	Service Level Agreement
SME	Subject Matter Expert
SMF	Sacramento International Airport
SMS	Safety Management System

SOA	Service-Oriented Architecture
UI	User Interface
WESTDOG	Western Airports Disaster Operations Group

APPENDIX A: Financial Considerations

Project justification will either be one of the first steps of the actual project itself, or it will be a significant part of your overall planning analysis. Regardless, a key deliverable of this activity is a feasibility analysis. A feasibility analysis is important because it drives the development of your project proposal, which can be presented to senior management to gain their commitment to the project and to obtain project funding. Your feasibility analysis should include the steps shown in Figure 24:

Figure 24. Feasibility Analysis Steps



This appendix is meant to assist operations/security/public safety managers at airports in developing a thought process and justification plan for their projects related to C2 with an emphasis on IT solutions.

STEP 1. IDENTIFY PROJECT ALTERNATIVES

The first step of performing a feasibility study is to identify potential alternatives for your project. Brainstorming and collaborative team meetings discussed throughout this Guidebook are useful tools in this stage of problem solving. Potential alternatives include:

1. **Do nothing.** A valid option is to remain with the status quo and not implement an application at all. Remember, you do not have to automate everything.
2. **Reengineer the (manual) processes, not the computer-based process.**
3. **Enhance existing processes.** Look at existing processes and either add new features, substitute or combine components, or eliminate processes.
4. **Purchase a packaged application and integrate.** Perhaps your best alternative is to choose one or more commercial-off-the-shelf packages developed by a software company that specializes in the problem domain that you are attempting to automate.

The important thing is to identify several viable alternatives for your project so that you may assess and then compare them to select the best one for your airport. Once alternatives have been identified, the collaborative team should identify potential sources for funding. Sources of funds can be airport funds (internally generated), passenger facility charges, Airport Improvement Program (AIP) funds, other grant sources, or bonds. Identifying potential sources of available funds early in the assessment process will increase the likelihood of project acceptance.

STEP 2. DETERMINE ECONOMIC FEASIBILITY

Investments in projects involve the expenditure of capital, Operations and Maintenance funds, and other resources to generate future benefits, whether in the form of revenue, cost savings, or social/intrinsic benefits. For an investment to be worthwhile, the future benefit should compare favorably with the expenditure of resources needed to achieve them.

Economic feasibility of a project alternative answers the basic question, “Does the project make financial sense?” You can attempt to answer this by performing a benefit-cost analysis (BCA), which compares the costs of the project to its benefits. The alternatives should be evaluated on the basis of their contribution to net cash flow, the amount by which the benefits exceed the costs, because the primary objective of all investments is to improve overall organizational performance.

Most Airport Operators are already adept at performing BCAs, as it is required by AIP authorizing legislation for airports applying for funding for capacity-enhancing projects requiring \$10 million or more, and other projects as requested. There are several publications that outline how to perform a detailed BCA including “ACRP Synthesis 13; Effective Practices for Preparing Airport Improvement Program Benefit-Cost Analysis” and “FAA Airport Benefit Cost Analysis Guidance.” The BCA outlined in this section will be less robust than is required under the AIP program; however, the economic analysis is still an important step in the overall evaluation of project alternatives.

Table 4 lists some of the potential costs and benefits that may be incurred by an IT software project. Although the list is not comprehensive, it provides an indication of the range of factors that you should take into consideration when assessing the economic feasibility of a project. The table includes both quantitative factors (costs or benefits for which monetary values can easily be identified) and qualitative factors (costs or benefits that are subjective in nature). Both kinds of factors should be taken into account when performing a BCA.

Table 4. Potential Costs and Benefits of an IT Project Related to C2

Type	Potential Costs	Potential Benefits
Quantitative	Capital Costs <ul style="list-style-type: none"> • Hardware/software purchases • Construction costs (if applicable) 	<ul style="list-style-type: none"> • Reduced operating costs
	Operation and Maintenance Costs: <ul style="list-style-type: none"> • Cost of labor (salary + benefits) • Ongoing support costs for the application • Upgrade costs of existing hardware/software • Training costs for users to learn the application • Costs associated with forming and managing stakeholder groups 	<ul style="list-style-type: none"> • Reduced personnel costs from a reduction in staff • Increased revenue from enhanced information sharing affecting operations and reduced downtime
Qualitative	<ul style="list-style-type: none"> • Increased employee dissatisfaction from fear of change • Stakeholder will not adopt new process • Negative public perception from layoffs as the result of automation 	<ul style="list-style-type: none"> • Improved decisions resulting from access to accurate and timely information • Expanded range of partnerships, both formal and informal • Improved capacity for collaborative planning and service delivery • Increased effectiveness across programs due to better working relationships with stakeholders • Opportunities to link related services to each other, as a result of coordination between departments and levels of government • Positive public perception that your organization is an innovator

STEP 2.1. QUANTITATIVE BENEFIT COST ANALYSIS

There are several economic evaluation methods to assess an investment in a project. The most widely used methods are Net Present Value (NPV) and Internal Rate of Return (IRR). To perform a quantitative

BCA, you need to identify the initial monetary costs of the project (capital), the expected monetary costs of operating and supporting the project, and the expected future monetary benefits of the project. Because these costs and benefits are accrued at different times, some immediately and some in the future. You need to convert the costs to present-day values so that you can compare them fairly.

Present value is the value of a future cash stream discounted at the appropriate market interest rate, called the discount rate. The present value of the future cash flow can be calculated using the following equation:

$$PV = \frac{FV}{(1+r)^n}$$

Where: PV = present value of the amount
 FV = future value of the amount n periods from now
 r = discount rate
 n = year that the amount occurs

NPV is adding the present values of each individual positive or negative cash flow based on the opportunity cost of capital. In this case, the “present” is taken at the time at which the evaluation is carried out.

In order to evaluate the net benefit of an alternative, it is advised that you also calculate its IRR, which measures profitability as a percentage showing the return on each dollar invested. IRRs are important because your organization can often invest its money in several projects at any given time; therefore, it wants to choose the ones that provide the best payback for its investment (i.e., the ones with the greatest IRRs).

IRR is also important from a risk management point of view, as high-risk alternatives should have a greater IRR than low-risk alternatives. For example, if alternatives A and B both have IRRs of 15%, which is a better one to undertake? It is difficult to ascertain unless you also analyze qualitative benefits, discussed below, and risk. If alternative A has a lower risk than B, then it is the better one, as its risk-to-return ratio is superior if qualitative benefits are the same. IRR is an important economic measure because it allows you to compare investments of different scope and size, and therefore is a critical deciding factor in determining whether or not a project should be undertaken.

There are other types of financial analysis that can be used to evaluate a project investment, as shown in Table 5. All of these financial measurements can be performed using any version of Microsoft Excel, or any alternate spreadsheet app, including Numbers and Google Sheets.

Table 5. Types of Financial Analysis

Return on Investment (ROI)	Net cash receipts of the project divided by cash outlays.	A higher ROI is ideal.
Payback Period (PP)	Amount of time for an investment to generate sufficient cash flows to recover its initial cost.	A shorter PP is ideal.
Profitability Index (PI)	Measures relative profitability of an investment. Equal to PV of cash flows divided by initial investment.	Favorable if PI is greater than 1.

Remember to evaluate each project alternative to compare which project has the more favorable quantifiable outcome.

STEP 2.2. QUALITATIVE BENEFIT COST ANALYSIS

If you can quantify the qualitative aspects of a project, the evaluation of project alternatives will yield better and more defensible results. The following steps should be followed in order to address qualitative benefits of a project:

1. Identify the qualitative factors utilizing your brainstorming and collaborative team. Table 1 includes some common general qualitative attributes to help get you started.
2. Quantify the importance of each factor to your organization. For example, give each factor a rating of 1 to 5, where 5 is the most important.
3. Numerically rate each alternative against each qualitative factor. For example, rate each alternative on a scale of 0 to 10 where 10 is the highest possible rating.
4. Multiply the importance weighting by the rating for each alternative.
5. Calculate the overall score for each alternative by summing the individual scores.

Look for the benefits first. You should first look for the benefits of a project and then determine if you can afford it. It is an issue of perspective: if you know the benefits first, then you are able to quickly decide whether or not the project has a chance of addressing a need and being successful. If you begin by looking at the costs, you are more likely to buy into the project, and you can become more motivated to falsely justify the project by improperly estimating costs. If the project offers very little in the way of benefits, you can stop it right there.

Allocate costs fairly. If your project requires hardware or software upgrades that other applications also need, then you should not have to bear the full cost of the upgrade. You will need to negotiate your portion of the upgrade with senior management.

Allocate benefits fairly. Many benefits can be achieved through the improvement of business processes, without the need for additional automation. The only benefits that you can claim are those that are the direct result of the software.

STEP 3. DETERMINE TECHNICAL FEASIBILITY

You should document the advantages and disadvantages of each technology alternative that your collaborative team identifies. Part III of this Guidebook provides a process to evaluate how technology can help your organization achieve C2. Because technologies evolve quickly, if you discount a technology today you should document what needs to occur for it to be reconsidered at a later date. For example, a document sharing software may fail your technical assessment because the current version is too robust for your organization, but you might reevaluate it if additional departments within your organization are also looking for such a solution.

Table 6 describes two basic categories of issues that should be addressed by a technical assessment. The first category addresses hard-core technology issues such as the scalability of the technology, whereas the second category addresses market issues with the technology such as the viability of the vendor. Both categories are important to adequately assess the technical feasibility of a project.

Table 6. Some Issues to Consider when Determining Technical Feasibility

Technology Issues	Market Issues
<ul style="list-style-type: none"> • Performance • Ease of learning • Ease of deployment • Ease of support • Operational characteristics (i.e., can it run 24/7?) • Interoperability with your other key technologies • Scalability 	<ul style="list-style-type: none"> • Vendor viability (i.e., is it likely that they will be in business in two years? In five?) • Alternate sources for the technology, if any • Third-party support for related products and services • Level of support provided by the vendor • Industry mindshare of the product (i.e., is the market gravitating toward or away from this technology?)

STEP 4. DETERMINE OPERATIONAL FEASIBILITY

Operational feasibility is the process of examining the likelihood that the project will achieve its desired goals, and can solve the business problem identified at the project justification onset. The operational assessment should address which project alternatives fit within the current business structure, or can be adopted without significant disruption. The issues listed in Table 7 are meant to assist your collaborative group in identifying those operational issues of each project alternative.

Table 7. Issues to Consider when Determining the Operational Feasibility of a Project

Operations Issues	Support Issues
<ul style="list-style-type: none"> • What tools are needed to support operations? • What skills will stakeholders need to be trained in? • Do you have the requisite skills to implement and maintain the technology solution? • What processes need to be created and/or updated? • What documentation does Operations need? 	<ul style="list-style-type: none"> • What documentation will users be given? • What training will stakeholders be given? • How will change requests be managed?

STEP 5. DETERMINE POLITICAL FEASIBILITY

Will this project be allowed to succeed? The proposed project can be determined to be feasible from an economic, technical and operational aspect, yet still not be accepted by senior management or a Board for political reasons. The project champion will need to be cognizant of the political landscape and present the feasibility study appropriately.

The project champion should involve and inform stakeholders and senior management throughout the process in order to increase the likelihood of acceptance.

FINAL CHECKLIST

- 1. Document your assumptions:** Document any assumptions you make during the feasibility study. This is important information that management needs to judge the validity of your work.
- 2. Follow the steps:** Identify project alternatives, perform economic feasibility, evaluate technical feasibility, assess operational feasibility, and gain an understanding of the political environment.
- 3. Prepare a presentation:** Remember that your project is competing for funding along with many other viable projects across your airport organization. Presenting the results of your feasibility study will show your audience that the project proposal was thoroughly vetted, and provides benefits (quantitative and qualitative) to your organization.

APPENDIX B: Best Practices Summary

The following is a compilation, sorted alphabetically by entity, of C2 success stories, highlighting both individual (siloe) successes of smaller C2 initiatives and successes of C2 projects that were part of a larger C2 effort. The two Management Hackathon summary reports in Appendix E should be considered part of this compilation.

Cultures that enable/support better C2:

- **Lessons Learned** – open to (give and take) constructive criticism and feedback with the goal of improving processes and behaviors
- **Customer-centric** – e.g., if a passenger needs help, it is everybody's responsibility to provide assistance; everybody benefits from improved customer satisfaction
- **Process-Driven** – concerted effort to evaluate and improve processes on a regular basis
- **Consensus** – team effort to work through things; collaborative decision making
- **Training** – continuous improvement of knowledge and skills
- **Progressive** – forward thinking, embracing innovation

BOCA RATON AIRPORT (BCT)

- BCT is currently working with a local university to develop a database tool in exchange for use of airport property. The airport can use this to create distribution tags for emails.
- The Boca Raton Airport Authority compiled a working group consisting of Board members, Authority staff, and Airport stakeholders including a diverse group of pilots, administrators, tenants, business leaders, and the general public to hold a visioning workshop. The goal of the workshop was to focus on how the Airport could continue to drive economic development and growth in the City of Boca Raton. Several strategic initiatives including and corresponding objectives were developed from the workshop.

CENTENNIAL AIRPORT (APA)

- At APA, the Executive Director takes on the role of the C2 Champion, as he is also the Executive Director of an airport-sponsored charitable foundation; this allows him to build relationships with many of the airport's stakeholders during foundation outreach efforts.
- The Executive Director frequently uses simple call trees, which identify who needs to be informed during which type of event.

DALLAS/FORT WORTH INTERNATIONAL AIRPORT (DFW)

- DFW hired an analyst to assess type, frequency, usefulness, and distribution of various information. The purpose is to identify overlap and make sure that the appropriate stakeholder only gets relevant and needed data.

DENVER INTERNATIONAL AIRPORT (DEN)

The interview discussion, which was centered on deployment of Aerobahn Ice-Man system (used by DEN for managing the collaborative environment of deicing), yielded the following valuable high-level assessment items:

- In order to effectively use this tool, DEN had to establish a new and improved means of C2 among the key stakeholders.
- The process used can be adopted by any airport of any size.

- The process required an initial set of five collaboration workshops where all stakeholders contributed in defining the criteria for success. For these workshops to be successful in improving communication and collaboration, the following was needed:
 - They first had to define what they wanted to improve: managing de-icing queues and reducing all the negative aspects around the poor management (delays, fuel costs, frustrated passengers, etc.)
 - Then ground rules needed to be set: most importantly, nobody could have the mind set of “If they lose, I win.” For those in the room that had this mindset, DEN explained how this attitude was in the long-run, false.
 - Once agreement to the process was achieved by all stakeholders, compliance and penalties to non-compliance were defined. This was important to be able to set the ground rules.
 - A Concept of Operations was written defining all operational procedures.
- Using the concept, they established the parameters of the tool, and ensured that every stakeholder received a dedicated user license for this tool.
- After the workshops achieved their goals, and the tool was in place, they conducted training with an expanded set of stakeholders, thus achieving awareness across all divisions.
- They set the program in place and have recognized a measureable improvement over the first year:
 - During deice, saved 2.6 minutes per aircraft = \$107.30 per aircraft
 - \$88,000 per deice day
 - \$5.8 million per season estimate
- Lessons learned include:
 - The system has become self-policing
 - Communications has greatly improved, showing equally impressive improvements in process efficiencies
 - Having the means to track compliance, does not necessarily mean strict enforcement - common sense must be applied to a new process such as this.

FORT LAUDERDALE-HOLLYWOOD INTERNATIONAL AIRPORT (FLL)

- The director of security has one key contact at each of his stakeholders who he nurtures with frequent communication and the sharing of interests and concerns. In turn, each contact relays this interaction to the rest of their organization to maintain continuity and standardization.
- He has established an Advisory Group of critical stakeholders (e.g., VP level at each of the carriers, a ground handler, a concessionaire, etc.) who he discussed issues with and uses for decision-making purposes, mostly in a one-on-one fashion, as the issue dictates.
- He uses video clips in group settings with his stakeholders to get the attention of the airport community on issues of importance. By showing slips and falls, aircraft incidents and accidents, and security breaches, etc., he is able to discuss with tenants the right and wrong ways to do things. This process has been well received and well attended.
- FLL uses Geofeedia, a location-based social media monitoring platform to create an electronic fence around a location to centrally monitor all social media. This solution is also integrated with Everbridge to share the information with any stakeholder connected to the system.

GENERAL MITCHELL INTERNATIONAL AIRPORT (MKE)

- MKE developed clear, detailed IROPS procedures describing when airlines and the Airport Operator should complete specific tasks.

- During an event, the airport's Operations division then ensures that these procedures are followed by the airlines and the airport staff. In case any help is needed, the airport's Operation's division takes the lead in coordinating efforts between the two parties.

GULFPORT-BILOXI INTERNATIONAL AIRPORT (GPT)

- The director of planning discussed how the airport went through major terminal renovations; the airport had a banquet, invited airlines and concessionaires, and gave out t-shirts, etc. Airport management liked how the people got together at the banquet, shared stories, and built comradery.
- The airport believes that good record keeping is key so you can go back and make sure lessons are learned; and needs to have good records of airplane incidents for insurance, ops, etc.
- The airport pays an annual fee for satellite phone. They maintain five phones to keep communication open during a disaster when the internet is down.

MARICOPA ASSOCIATION OF GOVERNMENTS (MAG)

- MAG's way to escalate issues is to communicate priorities through a committee organizational structure, which consists of the following:
 - Regional Council at top (composed of board and elected officials) – high turnover.
 - Management Committee (city managers) – longer tenure; professionals – they make recommendations to Regional Council.
 - Many Transportation Committees, like (air quality, street etc.)
 - Mode-Specific Committees, e.g., Bike and Pedestrian committee. These are experts and their role is to provide their expertise on streets, bikes, and pedestrians, etc., depending on their specialty.
- Web-based collaboration tools will be important to MAG in the future, and they are looking into making investments now. MAG believes web-based collaboration tools will make in-person meetings more effective by sharing information ahead of meetings with other groups. This will push stakeholder collaboration faster, and drive better participation. For example, not many people show up for corridor improvement meetings, which are held in the evening. Usually there are more staff members and consultants there than the public. They average 50–60 people in their meetings versus having 700 people respond to online information. They want to make it easier for the general public to provide input at their convenience, instead of having to go to a public meeting.
- Extensive collaboration early on among stakeholders improves the process and project outcome since issues are identified early.

MIAMI INTERNATIONAL AIRPORT (MIA)

- MIA was the first airport in the country to provide behavior detection training; every new hire gets customer service and behavior detection training. They have a Memorandum of Understanding (MOU) with the police department to conduct the behavior training; every employee takes a 45-minute class to be able to detect odd behavior.
- MIA is in the process of building a centralized operations center. In addition to gaining operational efficiencies from the command center being in a single location, the airport will benefit from a reduction in operating costs from maintaining employees in multiple work locations throughout airport property.

MINNEAPOLIS–ST. PAUL INTERNATIONAL AIRPORT (MSP)

- MSP has created a culture of inclusion and partnership, guided and demonstrated by senior leadership. Numerous teams, committees, and informal but regular get-togethers exist among the airport community. This fosters understanding, trust, and respect. This also results in community members who know each other well enough to know who to go to for help or information sharing, depending on the situation.
- The Field Maintenance department justified the cost of hiring additional snow equipment operators by working with the hub carrier to identify savings that would result from greater runway availability. This was made possible because the carriers at MSP know their costs of operation by calculating them based on “per minute of delay.”
- Their director of emergency management uses a federal tool called the National Homeland Information Network (HSIN), a SharePoint site with built-in Adobe Connect, as a primary means of contact on a day-to-day basis with all key stakeholders. It is a pull (not a push) process that allows incidents, status reports, and general information to be posted to the site for access by all appropriate personnel. His next step is to integrate resource management into this system.
- The Office of Emergency Management (OEM) uses a technology called Swift Reach for internal communications (including mass communication) during incidents.
- He plans on integrating resource management through the use of Web Emergency Operations Center (EOC), to facilitate interaction with the county. It is a practical tool that provides status in real time, overall better situational awareness, and the potential for virtual command and control. This will replace the current process where one agency has to log into the other agency’s operating system to communicate through technology.
- He intends on customizing and modifying the HSIN network to facilitate virtual connectivity, rather than having to have all parties respond to a physical EOC location, unless absolutely necessary.
- The director’s key method in gaining and maintaining positive stakeholder relationships lies in his belief that execution is as important, if not more important, than relationships. What he means by this is that his department must walk the talk in its interactions with stakeholders to gain their trust and respect, and subsequent partnership. His staff needs to be fully trained, knowledgeable, consistent, and reliable in their performance. If they say they are going to do something, they better be able to do it, and do it in the timeframe promised. If this level of performance does not exist, relationships will not be strong. To make all of this happen, OEM must have a clear vision, identifiable goals, and well-defined roles and responsibilities.
- A special program, called MIST (MSP Incident Support Team), has been developed by the Metropolitan Airports Commission staff that greatly facilitates C2, creating efficiencies. MSP’s MIST initiative provides for scalability of response and minimization of redundant and oversized response activities. Through MIST, virtually any out-of-the-ordinary event of any significance would result in the forming of an Incident Command (IC), normally under the command of a police or a fire supervisor, depending on the situation. If an expanded response is needed, the IC would call out the remainder of the “Big Four” departments—Police, Fire, Airside Operations, and Field Maintenance—and a Unified Command (UC) would be formed. Under many circumstances, these four responding elements would be sufficient to deal with the event. If the situation were to require additional resources, the UC would have Communications make the calls to whatever departments or mutual aid elements are required. If at any time in this process it is determined that other airport

stakeholders may be affected adversely by the incident, MIST would be activated by the IC or UC. Then calls would be made to representatives of the airlines and other tenants who know to respond to the situation room where they will receive status reports and will be in position to assist the IC/UC as required.

ORLANDO INTERNATIONAL AIRPORT (MCO)

- A qualitative example is with the badging process for access control. MCO must process over 18,000 badges for controlling physical airport access, but the badging office has not advanced much, and the application process is slow and drawn out, and not very efficient. The airport reached out and communicated with all of the stakeholders, i.e. people who work at the airport and require security badges, with the airlines being the largest group. They surveyed these stakeholders, held face-to-face meetings, and were able to obtain very good feedback and input on how the airport could improve and streamline its badging process. They made many changes to improve the process. The atmosphere is much better now. The airlines like the new process and the airport has leveraged automation where applicants can submit information online and do not have to come to public counters anymore, where long lines tended to form. The airport also offered computer training for stakeholders on the new process.
- Another example is on an initiative the airport undertook to improve customer service. There are 38.5 million passengers that come through the airport and the airport wanted to improve their customer service levels. They engaged a consultant and included all airport concessionaires to establish an improvement plan and train all airport employees on customer service. They held community meetings, and did outreach using software purchased to monitor social media, such as Twitter and Facebook, to assess what people were saying about their experiences at the airport. This collaborative initiative led to increased levels of customer satisfaction as evidenced by customer satisfaction surveys.

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT (PHX)

- PHX tries to be as inclusive as possible and share openly. The airport's IT department helped secure a document portal available through the public website. They put airport emergency and other contingency plans for stakeholders on the portal. A stakeholder needs an account, and then has access to emergency/disaster plans. The challenge is with SSI, but otherwise, the airport will openly share documents.

PORTLAND INTERNATIONAL AIRPORT (PDX)

- PDX is big on National Incident Management Structure, and uses the Incident Command System (ICS) process for most response, regardless of how small. Escalation decisions are made by the initial IC, who very often will be an operations specialist on the airfield. For longer term events and those that would require the Public Information Officer to respond, the EOC would generally be formed, and all information flow decisions would be made by the Emergency Manager in the EOC at that point.
- PDX has an "Airline specific notification system" that would be used if, for example, a situation was evolving that would require their representation in the IC or EOC.
- PDX coordinated with the county health department to write the airport's communicable disease plan. For example, if someone comes in with the measles or TB, the County Health Department is one of the first entities called. Airport staff can then help the County Health Department staff to get airline manifests. That relationship really pays off, since medical events happen regularly. That work

with the county department also led to coordination with state agencies regarding refugees from the Japan tsunami. The airport had a radiation plan, and worked closely with the state when arrivals came in from the affected area.

- PDX works well with external stakeholders in creating partnership relationships. They work with the Centers for Disease Control (CDC) and the county health department on a Communicable Disease Response Plan, the Regional Hospital Group for mass casualty incidents (train together during their triennial Airport Emergency Plan [AEP] exercise), the medical examiner's office on handling the deceased, and the Red Cross for needed resources during any type of large event. Finally, PDX is a Point of Dispensing (Medication Center) in support of the Cities Readiness Initiative, which exists to support mass casualty accidents in other regions of the US. PDX also has a strong Family Assistance Center program.
- Informal get-togethers are also encouraged and practiced at PDX to include everything from happy hours with TSA and airline personnel to informal lunches. They firmly believe that the more you get to know one another, the easier it is to find the right person to help in times of trouble.
- As a safety element for their 400 employees, PDX has Floor Captains and Fire Teams in their office building to provide structure to their evacuation and other safety-related plans.
- “*Bubba Network*” – informal, face-to-face individual meetings or group workshops where stakeholders can have C2 conversations and exchange business cards. Attendees can get to know one-another and clarify who can or should be called when help or information is needed. Even if it is not always clear who to call right away, calling someone in the network or someone met at the get-togethers will quickly lead to identifying the appropriate contact.
- To ensure problems are discovered, documented and corrected, PDX conducts hot washes (debriefs) after medium-sized events. For larger events, they create an After Action Report (AAR) and an Improvement Plan to ensure status gets updated along determined timelines.
- PDX is compliant with the Federal Emergency Management Agency's (FEMA) Homeland Security Exercise and Evaluation Program, which requires an agenda, workshops, and AARs in a formalized training/evaluation process.
- PDX employs Plan-Based Exercises for training. They will pick a specific plan, such as the Communicable Disease Response Plan or the Power Outage Plan, and do an exercise or a Functional Workshop around that plan to ensure everyone is up to speed on their responsibilities.

SACRAMENTO INTERNATIONAL AIRPORT (SMF)

- In the recent past, the airport has begun to encourage all stakeholders to offer their opinions and suggestions before making a decision that will affect those stakeholders. This process, in and of itself, has engendered a more trusting environment, and has encouraged even greater participation by stakeholders. As a result, better decisions are made and the early participation has created a buy-in that facilitates employment of the decision.
- Good two-way communication creates better information flow. To quote the interviewee, “The better informed, the better we work together, especially during emergency response for airport operations.”
- Since C2 has started to improve among the stakeholders at the airport, the airlines and concessionaires have reached agreement on the best course of action for enhancing retail and food

and beverage offerings to the public, such that money is now being made “hand over fist” in the revamped Terminal A

SAN DIEGO INTERNATIONAL AIRPORT (SAN)

Customer Satisfaction Data: The airport overlays customer satisfaction data with its revenue timeline data. This revealed that the airport had periods of higher revenue at the times that customer satisfaction scores were also high. This suggests that these two variables are positively correlated, which prompts the airport to strongly focus on gathering customer feedback to improve customer satisfaction.

Ideas around Innovation Lab: SAN’s focus on innovation resulted in developing an Innovation Lab, where vendors can come in and run/test/showcase solutions. In conjunction, SAN established a Customer Service Steering Committee, which initiated a change in how committee members work together to address innovation related issues. SAN is working on developing a process on how to best turn innovative ideas into workable solutions. This could include the following steps: the newly established Business Development department is researching the conceptual idea; getting required buy-in; handing it off to an internal sponsor or owner; getting approval for some funding; and rallying all stakeholders and implementers. SAN is continuing to experiment with this process and analyze its feasibility.

SAN FRANCISCO INTERNATIONAL AIRPORT (SFO)

- They have monthly Emergency Operations Group Meetings, a weekly Security Operating Group meeting with all stakeholders, and a Quarterly Security Council made up of all leaders/high level policy makers to have strategic discussions. They also have an airline ground handlers meeting where they discuss safety and rules and regulations; a local runway safety team that includes the Airlines for America team; and an International Terminal Operations committee. Finally, they have an Aircraft Recovery Team and Strike Teams. Duty Managers pull together any ad hoc meeting they need. They have two duty managers 24/7 who serve as the first point-of-contact for any challenges. The airport views them as the incident commanders whose role is to deal with the situation quickly, or to bring a team together if necessary. They have a great amount of authority and can make decisions for the airport.
- A Quarterly Security Council is composed of the Federal Security Director (FSD), the highest ranking official of the Federal Bureau of Investigation (FBI), Customs and Border Protection (CBP), the Chief Operating Officer (COO), Deputy Director of Operations, Director of Safety and Security Services, the County Sheriff, and the Police Chief. The last topic discussed was SFO’s security posture in light of the events in Brussels, and whether the airport should change direction. There was a debate among some who felt strongly one way or another, and the airport had to balance all of that. There has never been a situation where the Council had to come together specifically for an event (although they would if needed), because this Council deals strictly with strategic decision-making, leaving the tactical decisions to teams at levels below.
- SFO has established a strong culture of inclusion in their planning and decision-making, which has allowed for a quick, consensus-style response to events, and to a proactive rather than reactive approach to improvement. In their words, good communication and collaboration “is an investment for us.” Examples of this abound:
 - Working with the air carriers and others, they quickly put together a working group to respond to the Ebola scare, creating guidance documents and plans in the event of problematic arrivals at SFO.

- They plan in advance with the TSA for the possibility of long checkpoint queues, allowing them to stay ahead of problems.
 - They have numerous standing committees of staff and stakeholders that deal with safety, security and operational issues
 - Their Quarterly Security Council is another standing committee that deals strictly with strategic decisions, leaving the tactical decisions to teams at levels below. The Council is made up of the highest ranking among the local FBI, CBP, County Sheriff and the Airport Director and COO.
 - The Duty Manager hosts a daily morning briefing for all tenants who choose to call-in
 - In addition to the plethora of collaboration processes, the airport also employs a theme of putting only the appropriate people in the room when problems need to be solved. They stated that less is more when it comes to making good decisions.
 - To ensure things don't slip through the cracks, SFO documents their response to each event with an AAR, and conducts follow-up to ensure corrective actions are taken.
- SFO is looking at technology that can facilitate their C2 processes. Specifically, they are interested in what can help them with their roll-out of Safety Management System (SMS). They believe they need something to replace their in-house developed Part 139 compliance software, to add flexibility. They stated that, “there are a lot of nice off- the-shelf products, and SMS is high on our list.”
 - They looked at the Brussels event and did a loose tabletop. They walked through the events overseas and talked about what they should do differently at SFO to prepare. They walked out with a good bit of work to do. They also looked at the shooting at LAX and walked away needing to do more with terminal evacuations.
 - As for documentation, SFO has written plans and agreements, including an LOA with ATCT, an MOU with regulators, SOPs, a CONOPS document, an Emergency Plan, a Business Continuity Plan and Communications Plans.
 - SFO tries to make things tangible for their employees and stakeholders, with the belief that if people are involved in decision making and problem solving, they will take pride and ownership in the results. For example, to solve a recent ground transportation problem, they formed a working group to lay out the specifics of the problem and define the challenges. In working toward a solution, the words “can't” and “no” were unacceptable. (In other words, failure was not an option.)
 - SFO is big on bringing in specialized third-party vendors to help them with problem resolution, assessments of operational capabilities, and training (most recently, airport-wide active shooter training.) Of course, as a large airport, it is easier for them to find the funding for this practice.

APPENDIX C: C2 Health Assessment Questions

C2 ASSESSMENT

Chapter 4:

1. Do you have a shared C2 vision?
2. Do you have a C2 champion?
3. Do have an organizational structure in place?
4. Do you have a governance model?
5. Do you have roles & responsibilities defined?

Chapter 5:

6. Do you use in-person (face-to-face) meetings or get-togethers to initiate stakeholder relationships?
7. Do you utilize a structured approach when conducting face-to-face meeting?

Chapter 6:

8. Do you identify information sharing requirements as part of improving C2?
9. Do you utilize a structured approach to identify info sharing requirements?
10. Do you formally document information sharing requirements?

Chapter 7:

11. Do you have written policies and procedures that govern C2?
12. Do you include your stakeholders when developing C2 policies & procedures?
13. Are your policies & procedures standardized?

Chapter 8:

14. Do you have KPI's identified to continuously improve operational efficiencies?
15. Do you apply C2 contributions to KPI measuring?

Chapter 9:

16. Do you use partnering or alignment agreements to improve C2?
17. Do you consider your agreements to be well developed?
18. Do you have the appropriate agreements in place to cover the airport in regard to sensitive and protected information?

Chapter 10:

19. Do you provide different types of training for stakeholders to improve C2?
20. Do you carefully identify the appropriate stakeholders for each training?

Chapter 11:

21. Do you make the sustaining of stakeholder involvement an intentional effort?
22. Do you include strategies for sustaining stakeholders early in the planning phases?
23. Do you have a formal approach to sustaining and continuously improving C2 efforts?

IT ASSESSMENT

Introduction:

1. Do you leverage Social Media options to improve C2?

Chapter 12:

2. Do you leverage an enterprise data management (EDM) strategy to improve information sharing?

Chapter 13:

3. Do you have a communications architecture that includes various communication technologies in place to facilitate C2 during any operational scenario?

Chapter 14:

4. Do you control data access through access privileges?
5. Do you have a technology platform in place that allows data to be delivered to and displayed on multiple devices?
6. Do you have a technology solution that enhances situational awareness among stakeholders?
7. Do you deploy any data visualization tools?
8. Do you use mobile devices as part of your C2 efforts?

Chapter 15:

9. Do you have a strategy to address how to integrate disparate systems used in C2?

Chapter 16:

10. Do you have an integration platform solution?

APPENDIX D: Checklists

CHAPTER 4: ESTABLISH COMMITMENT AND STRUCTURE – SHARED C2 VISION



- Get management support for developing a common vision, mission, and values statement.
- Identify a champion who is responsible for leading group discussions and facilitating the creation of a common vision, mission, and values statement. Consider identifying a deputy champion who can take control to keep the C2 efforts on track in case personnel changes occur.
- Have the champion establish a Work Team of executive staff from the airport and participating external stakeholders.
- Hold face-to-face meeting(s) to co-create the draft vision, mission, and values statements. Create and use a process that ensures full participation, openness and creativity. Research has shown that vision, mission, values statements can improve performance providing they have the following characteristics:
 - Statements should be concise and clear.
 - The vision statement explains what the airport is striving to become in the future, and does so in a way that creates understanding and alignment throughout the airport. It needs to be both inspirational and aspirational; a catalyst for change.
 - The mission statement accurately describes the responsibilities of the airport currently, day-to-day.
 - The values statement incorporates those aspects of the community's culture that serve to support and forward the mission and vision of the organization, and are both lofty and specific.
- Ensure the champion documents each statement in written drafts, ensuring the following answers are provided in each statement:
 - Vision: Where are we going? (future oriented)
 - Mission: Why do we exist? What greater good do we serve? (significant purpose)
 - Values: What principles guide our decisions and actions on our journey? (clear values)
- Do the cosmetic work offline. Circulate statement drafts to Work Team members for edits, and then create a final draft that incorporates all team member inputs. The champion can do this offline, with volunteer help as required.
- Reach out to any outliers. If there was anyone who disagreed with any of the final documents, or whose favorite idea was not incorporated, talk with them privately to gain their commitment to the end product. Explore ways to incorporate their interests and needs.

- Reconvene the Work Team and review the final draft before sharing it with airport senior management. Also, review the draft with those stakeholders who were not participants in the process.
- Communicate the vision, mission, and values statements to relevant airport and stakeholder staff, and add to policy manuals, as appropriate. Also, post these statements on the airport website, intranet, or other communication means as applicable to your airport.
- Have the champion revisit the statements on an annual basis, and update them as needed with assistance from the Work Team.

CHAPTER 4: ESTABLISH COMMITMENT AND STRUCTURE – ORGANIZATIONAL STRUCTURE

- Start with a face-to-face meeting with representatives from all stakeholder groups to assess existing organizational structures, and to determine what type of overarching structure and governance model will work best for your situation.
- Identify the roles that will be required in order for the organization to be effective, and to promote participation of stakeholders at all levels.
- Establish rules that define how formal and informal groups operate within the organization.
- Distribute the work by establishing working groups and action committees to carry out activities needed to support the program mission.
- Be prepared to evolve your organization as you learn from your experiences over time.



CHAPTER 5: BUILD RELATIONSHIPS THROUGH FACE-TO-FACE INTERACTIONS

- Be alert for opportunities for relationship development in informal settings, both on the job and away from the workplace.
- Identify those frequently occurring events (e.g., construction activities, weather events, VIP arrivals, etc.) that could negatively impact internal and external stakeholder operations.
- List the response partners and potentially impacted stakeholders for all identified events.
- Create informal discussions around each topic to draw out wants and needs regarding response activities (e.g., what is not getting done during such events).
- Create cross-functional, interagency teams to develop drafts of corrective action plans for all outstanding issues/concerns.
- Reconvene all stakeholders and response partners to review and comment on the draft plans/suggested courses of action.
- Build the results of this input/feedback into SOPs for future events.
- Apply this same procedure to all extraordinary events, such as IROPS events, aircraft emergencies, and natural disasters, and incorporate the resulting modifications into the existing formal plans (e.g., IROPS Plan, AEP, Hazardous Weather Plan, etc.).
- Celebrate milestone successes with casual events and get-togethers to acknowledge the work that has been done jointly, and to expand and strengthen the relationships that have been developed in the process.

CHAPTER 6: IDENTIFYING INFORMATION SHARING AND DOCUMENTING REQUIREMENTS

- Get Management Buy-in: Remember how you put together your C2 shared vision statement? Now put together a similar statement (i.e., a problem statement) for management, which:
 - Describes the issues and possible consequences related to failing to identify information sharing requirements.
 - Provides explanations on how identifying information-sharing requirements can improve C2.
 - Emphasizes the alignment to the shared C2 vision.
- Break down your information-sharing requirements for each operational objective (e.g., improving on-time departures). Do not try to address the entire airport all at once.
- Prepare a few basic charts, identifying the primary stakeholders and the information to be shared by these stakeholders. Refer to the figure on pages 3–10 in “Airport CDM Implementation – The Manual” as an example of how to present this information. Press the Control key (Ctrl) and [click here](#) to access this source.
- Consider performing an “as-is” internal assessment to discover all processes, procedures, and information flows (formal and informal) in use by the information owners. Include type, frequency, usefulness, mode, and distribution, etc. in order to identify overlaps, gaps, obstacles, and opportunities. The help of a good Business Analyst can help in logically presenting this type of information.
- Hold a face-to-face meeting with at least the set of identified stakeholders. In this meeting, confirm and refine the problem statement, the information to be shared, and the risks and opportunities. It is important to discuss and understand the risks to business continuity and airfield operations that may arise if stakeholders do not share information. This is also an opportunity to note any systems used, where the information resides, and who creates and maintains the information (i.e., the system owner).
- Conduct tabletop exercises and leverage event debriefing opportunities to assess the appropriateness and effectiveness of information flow (did all stakeholders receive the information they needed and on a timely basis?) Also, note why certain information was not communicated and what the constraints were, if applicable.
- Create a spreadsheet tool and other documentation that captures the information requirements collected during these discovery efforts.

CHAPTER 7: ESTABLISH AND REVISE POLICIES AND PROCEDURES

- Identify a champion who is responsible for leading group discussions and drafting or revising a C2 policy.
- Identify to the Board the need for policy development/revision for approval of the work process.
- The C2 champion establishes a Policy Work Team and selects diverse team members to garner input on what should be covered in a C2 policy.
- Face-to-face meeting(s) are held to discuss ideas, which the C2 champion documents in a written draft.
- The draft is circulated to team members for edits, and a revised draft is created based on team members' input and feedback.
- The revised draft is coordinated through the Board for additional feedback to create a final draft.
- The final draft is then shared with airport executive management as necessary to comply with policy formulation (i.e., Board services manager, HR, Public Affairs, etc.)
- The final draft is executed as policy. The policy is communicated to Airport Operator staff, and added to any policy manuals. In addition, it is posted on the airport website, intranet, or other communication means as applicable to your airport.
- The C2 champion revisits the policy on an annual basis, and updates it as needed with assistance from the Policy Work Team.

CHAPTER 8: DEVELOP KEY PERFORMANCE INDICATORS

- Make sure that you have support with building a culture around a completely open and transparent means of C2. Having this in place will help to make a successful program for the measurement of KPIs. You should ensure full management support and, if possible, include the concept of open and transparent C2 in your policies and procedures.
- Do you have a formal means of tracking KPIs? If yes, then review the KPIs that impact your area, and identify for each KPI how C2 should contribute to the benefit of that KPI.
- If you do not have a formal set of KPIs, start one by reviewing the standard lists included in ACRP Report 19A, and pull out the KPIs that apply to your process. Then review the KPIs that impact your area, and identify for each KPI how C2 should contribute to the benefit of that KPI.
- Once you have documented your opinion of C2 contributions to the relevant KPIs, call for a face-to-face meeting with the key stakeholders to review and discuss the list. Use the seven points of “Key Contributions of C2 Effectiveness” shown at the beginning of Chapter 8 as a discussion guide during the meeting. Remember to start simple. Don’t try to conquer all the KPIs at once.
- During the meeting, identify what needs to be measured and how it will be measured for each KPI. For each measurement, associate the specific C2 requirements needed.
- Begin to measure and track. Call for periodic face-to-face meetings to assess the success, and to adjust both the KPI and C2 contributions as required.
- Set aside time to review KPI measurement results with your Steering Committee.
- Assess the benefit of new technologies to help add a layer of efficiency and productivity to your KPI monitoring and measuring program.

CHAPTER 9: EXECUTE PARTNERING/ALIGNMENT AGREEMENTS

- Hold a series of face-to-face meetings with the appropriate stakeholders in the room to develop an agreement that includes the following:
- Stakeholders involved in the agreement are identified by name, office, and title.
- Roles and responsibilities of each stakeholder are clearly defined and expressed.
- Contributions and obligations of each stakeholder are plainly identified.
- Objectives and goals are defined and included in the document.
- Timelines and assignment of tasks are built in to the agreement.
- When financing is applicable, the parties responsible for providing funding are stated. Payment schedules and milestones are included, as well as consequences if payment and milestones are not met.
- Chain of command and the decision-making process is outlined.
- Your agreement(s) have senior leadership support and backing.
- Address how personally identifiable information (PII) will be handled, who has access to sensitive information, and the ramifications for the stakeholder that does not adhere to these standards.
- Information usage is addressed. Specifically, the type of information to be used and collected; purpose of the information; how it will be disseminated and to whom; which party will maintain it and for how long; and restrictions on information use.
- References to regulatory requirements are included in the agreement, as applicable.
- Intellectual property concerns are addressed.
- Indemnification clauses are included to identify who assumes liability for certain actions, including actions of employees or representatives.
- Contact information is included for the stakeholders party to the agreement.
- Clearly state the duration of the agreement, including beginning and expiration dates. If extensions of the agreement are applicable, be sure to include the length and number of times the agreement can be extended with all parties' consent.

CHAPTER 10: ENSURE STAFF AND STAKEHOLDER TRAINING

- Start with an internal face-to-face C2 training kick-off meeting. Include, among others, HR staff in charge of training, IT representatives knowledgeable about C2 related systems, customer service management staff, operations/security/safety management, and the members of the Advisory Committee to:
 - Assess at a high level the current training status.
 - Identify training gaps.
 - Identify stakeholders that require training.
 - Discuss training approaches.
 - Designate a C2 Training Champion to lead the effort and report back to executive management.
- Hold a series of face-to-face meetings using Work Teams for divisions or functional areas (should include external stakeholders, as deemed appropriate) with all necessary stakeholders to fill in the gaps identified in Step 1.
 - Evaluate in detail the current training needs, including who (internal and external stakeholders) needs to be trained on which systems/tools, for example.
 - Establish levels of competencies that currently exist in all other training areas discussed in this chapter
 - Identify any staff who can function as trainer(s) for a possible train-the-trainer approach
- Based on the detailed analysis in Step 2, develop a stakeholder C2 training matrix.
- The C2 Training Champion reports back to the Advisory Committee to present stakeholder C2 training, discuss identified training priorities, and develop an action plan.

CHAPTER 11: REVIEW AND REFINE FOR SUSTAINABILITY AND CONTINUOUS IMPROVEMENT

- MONITOR AND REPORT
 - Measure performance
 - Collect and process performance and conformance data
 - Analyze and report performance
 - Ensure the implementation of corrective actions
 - Measure internal controls
 - Monitor internal controls
 - Review the effectiveness of C2 Program process controls
 - Perform control self-assessments
 - Identify and report control efficiencies
 - Ensure that assurance providers are independent and qualified
 - Plan assurance initiatives
 - Scope assurance initiatives
 - Execute assurance initiatives
 - Monitor, evaluate, and assess compliance with external requirements
 - Identify external compliance requirements
 - Optimize response to external requirements
 - Confirm external compliance
 - Obtain assurance of external compliance
- ASSESS NEXT STEPS
 - Continually reassess the direction of the C2 Program
 - Establish a schedule of consistent C2 Program reevaluation
 - Reevaluate the list of planned initiatives and redefine the initiatives as required
 - Assess the KPIs and their targets for the value they provide in measuring the current C2 Program objectives
 - Evaluate the performance measurement system for opportunities to improve
 - Review industry benchmarks
 - Evaluate key factors for consideration
 - Address fundamental impacts

CHAPTER 12: ESTABLISH AN ENTERPRISE DATA MANAGEMENT STRATEGY

- Establish a working group within your C2 organization led by a data architect
- Leverage your systems integration strategy to identify the appropriate approvers, resources, participants, and stakeholder representatives
- Provide appropriate training for both non-technical and technical personnel
- Engage external consultants to assist with the transition (optional)
- Evaluate and select enterprise service bus (ESB) technology that best fits
- Define initial data standards and management procedures
- Evaluate and select new technologies, if necessary
- Implement foundational components of your enterprise data management (EDM) strategy
- Execute your EDM roadmap for selected areas and pilot projects
- Define a transition plan, including implementation and change management procedures
- Communicate the EDM strategy and the C2 value achieved in the pilots, as well as the challenges and lessons learned

CHAPTER 13: ENHANCE COMMUNICATIONS SYSTEMS

- Ensure your network architects and administrators participate in the IT department's formal change management process. Establish one if it does not exist.
- Ensure your network team participates in the airport's IT project management governance.
- Network design is complex. Ensure your network team works closely with your technology vendor(s) to secure training and craft secure and extensible solutions that the vendor can support.
- Incorporate twice-yearly (optimally) network security audits using both internal and external audit organizations and/or contracts.
- Participate in the C2 practice sessions.
- Consider deploying a Mobile Command Post that can be used to extend your communications network and key Incident Command staff into the arena during extended incidents.
- Monitor the government- and industry-led initiatives to develop new communications standards and adjust your plans accordingly.

CHAPTER 14: ESTABLISH DATA DISPLAY STRATEGIES

- Establish a working group to develop best practices for delivering data to internal and external stakeholders.
- Leverage your enterprise data and systems integration strategies to determine the appropriate approvers, resources, and stakeholder representatives.
- Determine security requirements, and leverage best practices for delivering data while controlling access privileges.
- Assess and document the goals and context for how data will be used by different stakeholders across the community.
- Determine the types of devices that will be used for each scenario.
- Create a scalable reference design for each type of device.
- Design for mobile devices first, as they have the most constraints.
- Determine when to use mobile web applications versus native applications.
- Focus on situational awareness.
- Take advantage of data visualization where appropriate.

CHAPTER 15: DEFINE A SYSTEMS INTEGRATION STRATEGY

- Establish an Enterprise Systems Integration Architect role or position** – In order to work with a team of business analysts, business managers, software developers and systems/network engineers, and guide them in defining business and technical requirements for enhancing communication and collaboration.
- Understand the Airport Enterprise and Problem Domain** – This, in effect, is like requirements gathering.
- Make Sense of Airport Data** – Use the data architecture to gain an understanding about your airport’s enterprise data stores.
- Make Sense of the Airport Business Processes** – In order to determine how to approach the airport’s business model for supporting stakeholder communication and collaboration, an understanding of the airport at its process level is needed.
- Identify Airport Application Interfaces** – In addition to seeking common methods and data to integrate, interfaces also need to be addressed.
- Identify the Airport Business Events that Require a Collaborative Response** – This activity focuses on what invokes such events, and how one event may trigger other events.
- Identify Data Schema & Content Transformation** – This stage addresses how the schema and content is transformed.
- Map Information Movement** – This involves looking at where data element or interface originates. The movement of information needs to be mapped so at all times in order to know where it is physically located.
- Determine Systems Integration Strategy** – Before making a decision about your Systems Integration Architecture strategy, in addition to taking into account what you have learned from Steps 1–8, it is important to have a good idea of how you would you answer these questions:
 - How many applications or systems does your airport need to integrate?
 - Will your airport need to add applications in the future?
 - How many communication protocols will your airport need to use?
 - How important is scalability to your airport enterprise?

CHAPTER 16: ESTABLISH AN INTEGRATION PLATFORM

- Establish a working group within your C2 organization led by a Systems Architect.
- Leverage your systems integration strategy to identify the appropriate approvers, resources, participants, and stakeholder representatives.
- Provide appropriate training for both non-technical and technical personnel on Systems Integration Architecture.
- Engage external consultants to assist with the implementation and transition (optional).
- Select a pilot project that is not too large in scale, but will demonstrate the C2 value.
- Evaluate and select technology tools that best fit your systems integration strategy.
- Train appropriate technical staff on new technology tools.
- Implement the technical layers of your systems integration platform and execute the pilot project(s).
- Define a transition plan, including implementation and change management procedures.
- Communicate the results of the pilot project(s) and the C2 value achieved in the pilots, as well as the challenges and lessons learned.

APPENDIX E: Aviation Management Hackathon Summaries

DENVER INTERNATIONAL AIRPORT

PART 1: SETTING THE STAGE

Setting the Stage: The PARAS 0003 project team’s facilitator opened the Management Hackathon by having everyone introduce themselves. She then discussed PARAS 0003 in more detail by discussing how communication and collaboration, called C2, will be addressed in the PARAS Guidebook.

The Principal Investigator described the overall PARAS 0003 research process and where Management Hackathons fit in the process. The research process involves conducting a literature review; obtaining feedback from an Advisory Group (organized by the research team and includes 18 experts from the aviation industry) to validate research; conducting interviews with airport and non-airport personnel who can provide good insight on C2; and hosting Management Hackathons, like this one, in order to problem-solve C2 at airports.

Management Hackathon Process: Management Hackathons are structured problem-solving efforts conducted in fast group sessions that involve learning, diagnosis, priority setting, idea generation, idea ranking, and feedback. During Part 3 of the Management Hackathon, an “innovation café” style format was used to create known and unknown improvement opportunities; to diagnose, prioritize, and rank ideas; and to develop bold, yet highly actionable, ideas for reinventing C2 processes. Refer to Breakout #3 section on p. E-21 for a detailed description of the innovation style format.

The Principal Investigator then discussed the research team’s preliminary findings, especially C2 challenges related to data integration and systems interoperability, and major differences in implementing C2 solutions at larger versus smaller airports.

The attendees developed the following ground rules for the Management Hackathon:

- This is a brainstorm process – no commitments
- All participants will review the Summary Report and approve for distribution
- The sponsor of the Management Hackathon will ‘close-the-loop’ with follow-on deicing discussions
- Proposed ideas are “interest-based”

ICEBREAKER – Breakout #1: Calling the Questions? During this first breakout session, attendees broke into five teams and were asked to come up with questions related to C2 at DEN that they would like answered. Each team selected a scribe to document their deicing questions for the workshop. The questions they came up with were collected and categorized as follows:

Strategy:

- Why are there so many vendors?
- Is there an opportunity to use the East/West Runways?
- Will fleet mixes be changing and, if so, how?

People/Communication:

- Do the FAA, SOR, Tower Control, and Pad control all communicate with each other and the City?
- Are there any pilots in the room?

Execution/Procedures/Infrastructure:

- Why isn't there an international standard for deicing an airplane vs. each airline having its own specific processes?
Comments collected: (a) Airports need to be a part of a standardization process like in Canada with Transport Canada; (b) there are variables/fleet differences for each airline that drive different standards—for instance, there are 18 different deice vendors/programs at one DEN station; (c) the city maintains deicing / chemical records; and (d) there are different perspectives of efficiency.
- Why is there a lack of deice pad infrastructure at DEN?
- What are the best practices for setting up a bay?
Comment collected: DEN's pads and bays are not properly equipped for lighting, which affects safety, security, and efficiency.
- How do we safely move aircraft off the deice pad faster?
- How can we reconfigure the pads to improve queue management?
- Why don't airlines maximize the number of deice trucks for faster throughput?
- How can we increase the predictability of throughput off deice pads?
- How can we improve the process of snow removal on the deice pad?

Technology:

- Are there any new deicing technologies on the horizon?
- What are the pros/cons of AeroBahn's Deicing Manager program, generally referred to as "Ice Man"? Does it work? To what extent?
- How else can Aerobahn help?
- Can improvements in weather forecasting be made?
- Can we upgrade deice pads?

Cost/Benefit:

- What is the cost of change?
- What is the cost of time?
- What are the savings for airline/city/deice vendors?
- What does the airline get from this research program?

PART 2: AIRPORT CDM

Airport Collaborative Decision Making (CDM): An Associate Researcher of the research team described how CDM is used at European airports for operations decision-making purposes. European airports have found CDM reduces flight delays, increases fuel savings, improves operations planning, improves resource/asset management, and lowers carbon emissions.

Data exchange is the key to CDM, and there are many opportunities for information sharing in the industry to create efficiencies and opportunities for DEN across the board (e.g., security, safety, traffic flow, radar, etc.)

Breakout #2: Denver's Ramp Tower Manager described the current approach to deicing from the airport's perspective as:

Despite having achieved measurable successes in departure queue management with the Aerobahn system and its accompanying deice management product, "Ice-Man," DEN is challenged to

improve its departure scheduling during de-ice and snow events. Each minute of reduced aircraft taxi time saves significant dollars for the airlines and reduces passenger wait time. A successful solution to this problem would provide a more flexible deice process that would more efficiently utilize the five existing deice providers or create a single deice company or consortium that could service any airline.

Using this problem statement as a prompt, the group again broke into five teams where they discussed “What is going well?” and “What is not going well?” Answers related to each question are summarized below.

What is Going Well?	What is Not Going Well?
<ul style="list-style-type: none"> • Peak time pad allocation • Shorter queue to the pad • Better tools • Pad sharing • Full deice • Push from gate to pad • Policy • Snow removal efforts • Strategic throughput (more flexible aircraft flow and improved predictability) • Improved holdover • After event collaborative communication: <ul style="list-style-type: none"> ○ Try to have immediate hot washes in the EOC—both face-to-face and conference calls ○ Sometimes hold a later face-to-face meeting with more stakeholders • Pre-event briefing sheet for planning and the daily call—the day before and day of • Slot allocation—Aerobahn (some airlines use it) • FAA clearance from pad (avg. 6 min 7 sec) 	<ul style="list-style-type: none"> • Trying to flex use pad for better utilization; trying to flex the vendors' use of a pad is a negative when changing from lighter to denser deice requirements (more snow) • Slot allocation (painful for some airlines; different reasons for different airlines) • Pad sharing • Partial deice • Airport view: Need more pads for efficiency purposes • Airline view: Need better throughput through existing bays vs. needing more bays • Need better location of snow melters; can be an impediment to aircraft movement • Need better queue to the pad (not everyone is using Ice Man tools) • Coordinate taxiways and oncoming snow removal efforts on the pad <ul style="list-style-type: none"> ○ Inconsistent coordination currently ○ Need direct communications between vendors and others; need communication down from FAA or up from airlines ○ Need 30 minutes advance notice • Better queue out of the pad (sometimes it's blocked): <ul style="list-style-type: none"> ○ Snow Removal needs ○ Aircraft Configuration (some aircraft have longer checklists) ○ Process – Pilot • Infrastructure (pad improvements): <ul style="list-style-type: none"> ○ Lighting/Visibility ○ Stop bars ○ Cleaning • Personnel <ul style="list-style-type: none"> ○ Staffing ○ Multi-operational period • Airlines operate on one concourse, but deice vendor operates on another

What is Going Well?	What is Not Going Well?
	<ul style="list-style-type: none"> • Deice vendor does track when deice is complete; but that data is not given to Aerobahn; need data exchange • Recovery efforts • Weather Forecasting – specific communication needed (e.g., more than “it’s going to be nasty”) • Slot allocation – no teeth in Aerobahn so many airlines don’t use it • Hot washes need better participation from all stakeholders • TSA directives are changing; makes it more difficult to bring staff to work sites • Future concern: outside vendors can pose a security threat

PART 3: DEN – DEICING MANAGEMENT: PROBE THE POSSIBLE

The Management Hackathon facilitator set up the process as a means of “probing the possible” through three steps that included:

1. **Managing the present** – optimizing the process
2. **Reviewing the past** – determining what is working and what needs improvement (using information from the Icebreaker Session/Breakout 1)
3. **Creating the future** – inventing new ‘possible’ deicing business models

Breakout #3: Management Hackathon using the Innovation Café Process: This innovation café focused on a series of four café-style conversations designed to encourage collaborative dialog, share mutual knowledge, and discover new opportunities for action. Participants broke into four different working groups and were given 7–10 minutes to make their contributions related to each topic on flip charts before moving on to another topic. Each group added to the comments from the previous group to provide a deeper dive into each topic below:

Re-think: Process	Re-Invent: Out of the Box	Re-Frame: Organization	Re-Wire: Communications
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After the groups completed the four topics, the group was asked to rank their inputs on a scale of 1 to 5 (1= not attractive, 5= highly attractive). They were also asked to determine the top three recommendations overall and the top three that could be implemented this year.

Re-Think: Process

Ranking	Proposed Ideas
1	Unbalanced → Balanced → Strategic slotting ?Next? = Automate the process via NextGen?/ Aerobahn?*
1	Pad snow removal: more structured process; planning communications**
1	Allow end runway deicing***
2	Allow gate deicing with pads***

Ranking	Proposed Ideas
2	Demand plan to match capacity – recovery as well as event*
2	Define new “process” for clearing pads (especially during the operational day/window)**
3	Communication and training of changed processes (FAA?) NextGen*
3	Add center-line lighting to purple & green ramp center-lines**
3	Focus on adding resource (pads) vs. optimizing existing (opt for DEN not the same as opt for airlines)***
3	Increase pad capacity (more pads)***
3	Create South-flow deicing process (bottlenecks with present occasional south flow and west deice)**
4	Establish standard de-ice process – all airlines per aircraft manufacture type*
4	Evaluate melter locations to optimize gate and ramp utilization**
4	Re-evaluate pad capacity (safe zones)***
	Who is our (FAA) customer?
*Local concern **Airport-wide (any airport) ***Optimize	

Re-Frame: Organization

Ranking	Proposed Ideas
1	Consequences / Enforcement / Incentives
1	Limit Numbers of Deicing Providers (minimum standards)
3	Airlines in EOC – breakout room
3	Find a common goal that doesn’t conflict with individual business goals
4	Establish norms/expectations, roles / responsibilities, compliance review Normalize benefits to all
5	Pre-season briefing/tabletop
5	After Event Recovery Process
5	Policy Group (stakeholders: CCD, FAA and Airlines) –CDM Seasonal/Strategic & Storm/Tactical
	Training beyond “how to” – harmonize

Rewire: Communication

Ranking	Proposed Ideas
1	Online (web-based) – dynamic (include read time information) – centralized – sharable <ul style="list-style-type: none"> • Weather (forecasts; event updates) • Cancellations (Aerobahn) • Runway closure information • Documents and briefs
2	Who is the communication “champion” at City / DEN? <ul style="list-style-type: none"> • Airline stakeholders represented at EOC
3	Additional frequencies on pad

Ranking	Proposed Ideas
	<ul style="list-style-type: none"> • S-team • Communications of shared pad
4	Non-verbal / Simple <ul style="list-style-type: none"> • Lighting leading lights • Stop bars • Traffic light • Sign boards
4	Solar tiles to reconfigure lighting lines
4	Automated stop bars (battery backup solar powered)
	App for pilot use on airport status (real time) during event <ul style="list-style-type: none"> • Include de-ice procedures for DEN (and images) • Use of GPS (position on runway) • Real-time visual of airfield showing where equipment is; closures • Deicing post requirements communication piece • Pilot training / education / briefs
	Develop performance measures for each pads Develop Metrics or KPI's How much fluid Same rate Pad throughput information Review Aerobahn capabilities

Re-Invent: Considerations of New Deicing Business Models

Ranking	Proposed Ideas
1	iPad with an app (impacts ACARS, CBLIC, and information sharing – as mentioned below) <ul style="list-style-type: none"> • Brings information to those who need it • Tied in with many of the comments from this section • Frequency driven • Decision making as to when to deice
2	Standardized checklists – To expedite out of pod
3	New pads – lighting; re-engineering (include #5) <ul style="list-style-type: none"> • Staging/exiting bays – amending (checklists, procedures) <ul style="list-style-type: none"> ○ Driven by aircraft manufacturers ○ Sign boards ○ Every process • Start from scratch
4	Hot shot deicing team
5	Redesign of existing pads
	In-tank storage heaters (exhausted trucks often take too long to reheat) <ul style="list-style-type: none"> • Telemetry • Measuring – IOT (Internet of Things) New generation cameras Information sharing

Ranking	Proposed Ideas
	Gantry type – car wash – coming back
	ACARS Integration – “I am 10 minutes out, start the process”
	CBLC <ul style="list-style-type: none"> • Data link from aircraft – information might be more fluid
	Solar lighting – for tiles on road <ul style="list-style-type: none"> • Striping color • Commercial safety zones
	Gate deicing – drainage?
	IR – Waste, fluid reduction
	Aircraft ports
	GPS parking <ul style="list-style-type: none"> • Trucks • Aircraft
	Heads up displays for trucks
	High speed tugs
	Re-look – aircraft on arrival

PART 4: FUTURE FORWARD – SELECTED OPTIONS

Summary and Next Steps: Consistent themes throughout the breakout sessions:
Predictability – Agile - Safe – Efficient Deicing Operations.

The workshop closed with agreement on the next steps.

- A summary report will be completed by the PARAS 0003 Project Team
- The Deicing Management Hackathon Summary Report will be distributed to all attendees with a request for approval and sign-off
- Future discussions should provide for all attendees to participate in drafting the problem statement
- Recommendations and future deice actions by DEN should be signed-off by these participants

Check-Out: Areas of continuous improvement for Aviation Management Hackathon process.

What went well today?	What needs improvements?
<ul style="list-style-type: none"> • Good open discussion • Guidance (SAE) exists on these issues • Knowing we are not alone in facing these problems • An inclusive and collaborative group • Good experience and expertise in the room – knowledgeable stakeholders • Insight from other stakeholder experiences on the deicing issues 	<ul style="list-style-type: none"> • Start with shared goals and metrics • All participants / stakeholders should join in crafting the problem statement. • All participants should have a say in the ultimate decisions that stem from the ideas generated by the discussion • More stakeholders. (It was noted that several participants may have read the Safe Skies (security) information vs. the agenda inserted in the Meeting Invitation (Deicing Workshop). • Add more videos and visual of the current deicing • A pilot’s perspective was needed. • The scope may have been too broad.

BURBANK BOB HOPE AIRPORT

PART 1: SETTING THE STAGE

Setting the Stage: The PARAS 0003 project team’s facilitator opened the Management Hackathon by having everyone introduce themselves. She then discussed PARAS 0003, which will produce a guidebook focused on communication and collaboration (called C2).

The Principal Investigator described the overall PARAS 0003 research process and where Management Hackathons fit within that process. The research process involves conducting a literature review; obtaining feedback from an Advisory Group (organized by the research team and includes 18 experts from the aviation industry) to validate research; conducting interviews with airport and non-airport personnel who can provide good insight on C2; and hosting Management Hackathons, like this one, in order to problem-solve C2 at airports.

Management Hackathon Process: Management Hackathons are structured problem-solving efforts that involve learning, diagnosis, priority setting, idea generation, idea ranking, and feedback. During the Management Hackathon, an “innovation café” style format was used to create known and unknown improvement opportunities; to diagnose, prioritize, and rank ideas; and to develop bold, yet highly actionable, ideas for reinventing C2 processes.

The Principal Investigator then discussed the research team’s preliminary findings, especially C2 challenges related to data integration and systems interoperability and major differences in implementing C2 solutions at larger vs. smaller airports.

ICEBREAKER - Breakout #1: Calling the Questions? During this first breakout session, attendees broke into three teams and were asked to come up with questions related to C2 at BUR that they would like answered related to this problem statement:

A recent study showed that among the Southern Californian Airports, the Burbank Bob Hope Airport is most suited to survive a major earthquake event. With this in mind, the Burbank Glendale Pasadena Airport Authority (BGPAA) embarked on an effort to coordinate the many first responder stakeholders. Despite having achieved measurable successes the BGPAA recognizes the need for on-going work of improving coordination and collaboration among responders. Each minute of improved coordination can significantly impact the safety and security, and the operational efficiencies of managing through such an event. Along with the coordination of stakeholders, other issues to consider are: supplementing the scarce resources available to a small airport; ensuring technology is ready when needed; and understanding the jurisdictional “hurdles” to overcome across the many regions affected. As the BGPAA successfully manages through the potential event, all of LA County will benefit.

Each team selected a scribe to document their questions. The questions were collected and categorized as follows:

Roles and Responsibilities

- What are the airlines’ roles?
- How can we define roles better and get the right people to do what is needed?

Notification and Communication

- How do we communicate with one another?
- What technology can we use to communicate?
- What various assets do we have to communicate?
- What is the state of the airport's communication network?
- Is there a time limit on communication?
- How will aircraft know whether or not they can land at the airport?

Logistics

- Do we have a logistical plan?
- Do we have a gathering point identified?
- What resources do we have available (airport and airline)?
- Where are the airport's and City's resource staging areas?
- If aircraft can land, where is an airline's central location for supplies and how do they guard supplies?
- Where is incident command?
- Do the airport and airlines have help kits? Where are they located?
- What does the airport do with the employees and passengers?
- Where do people get medical aid?
- Where does the airport send people to get help?
- Where do airlines park aircraft?
- Is the airport ready to receive large aircraft?
- What type of transportation is available for use?

Protocols

- How do we determine whether the airport is operational and infrastructure is sound (i.e., runways intact for aircraft takeoffs and landings, taxiways, ILS system, etc.) and whether the buildings are safe and secure (i.e. consider after-shocks)?
- How do we determine whether the airport perimeter is secure or not?
- What can the RITC be used for?
- Who will come to help us?
- What triggers the activation of the City's EOC?
- What is the fire department's internal response capability (i.e., how do we help ourselves)?
- How do we ensure the airport's agreements with others will be implemented in a timely manner?
- What is the plan for recovery?

Airport Collaborative Decision Making (CDM): The PI described how CDM is used at European airports for operational decision-making purposes. European airports have found CDM to reduce flight delays, increase fuel savings, improve operations planning, improve resource/asset management, and lower carbon emissions.

Data exchange is the key to CDM, and there are many opportunities for information sharing in the industry to create efficiencies and opportunities for BUR across the board (e.g., security, safety, traffic flow, radar, etc.)

Breakout #2: Emergency Response (Current Approach): The team was to reflect on the current approach to emergency response considering the following from the Problem Statement:

- Confirming procedures and processes for effective internal communication and coordination
- Identifying additional resources that can be made available to a small airport
- Ensuring technology is ready when needed
- Understanding and overcoming the jurisdictional hurdles across the many regions affected

Using these four statements as a prompt, the group again broke into four teams where they discussed “What is going well?” and “What is not going well?” Answers related to each question are summarized below.

Topic	What is Going Well?	What is Not Going Well?
Communication	<ul style="list-style-type: none"> • Effective communication between police, fire, and operations through a common radio system channel (public safety side has business continuity) 	<ul style="list-style-type: none"> • How should or can the airport and others use Everbridge? • How can we connect airlines to common communication platform that the airport and emergency responders use? • Not sure if we have enough radios to hand out to increased stakeholders after an actual earthquake, or if we have the proper communication channels set up between everyone • Radios need to be updated; need to address communication dead zones in the airport; need to determine if they will work after an earthquake • Need to harden communications (e.g., use satellite phones) • Communicating on the public side does not work for tenants
Resources	<ul style="list-style-type: none"> • Have local resources (e.g., police, fire, maintenance, etc.) • WESTDOG has promised “first dibs” on resources in case of disaster • Airport is trying to be self-sufficient; trying to ensure they have enough internal resources (particularly fire staff) to manage a crisis on their own • Space is rented out for moving resources between entities. 	<ul style="list-style-type: none"> • In an actual earthquake, other airports will be impacted and will be vying for the same resources (e.g., city Fire Department will not be able to assist) • How can the airport manage jet fuel tanks during emergencies and/or inform airlines they need to provide their own fuel during emergencies?

Topic	What is Going Well?	What is Not Going Well?
	<ul style="list-style-type: none"> • Have multiple tanks of jet fuel in reserve • Las Vegas and Phoenix will be loading up SW and getting stuff here quick • Staff can use ham radios 	
Testing / Training	<ul style="list-style-type: none"> • Some local emergency training has occurred (e.g., Airport fire, police and maintenance) 	<ul style="list-style-type: none"> • Need additional testing (e.g., satellite phones, long term events involving extended radio communications) • Need to test how well emergency systems will work (e.g., Everbridge) • Need more continued education/training on emergency preparedness • Need to practice with airlines and other stakeholders • Need to perform a radio-less drill • Need to plan for and train on emergency security
Internal policies and procedures	<ul style="list-style-type: none"> • Good shape • Update incident command documents regularly 	<ul style="list-style-type: none"> • Need to send out/communicate updates to incident command documents
Roles and Responsibilities		<ul style="list-style-type: none"> • Need more articulation
Perimeter	<ul style="list-style-type: none"> • Secure 	<ul style="list-style-type: none"> • Need to plan for failures
Facilities	<ul style="list-style-type: none"> • RITC should be seismically sound 	<ul style="list-style-type: none"> • Beyond RITC, how seismically sound are other airport structures (e.g., new terminal, runway lights)? • Need to relocate radio antenna/repeaters • Need to define a shelter area
Power Sources	<ul style="list-style-type: none"> • Emergency lights and generators have been tested and are solid 	<ul style="list-style-type: none"> • Need to test emergency runway lights • Can we tap generator power for other uses? We need to be able to tap generators from outside (not inside) • Have not tapped into solar power options yet
Relationships	<ul style="list-style-type: none"> • Attitude of teamwork • Good relations and communication between airport stakeholders, unions, and airlines • People step up and go beyond their job responsibilities to get things done • City of Burbank has committed any resources the airport needs at any time • Under Jurisdictional authority of the California Emergency Services Act, all airport employees are registered workers and must report to work during emergency situations 	<ul style="list-style-type: none"> • Disconnect between tenants and airport; tenants feel like they will be on their own during an emergency

The Federal Emergency Management Agency (FEMA) as a Resource: The Principal at Magnusson Klemencic Associates, an expert in blast and earthquake-resistant structures, provided the group with an overview from FEMA. He described the organization as a group that prepares for and coordinates multiple-jurisdictional integrated response to national catastrophic events. FEMA tests plans and critical response and recovery functions, challenges systems and procedures, and identifies gaps and shortfalls. In addition, he provided insights from his work at John Wayne, Seattle, and San Diego airports.

He emphasized the importance of resuming critical airport operations as soon as possible after a major seismic event. As the designated airport for emergency operations and post-earthquake, it is very important that BUR's post-earthquake plan addresses the following actions:

- Identify critical uses for the Regional Intermodal Transportation Center (RITC) after a major seismic event. Currently, the facility houses the emergency operations center (EOC) and has been designed as an essential facility. The RITC also houses the rental car operations. However, given the size and proximity of the RITC to BUR, the RITC is a facility that will prove to be very useful for storing and distributing vital supplies, repair materials, equipment, and staff. Other uses for the RITC could include emergency medical treatment if the local hospitals are overloaded or inaccessible.
- Develop a post-earthquake plan to have critical airport facilities immediately assessed for structural damage – including the RITC, air traffic control tower, and the airport terminal. In 1989, with funding from the California Office of Emergency Services, California Office of Statewide Health Planning and Development, and the Federal Emergency Management Agency, the Applied Technology Council published the *ATC-20 Procedures for Postearthquake Safety Evaluation of Buildings*, and companion *ATC-20-1 Field Manual: Postearthquake Safety Evaluation of Buildings, Second Edition* (revised in early 2005). Written specifically for volunteer structural engineers and building inspectors, these reports include detailed procedures for evaluating earthquake-damaged buildings and posting them as INSPECTED (apparently safe, green placard), LIMITED ENTRY (yellow placard), or UNSAFE (red placard). The BUR plan should include having local engineers assigned who will immediately report to the BUR EOC post-earthquake and evaluate as quickly as possible whether these critical facilities can be occupied and used for ongoing airport operations.
- As a discretionary measure, consider designing the proposed new BUR airport terminal as an essential facility, which is beyond the California Building Code minimum design requirements.

PART 2: BUR – EARTHQUAKE READINESS – PROBE THE POSSIBLE

The facilitator provided an overview and application of ACRP Report 65: *Guidebook for Airport Irregular Operations (IROPS) Contingency Planning*. The guidebook's six-step management process can be beneficial in planning for earthquake events. The six steps are:

- Step 1: Executive buy-in / get organized
- Step 2: Document current situation
- Step 3: Establish procedures to cooperate
- Step 4: Review, update, training
- Step 5: Consolidated cooperation during an event
- Step 6: Capturing lessons learned / plan updates

There are four aspects of IROPS planning that need special attention, and could affect earthquake preparedness. These include understanding how surge, capacity, after-hours, and extended stay situations affect staffing and resources.

The facilitator discussed the role of social media in earthquake planning, and the new Google Crisis Response App. When a disaster strikes, the Google Crisis Response team assesses the severity and scope of the disaster, and the relevance of our tools for the situation, to determine whether and how to respond. BUR's responses may include creating a resource page with emergency information and tools, launching Google Person Finder to connect people with friends and loved ones, or hosting a crisis map with authoritative and crowd-sourced geographic information.

Tabletop Exercise: The Perfect Storm –West Coast Version. The Research Project Team Security Subject Matter Expert led the tabletop exercise that focused on considering how BUR would handle a major earthquake, in order to find better ways to share information and assess the effectiveness of current plans.

The group was first asked to define their internal (inside-the-fence) and external (outside-the-fence) stakeholders:

<u>Inside-the-Fence Stakeholders</u>	<u>Outside-the-Fence Stakeholders</u>
1. FAA Tower	1. City of Burbank
2. Public Information Officer	2. Governor's office
3. TSA	3. City of Burbank and City of Los Angeles
4. Maintenance & Operations / Janitors	4. Media
5. Parking Staff (Valet – airport; Parking – Vendors)	5. Hospitals (St. Josephs)
6. Fire Department (includes EMS)	6. General public
7. Concessions	7. Private ambulances
8. Airlines - fully staffed	8. Hotels/restaurants
9. Busing (14 buses)	
10. Taxis	
11. Skycaps	
12. Airline ground handlers (20 handlers)	
13. Special tenants / GAs	
14. EOC Personnel	
15. First Responders (Fire Command/Police)	
16. Rental Car Companies	

Ideal State: Next the group listed their key needs for effective emergency response. They described an emergency response situation as follows:

- Immediate: Within 12 hours of the event, air rescue and ATC team will start showing up one every hour or 30 minutes
 - Determine where to put supplies and personnel
 - Set up Command Center and put someone in charge
 - If this happens off duty, the order of command will be Police first, followed by Fire chief.
 - Set up Communications Center – figure out what works
- Determine how C2 will work by assessing what communication assets are up and running. If there are not any, some protocols to consider include:
 - Flying personnel in a helicopter to the emergency points
 - Using Everbridge, texts, or NextGen 911

- Maintenance recommendations:
 - Review contracts with vendors/tenants regarding issues discussed
 - Establish a meeting place for the first hours after incident; think about real-time face-to-face location options
- Work closer with airlines on communication means and resources:
 - Have the airlines communicated their emergency management plan to BUR?
 - Designate an off-site area as a communication center for families and people at BUR (possibly PHX?)
 - Push the emergency response with the 25 supervisors at Southwest Airlines
 - Host more meetings like this; regular face-to-face planning meetings
 - Compile a master list of all resources and contact numbers (central/master list for airports and airlines; VEOCI can be used to store information and push out notifications)
 - Push information down to the supervisory level
- Provide additional training/certification:
 - Host regular training sessions to work out various disaster scenarios
 - Provide training and engineering/inspection certification for in-house staff for special buildings
 - Train first responders on VEOCI system (airport and City of Burbank use it)
 - Add emergency response to HR’s new-hire onboarding training; talk to HR as to how to add this
 - Train airport staff on EOC procedures
- Policies and Plans:
 - In addition to the FAA focused plans, have the airport write a more general emergency plan to align better with or learn from the city emergency plans (review how the city’s EOC works through their Emergency Operations Plans such as mass notifications, authority, responsibilities, training, etc.)
 - Develop a plan to reach passengers’ families during a disaster situation.
- Equipment / Facilities:
 - Update radio communications systems
 - Identify the best uses for RITC

PART 3: INNOVATION

Following the tabletop exercise, the workshop moved to a series of four innovation café-style conversations designed to encourage collaborative dialog, share mutual knowledge, and discover new opportunities for action. Participants broke into four different working groups and were given 7–10 minutes to make their contributions related to each topic on flip charts before moving on to the next topic. Each group added to the comments from the previous group to hack or provide a deeper dive into each topic below:

Topic	Inputs
1. Notification	<ul style="list-style-type: none"> • Surveillance communication (inside: work; outside: home) • Robust training mode; prep at home – resp. • Smartphone disaster app • Disaster POC phone numbers • Everbridge mutual aid notification (unaffected airport stakeholders to families – canned message) • PA System • Air carrier corporate communication with families

Topic	Inputs
	<ul style="list-style-type: none"> • Use in-airport app to provide information • Ham radio • Use FIDS display to provide information • Disconnected PA System (Bull horn) • Digital roadway signs (especially for hearing impaired) • Have Google/Facebook/Uber come in for a briefing
2. Resources	<ul style="list-style-type: none"> • Staffing varies by days of the week <ul style="list-style-type: none"> ○ After-hours example: 10 p.m. on a Saturday – resources available: <ul style="list-style-type: none"> ▪ Airline crew / staff (varies by days of the week) <ul style="list-style-type: none"> • SWA – 0 • AAG – 0 • JB – Crew supervisor, gate staff, 150 passengers • TSA – 0 ▪ Communication center – 2 ▪ Rental Cars – 0 ▪ Red Cross ▪ LOA with hotels ▪ National Guard ▪ Maintenance – 6-7 (12 during the day) ▪ FEMA Office of Emergency Services ▪ Parking – 30 people (24/7) ▪ Ops supervisor – 2 ▪ Air Rescue and Fire Fighting (ARFF) (limited to medium fire) 24/7 ▪ ATC personnel 24/7 • Agreements with vendors (light towers, generators, etc.) • Mobile runway lighting system • Airline ground power units • Inventory of equipment (maintenance) • Several mobile generators • Honeywagons (fit 50 people for sleeping purposes) • Rental cars (100s) • 250,000 gallons of Jet A / burn in diesel oil • Concessions <ul style="list-style-type: none"> ○ Fresh/nonperishable food ○ Fast food restaurants ○ 250 MREs ○ Pallets of bottled water • FedEx and UPS Material Handling Systems • Costco • 6 LEOs • 6 Firefighters • Flatbed trucks • Bicycles to easy / fast access across the airport and neighborhood
3. Agreements	<ul style="list-style-type: none"> • Out-of-state agencies (AZ, NV, etc.) • Fuel farms/providers (Who has what and how much can be made available)

Topic	Inputs
	<ul style="list-style-type: none"> • Unaffected Airports (LV) to send canned message (possibly via Everbridge) to everybody on pre-prepared list • Hotels (Food) • Bus systems (BTS/MTA) • Uber • Taxis • Helicopter Services • Drones • Cargo tenant ramp space <ul style="list-style-type: none"> ○ Cargo relieve flights/ parking ○ Creating spaces / using cargo planes • Action Item: Review existing agreements for weaknesses, needed updates, overlaps. Include information from “resource assessment.” • Determine who has what and can make available • Food
<p>4. Technology</p>	<ul style="list-style-type: none"> • Family notification board (Red Cross – safe and well) • Social media (Facebook safe page) • AM radio channel – limited range • Full backup • Ample supply of radios, backup batteries, etc. • Means to plan / track channels in use / PA announcement • All leadership – Incident Command <ul style="list-style-type: none"> ○ Radio/other technology interoperability ○ Need key players for their system ○ Direct communication point • Pop-out (robot sweep)/ FOD – Visual vs. tech? • Checklist distribution <ul style="list-style-type: none"> ○ Higher level that can work with others (Apple, Bluetooth) • Social media – Start a group inside; there is a BUR page today • CUPPS – SITA App – Paging • Cell phone batter chargers – Solar power / rechargers for staff • VEOCI – Virtual EOC (like Everbridge, Internet-based, real time information) <ul style="list-style-type: none"> ○ Huge untapped resource; need to assess • Phone lines – number of • Thermal imaging / IT • Operations Center – Expanded lights • CCTV – low light tech • Power redirect • Drone technology (aerial survey) • Go bag – solar patch on backpack (water purifying, pre-packed, etc.) • Solar power (Hangar 25 – LEED certified with solar; RITC plans to be solar)

For BUR to operate effectively post-earthquake, the airport and regional stakeholders should periodically exercise and practice communications, operations, and response. Further, for BUR to be utilized for critical operations post-earthquake, critical BUR facilities should be designed to be operational. Otherwise, operations may have to occur outdoors without the critical infrastructure being

usable—which will slow down vital activities such as bringing materials, personnel, and assistance to the greater Los Angeles area.

PART 4: FUTURE FORWARD – SELECTED OPTIONS

The group provided final checkout thoughts that included the following:

- **Urgency:** This meeting was a good reality check. This could happen a second from now; it is real and important – we must be vigilant and prepared for emergency response; avoid complacency
- **Improve Awareness:** Understand airport operations and equipment agreements
- **Communicate:** With internal and external stakeholders
- **Be proactive:** Helped to identify ways to make sure my team is ready to go
- **Encouraged:** Impressive to see how everybody came together and the knowledge base we have
- **Continued Improvement:** Need continued training and exercises to test plans as well as open communication
- **Motivated:** See what this group can do, how much more work there is to do; need to keep the momentum going
- **Enjoyed participation:** Ability to think outside the box and see how everyone has something to contribute

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APPENDIX G: Glossary

6-Step Approach	An approach to use in face-to-face meetings and involves: (1) come together in person, (2) connect with one another in the same room, (3) capture attention without distractions, (4) contribute through interactive participation, (5) create solutions, and (6) continue to improve.
Advisory Committee	Appointed by the Joint Executive Steering Board and composed of business managers and process owners, this Committee is primarily focused on business coordination, process approval, identification of information to be shared, and standard operating procedures.
Airline	An air transportation system operator, including its equipment, routes, operating personnel, and management.
Airport	An area of land or other hard surface, excluding water, that is used, or intended to be used, for the landing and takeoff of aircraft, including any buildings and facilities (14 CFR 139.5)
Airport Community Emergency Response Team	Trained volunteers who can assist others at the airport following a disaster when professional responders are not immediately available to help.
Airport Operator	The public or private operator or sponsor of a public-use airport. This entity serves as the facilitating organization for the tabletop exercise and must be prepared to provide the necessary resources and provide the required space as determined by the IROPS Tabletop Planning Committee
Benefit Cost Analysis (BCA)	A systematic approach to estimating the strengths and weaknesses of alternatives that satisfy transactions, activities, or functional requirements for a business.
Bridge Call	A type of conference call used by airports to connect a large number of people together.
C2 Life Cycle	A 10-phase cycle that can be used to establish a solid foundation for facilitating effective communication and in sustaining collaborative relationships among stakeholders.
Champion	A person responsible for leading group discussions and drafting, creating, and updating C2 policies and procedures.
Cloud-Based Application Service	Applications made available to users on demand via the internet.
Concept of Operations	A list and definition of all airport operational procedures and how they relate to one another in one volume of information.
Data Architect	A person involved in a Data Governance Program who helps data stewards access, integrate, and manipulate data with their technical expertise, and typically will be associated with the airport technology division.
Data Architecture	The way in which enterprise data stores at an airport are organized and accessed. In general, the data architecture is defined primarily by models at four levels: 1. High-level Data Models, 2. Realization Overviews, 3. Data Source and Consumer Models, and 4. Data Transportation and Transformation Models.
Data Governance Program	A program that manages the availability, usability, integrity, and security of the data employed at an airport. The program often includes a governing body, a defined set of procedures, some technical resources, and a plan to execute those procedures.

Data Source and Consumer Model	A model that supports validation of target airport processes by identifying whether target data is contained within a single system, maintained by well-defined interfaces and processes, or spread across several (potentially inconsistent) sources.
Data Standards	Rules by which data are described and recorded to ensure consistency across multiple sources.
Data Steward	A person involved in a Data Governance Program who establishes and enforces data standards and formats. Data stewards can use quality analysis reports to improve the quality of data, reduce data redundancy and improve data management capabilities across the airport enterprise.
Data Quality Management	A key process within the Electronic Data Management Strategy framework for addressing issues in the quality of data and identifying exceptions in data elements.
Data Visualization	An effort to help people understand or make sense of data by placing it in a visual context rather than in text descriptions or in raw data. Visual context may include infographics, dials or gauges, geographic maps, heat maps, or detailed bar, pie, or fever charts.
Dedicated Web Application	Mobile web site tailored to a specific platform or form factor for particular smartphones or feature phones.
Emergency Management	The process of preventing, mitigating, responding to, and recovering from all types of hazards and incidents that can threaten life and property.
Enrichment	A data quality tool that enhances the value of internally held data by appending related attributes from external sources (for example, consumer demographic attributes or geographic descriptors).
Enterprise Data Management (EDM) Strategy	A data management strategy that ensures consistency of information, supports all operations, and enhances decision-making capabilities by helping airports migrate from disparate data silos to an integrated, enterprise-wide data environment. It features a data governance program using data architecture (data standards, data stewardship, data security, and data quality management).
Executive Steering Committee	Part of a Data Governance Program responsible for nominating work groups for managing the other critical components of the enterprise data management framework, such as data stewardship, data quality management, data standards and metadata, data architecture, and data security.
Face-to-Face Meeting	A meeting that includes all types of in-person gatherings, such as traditional meetings, workshops, training sessions, and tabletop exercises. Body language and facial expressions are important in these meetings, and often help to reveal the members' true feelings about a topic or new procedure.
Feedback Loop	A process that encourages people to ask questions and obtain clarification to improve future communication effectiveness.
Functional Working Groups	These groups are composed of representatives from the stakeholder work teams and the process owner(s). Members meet regularly in order to ensure that communication and collaboration takes place in accordance with the standard operating procedures established for each process, and the targeted results are achieved.
General Aviation	Civil aviation involving privately-owned aircraft.

Generalized Cleansing	A data quality tool that modifies data values to meet domain restrictions, integrity constraints, or other business rules that define sufficient data quality for the organization
Generic Mobile Web Application	Mobile websites designed to operate on every web-enabled phone.
Ground Handler	A person who services an aircraft while it is on the ground and (usually) parked at a terminal gate of an airport. Many airlines subcontract ground handling to airports, handling agents, or even to another airline.
Governance Model	The mechanisms, processes, and relations by which corporations are controlled and directed. Governance structures and principles identify the distribution of rights and responsibilities among different participants in the corporation (such as the board of directors, managers, shareholders, creditors, auditors, regulators, and other stakeholders). The model includes the rules and procedures for making decisions in corporate affairs.
Aviation Management Hackathon	A structured problem-solving effort that involves learning, diagnosis, priority setting, idea generation, idea ranking and feedback. During a Management Hackathon, participants “swarm” a specific challenge, developing bold yet highly actionable ideas for solving a challenge.
Harmonizing	A process where a Work Team reviews and revises existing plans and procedures, with the goal of creating efficiencies and ensuring effectiveness of day-to-day operational activities and responses to IROPS and emergency situations at the airport.
Health Assessment	An Excel-based spreadsheet developed as part of this research project that enables users to identify the status of communication and collaboration within an airport stakeholder community. It enables readers to determine which chapters of this Guidebook offer the greatest opportunity for improvement based on responses to the assessment questions.
High-Level Data Models	The top level of the data architecture at an airport. These models describe data from a conceptual viewpoint, independent of any current realization by actual systems currently in use at the airport.
Horizontal Systems Integration	A method of establishing systems integration architecture that uses a central communication point, which mediates the transfer of data between different systems or subsystems. Also called “message bus” integration.
Human Machine Interface (HMI)	An interface that permits interaction between a human and a machine.
Hybrid Application	Mobile applications that rely on more open and specialized development frameworks, and offer a very interesting compromise because they ensure cross-platform compatibility, and can access the mobile device’s hardware (camera, GPS, user’s contacts, etc.)
Indemnification	A clause or provision in an agreement (e.g., Memorandum of Understanding) or Interagency Agreement to identify who assumes liability for which of its actions, and those of its employees or representatives.
Incident Command System (ICS)	A standardized approach to the command, control, and coordination of emergency response, providing a common hierarchy within which responders from multiple agencies can be effective.
Information Sharing	Relates to the exchange of information among individuals or groups for the purpose of providing data to others. This can be accomplished as a matter of routine or on an ad-hoc basis, either proactively or upon request. It is vital to a collaborative work environment, turning individuals into teams, with members focused on a common cause.

Information Sharing Requirements	Defines when, where, why, and how information is needed.
Information Sharing Matrix	A spreadsheet containing detailed information sharing requirements such as identification, source, recipients, location, etc.
Information Sharing Plan	A communication plan developed specifically to address information-sharing requirements, as well as related procedures, processes, information flows, and chains of escalation.
Information Sharing Flow Diagrams	A graphical representation that shows relationships and processes involved in an Information Sharing Plan.
Irregular Operations (IROPS)	Exceptional events that require actions and/or capabilities beyond those considered usual by aviation service providers. Generally speaking, an impact of an IROPS event is the occurrence of passengers experiencing delays, often in unexpected locations for an undetermined amount of time. IROPS event examples include extreme weather events (e.g., snowstorms, hurricanes, tornados), geological events (e.g., earthquakes, volcanoes), and other events (e.g., power outages or security breaches).
Interagency Agreement	A formal agreement, sometimes called a Memorandum of Understanding, between two or more parties. These can be used to establish official partnerships between stakeholders for irregular operations or emergency situations; however, they are not legally binding.
Internal Control Measurement	Involves continuously monitoring and evaluating the C2 Program control environment, including self-assessments and independent assurance reviews. It enables the Joint Executive Steering Board to identify control deficiencies and inefficiencies and to initiate improvement actions.
Intellectual Property	Any product of the human intellect that the law protects from unauthorized use by others. Intellectual property is traditionally composed of four categories: patent, copyright, trademark, and trade secrets. However, it more specifically encompasses intangible products/assets of creative effort, such as technical information, software, data and databases, designs, models, methods, and literary works, among others.
Joint Executive Steering Board	A board composed of senior level management from both the airport and stakeholder organizations, whose purpose is to give voice and authority to operational departments, and who ultimately manage and operate collaborative processes.
Joint Use Agreement	A formal agreement between two separate government entities, often a school and a city or county, setting forth the terms and conditions for shared use of public property or facilities.
Key Performance Indicator (KPI)	A uniform standard, benchmark, indicator, metric, or scorecard to evaluate performance, such as stakeholder collaboration and coordination efforts.
Letter of Intent (LOI)	A document outlining one or more agreements between two or more parties before the agreements are finalized.
Matching	A data quality tool that identifies, links, or merges related entries within or across sets of data.
Memorandum of Understanding (MOU)	A formal agreement, sometimes called an Interagency Agreement, between two or more parties. These can be used to establish official partnerships between stakeholders for irregular operations or emergency situations; however, they are not legally binding.
Message Bus Systems Integration	A method of establishing systems integration architecture that uses a central communication point, which mediates the transfer of data between

	different systems or subsystems. Also called horizontal systems integration.
Mobile Command Center	A vehicle such as a van, truck or bus that can be sent wherever it is needed to provide on-site incident command. It is typically equipped with data/voice communications, video equipment, and a conference area.
Monitoring	A data quality tool that deploys controls to ensure ongoing conformance of data to business rules that define data quality for the organization.
Mutual Aid	An agreement among emergency responders to lend assistance across jurisdictional boundaries. This may occur due to an emergency response that exceeds local resources, such as a disaster or a multiple-alarm fire. Mutual aid may be ad hoc or a formal standing agreement for cooperative emergency management on a continuing basis.
National Incident Management Structure (NIMS)	A systematic, proactive approach to guide departments and agencies at all levels of government, nongovernmental organizations, and the private sector to work together seamlessly and manage incidents involving all threats and hazards—regardless of cause, size, location, or complexity—in order to reduce loss of life, damage to property, and harm to the environment.
Native Application	Mobile applications that are developed or coded with a specific programming language tailored to a particular mobile device platform.
Parsing and Standardization	A data quality tool that decomposes text fields into component parts, and formatting of values into consistent layouts based on industry standards, local standards (e.g., postal authority standards for address data), user-defined business rules, and knowledge bases of values and patterns.
Partnering Agreement	A written agreement between parties or entities to work together to establish a stated goal or provide a designated service.
Payback Period (PP)	Amount of time for an investment to generate sufficient cash flows to recover its initial cost.
Present Value (PV)	The value of a future cash stream discounted at the appropriate market interest rate, called the discount rate.
Policy	A direct link between an organization's vision and its day-to-day operations. Policies identify key activities and guide decision makers as issues arise by establishing limits and a choice of options.
Procedure	A series of consecutive action steps related to a policy that specifies how a particular process should be completed. A procedure includes information on who, what, when, and where of a policy.
Profiling	A data quality tool that analyzes data to capture statistics (metadata) that provide insight into the quality of the data, and aid in the identification of data quality issues.
Profitability Index (PI)	Measures relative profitability of an investment. Equal to Present Value of cash flows divided by initial investment.
Project Advisory Group	A group of aviation industry experts that the research team hand-picked to consult on a regular basis to obtain direction and guidance on best practices, to help develop roadmaps for advances in communication/collaboration technology, to validate the Guidebook development, and to leverage specific expertise in filling in any information gaps relevant to the project objectives.
Performance Measurement	Involves collecting, validating, and evaluating performance data of the C2 processes. Should be monitored during each process to ensure that it is

	performing against agreed-on key process indicator targets, and providing systematic and timely reporting to enable accountability.
Personally Identifiable Information (PII)	Any information that can be used to identify, contact, or locate an individual, either alone or combined with other easily accessible sources. It includes information that is linked or linkable to an individual, such as medical, educational, financial, and employment information. Examples of data elements that can identify an individual include name, fingerprints or other biometric (including genetic) data, email address, telephone number, or social security number.
Point-to-Point Systems Integration	A method of establishing systems integration architecture that relies on experienced software developers to create custom software code and embed it within each individual endpoint (IT system or application) to create a connection.
Proprietary Information	Information that is not public knowledge (such as certain financial data, test results, or trade secrets), which is viewed as the property of the holder. The recipient of proprietary information, such as a contractor in the procurement process, is generally duty-bound to refrain from making unauthorized use of the information.
Process Owner	A person who has the ultimate responsibility for the performance of a process in realizing its objectives measured by key process indicators, and has the authority and ability to make necessary changes.
Reliever Airport	An airport that is built or designated to provide relief or additional capacity to an area when the primary commercial airport(s) reach capacity.
Return on Investment (ROI)	Net cash receipts of the project divided by cash outlays.
Safety Management Systems (SMS)	An aviation standard for the management of safety. It was designed to enable product/service providers (certificate holders) and regulators to integrate modern safety risk management and safety assurance concepts into repeatable, proactive systems. It emphasizes safety management as a fundamental business process to be considered in the same manner as other aspects of business management.
Sensitive Security Information (SSI)	Information obtained or developed in the conduct of security activities, including research and development, the disclosure of which TSA has determined would (1) constitute an unwarranted invasion of privacy (including, but not limited to, information contained in any personnel, medical, or similar file); (2) reveal trade secrets or privileged or confidential information obtained from any person; or (3) be detrimental to the security of transportation. (49 CFR §1520.5)
Service Level Agreement (SLA)	An agreement between two or more parties, where one is the customer and the others are service providers. This can be a legally binding formal or informal contract. The agreement may involve separate organizations, or different teams within one organization, and usually covers the level of service expected between the end-user and service provider.
Service-Oriented Architecture (SOA)	An architecture an airport can use for building its business applications as a set of loosely coupled “black box” components, orchestrated to deliver a well-defined level of service to internal and external stakeholders by linking together business processes.
Shared Vision	The agreement and common goals of executive management and the stakeholders, and their outlook for the future. This varies from airport to airport.
Situational Awareness	Understanding the relationships of events and information relative to a given stakeholder’s point of interest in both time and space.

Software as a Service (SaaS)	A software licensing and delivery model in which software is licensed on a subscription basis and is centrally hosted.
Source Data Owner	A person involved in a Data Governance Program who prioritizes and executes data management, and addresses issues in data quality and standards, such as the merger or deletion of data, data enrichment, etc. A Source Data Owner must ideally be from the business side of the airport.
Stakeholder	A person, group, or organization that has interest or concern in some common area.
Standard Operating Procedure (SOP)	A set of step-by-step instructions created by a business to help workers carry out routine operations. Its purpose is to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with industry regulations.
Sustainability	Refers to the continuation of a program's or initiative's goals, principles, and efforts to achieve desired outcomes. It is to make sure that the goals of the program or initiative continue to be met in the future through various activities.
Systems Integration	The process of linking together different computing systems and software applications, physically or functionally, to act as a coordinated whole.
Tabletop Exercise	A training session where key personnel discuss simulated scenarios in an informal setting. It can be used to assess how well plans, policies, and procedures address realistic situations.
User Profile	A user profile is a record of user-specific data that defines the user's working environment. They can be used as control access privileges.

AUTHOR ACKNOWLEDGMENTS

This research was performed under PARAS 0003, “Enhancing Communication and Collaboration among Airport Stakeholders.” Barich, Inc., was the primary research consultant. Frank Barich, Principal of Barich, Inc., was the Principal Investigator. The research team was composed of Frank Barich, Bill Bayham, Marc Gartenfeld, Joseph Kratzer, and Jim Miller, all of Barich, Inc.; Tim Anderson, Chief Executive Officer (CEO) of Anderson Airport Consulting, LLC; Rose Agnew, Founding Principal of Aviation Innovation; Charlotte Bryan, CEO Charlotte Bryan Solutions, Inc.; and Carolyn Binder, Owner of Carolyn Binder CPA, LLC. Additional support was provided by Allison Larson, Jan McCormick, and Tyler Wilson of Barich, Inc., as well as Christina Coverdell of Aviation Innovation. Graphical elements were designed by Katie Barich.

The research team would like to thank the following airports/airport authorities and non-airport entities for providing key contributions through interviews and workshops:

- Boca Raton Airport
- Burbank Bob Hope Airport
- Centennial Airport
- Dallas/Fort Worth International Airport
- Denver International Airport
- Fort Lauderdale-Hollywood International Airport
- General Mitchell International Airport
- Grand Forks International Airport
- Gulfport-Biloxi International Airport
- Miami International Airport
- Minneapolis–St. Paul International Airport
- Orlando International Airport
- Phoenix Sky Harbor International Airport
- Portland International Airport
- Sacramento International Airport
- San Diego International Airport
- San Francisco International Airport
- Airbus
- City of Minneapolis Office of Emergency Management
- Maricopa Association of Governments
- Wipro Limited

In addition, the research team extends its gratitude to the members of the Project’s Advisory Group for their valuable feedback and input into the development of the Guidebook:

- Alan Burgess – SITA
- George Condon – San Diego International Airport
- Mark Crosby – Portland International Airport
- Sarah Dalton – Retired, Federal Aviation Administration
- Lisa Gahm – Denver International Airport
- Brian Gilliam – Orlando International Airport
- Amanda Greene-Guentzel – Minneapolis–St. Paul International Airport
- Tanya Gulchak – Honeywell International, Inc.

- Butch Howard – HMS Host
- Scott Kohut – Boca Raton Airport Authority
- John Newsome – Orlando International Airport
- Chris Rausch – Phoenix Sky Harbor International Airport
- Karen Scott – Tetra Tech IER (Formerly, Louisville International Airport)
- Lisa Stanton – Sacramento International Airport
- Lauren Stover – Retired, Miami International Airport
- Jacqueline Yaft – Retired, Los Angeles World Airports
- Don Zoufal – University of Chicago, SDI (System Development Integration, LLC)

Moreover, the research team wants to thank the Airports Council International–North America Business Information Technology Committee for providing a platform and exposure for the project and the research topic.