Alternative IT Delivery Methods and Best Practices for Small Airports

DETAILS

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AIRPORT COOPERATIVE RESEARCH PROGRAM

ACRP REPORT 128

Alternative IT Delivery Methods and Best Practices for Small Airports

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AIRPORT COOPERATIVE RESEARCH PROGRAM

Airports are vital national resources. They serve a key role in transportation of people and goods and in regional, national, and international commerce. They are where the nation's aviation system connects with other modes of transportation and where federal responsibility for managing and regulating air traffic operations intersects with the role of state and local governments that own and operate most airports. Research is necessary to solve common operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the airport industry. The Airport Cooperative Research Program (ACRP) serves as one of the principal means by which the airport industry can develop innovative near-term solutions to meet demands placed on it.

The need for ACRP was identified in *TRB Special Report 272: Airport Research Needs: Cooperative Solutions* in 2003, based on a study sponsored by the Federal Aviation Administration (FAA). The ACRP carries out applied research on problems that are shared by airport operating agencies and are not being adequately addressed by existing federal research programs. It is modeled after the successful National Cooperative Highway Research Program and Transit Cooperative Research Program. The ACRP undertakes research and other technical activities in a variety of airport subject areas, including design, construction, maintenance, operations, safety, security, policy, planning, human resources, and administration. The ACRP provides a forum where airport operators can cooperatively address common operational problems.

The ACRP was authorized in December 2003 as part of the Vision 100-Century of Aviation Reauthorization Act. The primary participants in the ACRP are (1) an independent governing board, the ACRP Oversight Committee (AOC), appointed by the Secretary of the U.S. Department of Transportation with representation from airport operating agencies, other stakeholders, and relevant industry organizations such as the Airports Council International-North America (ACI-NA), the American Association of Airport Executives (AAAE), the National Association of State Aviation Officials (NASAO), Airlines for America (A4A), and the Airport Consultants Council (ACC) as vital links to the airport community; (2) the TRB as program manager and secretariat for the governing board; and (3) the FAA as program sponsor. In October 2005, the FAA executed a contract with the National Academies formally initiating the program.

The ACRP benefits from the cooperation and participation of airport professionals, air carriers, shippers, state and local government officials, equipment and service suppliers, other airport users, and research organizations. Each of these participants has different interests and responsibilities, and each is an integral part of this cooperative research effort.

Research problem statements for the ACRP are solicited periodically but may be submitted to the TRB by anyone at any time. It is the responsibility of the AOC to formulate the research program by identifying the highest priority projects and defining funding levels and expected products.

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Primary emphasis is placed on disseminating ACRP results to the intended end-users of the research: airport operating agencies, service providers, and suppliers. The ACRP produces a series of research reports for use by airport operators, local agencies, the FAA, and other interested parties, and industry associations may arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by airport-industry practitioners.

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FOREWORD

By Marci A. Greenberger
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ACRP Report 128: Alternative IT Delivery Methods and Best Practices for Small Airports provides airport management from smaller airports options and alternatives for their information technology (IT) systems and operational models. Staffs at smaller airports tend to wear many different hats and may be unaware of industry best practices or the range of IT options associated with the different IT systems and their delivery alternatives. This guidebook will assist those staff members with determining the delivery alternatives and practices that are best tailored to their circumstances for each of their IT systems and assist in the development of a roadmap for IT delivery decisions. Staffs at larger airports with a better understanding of IT systems may also find the guidebook useful as the appendices provide in-depth coverage of the issues.

The speed at which the advancement of technology occurs can be overwhelming to staff at smaller airports with limited resources that do not have anyone solely dedicated to the management of their IT systems and services. These advancements have also created opportunities for these airports as more options become available and affordable to improve their business processes. Cloud computing is one such delivery method that is now ubiquitous and affordable for all size organizations. Understanding these options and their implications on other aspects of the operations can be overwhelming to non-IT professionals.

IT decisions should be aligned with the strategies and goals of the airport. The evaluation of IT options and alternatives should consider the unique attributes of the airport. Barich, Inc., as part of ACRP Project 11-02/Task 23, "Alternative IT Delivery Methods and Best Practices for Small Airports," developed this guidebook and templates to help airport staff understand the appropriate IT delivery methods and best practices based on their unique strategic goals, requirements, and overall airport goals.

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Note: Photographs, figures, and tables in this report may have been converted from color to grayscale for printing. The electronic version of the report (posted on the web at www.trb.org) retains the color versions.

CHAPTER 1

Introduction

With the current advancements in technology, more options are available to airports of all sizes to improve the efficiency and effectiveness of technology systems and services through alternative means, such as with cloud computing. The traditional approach of investing significantly in computer server farms and information technology (IT) engineers onsite is no longer the only viable option for obtaining the needed services. Small airports across the country are seeking to address technology requirements within a unique set of opportunities and challenges. Many are focused on specific technology solutions to address immediate needs, while others are working to establish a technology program that is aligned with the long-term business objectives of the airport.

When evaluating alternative IT solutions, IT programs must take into consideration the unique attributes of an airport, and the associated IT opportunities and challenges. Such attributes include ownership type, management culture with respect to technology, the availability of financial and local support resources, and the maturity level of an airport's IT function. Once these attributes are understood, a careful evaluation of requirements for human resources, systems and applications, and infrastructure is necessary.

IT human resources can be grouped into the categories of governance, management, operations and maintenance support, and project delivery. In airports of all sizes, the governance and management functions should both be provided through airport staff resources in most cases. Operations and maintenance support functions can be satisfied by a range of options including airport staff, contracted resources, or resources shared with another entity, such as another city department. Project delivery is often executed with a combination of resources including airport staff, contracted vendors, and consultants. Depending on the scope and complexity, a project could be fully executed internally or almost completely outsourced.

Alternative delivery methods associated with applications and systems include purchasing off the shelf, developing internally or through a contractor, hosting onsite or remotely, sharing collaboratively with another entity, or obtaining freeware or open source solutions. For infrastructure components, the question arises whether to purchase or lease. A third option exists where an airport might share these components with another entity, such as a city or state. To make the most appropriate determination of suitable alternative delivery methods, IT professionals should consider the evaluation of each method according to its benefits, risks, cost considerations, scalability, integration, and dependencies, as presented in this guidance document (Guidance).

In small airports, the strategic alignment of the IT program to the objectives of the airport business unit becomes necessary when stakeholder needs dictate a level of accountability for IT service and support. To effectively align the technology program with the airport manager's mission, vision, values, and objectives, the user of this Guidance must take a strategic approach to understand the current business objectives, the basis for changes in the environment, and the specific needs of the stakeholders.

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To that extent, the concept of IT governance becomes relevant and very helpful. IT governance refers to the oversight of the IT function. Just as a board of directors may provide governance over the airport, airport management should have a committee that provides governance over the IT program. Appropriate committee members should represent the key airport stakeholders, such as each airport division. The basic responsibilities of such an IT governance committee include defining stakeholder needs, correlating airport goals with these needs, and ensuring that the IT goals are developed that support the airport goals.

The purpose of this Guidance is to provide readers with a roadmap for understanding how to achieve an optimum IT delivery solution, considering their specific airport attributes. The primary intent of this Guidance is for use by small airports; however, the material is relevant and can be of value to airports of all sizes. This Guidance was developed to provide those responsible for management and oversight of the IT function with the necessary guidance in making the best decisions for IT delivery. The Guidance was also developed to provide the airport executive and other division leaders an understanding of IT solution options.

A major component of this Guidance is Appendix E, Strategic Planning and Business Case Development Guide. This appendix provides a structured set of templates that guide the user through a step-by-step process of defining appropriate IT delivery methods based on a strategic evaluation of unique stakeholder needs and the overall airport goals.

CHAPTER 2

Overview

This chapter provides a brief overview of the purpose, intended audience, and structural breakdown of the Guidance.

Purpose and Intended Audience

The purpose of this Guidance is to provide the user with a roadmap for understanding how to achieve an optimum IT delivery method, while considering the specific airport attributes. Although this Guidance can be used across airports of all sizes, the primary focus is on small airports. The structure of this Guidance was designed so it can be used as a point of reference for a specific subject or as thorough guidance on developing and implementing an overall airport IT strategy.

This Guidance provides the following three key objectives:

- An assessment process to determine airport attributes and IT maturity level.
- Definitions and explanations of systems and services applicable to the airport industry with the IT delivery methods for each. (Note: Some of the systems presented are not typically utilized at a medium or small airport today; however, discussion on these systems is included based on an assumption of future applicability.)
- An evaluation process to align business needs and the IT delivery methods available based on previous evaluation.

This Guidance was developed to provide the airport professional who is responsible for the IT function with the necessary information and guidance in making appropriate decisions for IT delivery. It was also developed to provide the airport executive and other division leaders with an understanding of various IT solution options.

Organization

Following this chapter and preceding the appendices, the main body of the Guidance is divided into the following three chapters.

Chapter 3 provides information to guide the user in assessing and understanding primary attributes that have a significant impact on the evaluation of alternative IT delivery methods. To that extent, Chapter 3 focuses on key differentiators and IT maturity levels of small airports. In addition, it presents discussions on different airport profiles, common as well as outlier.

Chapter 4 presents alternative IT delivery methods and practices relevant to small airports. It addresses recent airport IT trends and the importance of collaboration, provides a high-level

Table 1. Guidance quick reference.

Desired Results	Where to Start
High-level understanding of airport IT best practices	1. Chapter 3, Understanding Small Airport IT 2. Chapter 4, Delivery Methods and Practices of Small Airport IT
Alignment of the technology program with the airport manager's business objectives	1. Chapter 4, Delivery Methods and Practices of Small Airport IT; Strategic Technology Alignment 2. Chapter 4, Delivery Methods and Practices of Small Airport IT; Human Resources 3. Appendix E, Strategic Planning and Business Case Development Guide
IT organizational structure/ staffing/project delivery methods	1. Chapter 3, Understanding Small Airport IT 2. Chapter 4, Delivery Methods and Practices of Small Airport IT; Human Resources 3. Appendix B, Human Resources
Specific IT application/ system options	1. Chapter 4, Delivery Methods and Practices of Small Airport IT; Applications/Systems 2. Appendix C, Applications/Systems
Specific IT infrastructure	1. Chapter 4, Delivery Methods and Practices of Small Airport IT; Infrastructure 2. Appendix D, Infrastructure
Business Case for IT initiative	1. Chapter 3, Understanding Small Airport IT 2. Chapter 4, Delivery Methods and Practices of Small Airport IT; Strategic Technology Alignment 3. Appendix A, Strategic Technology Alignment 4. Appendix E, Strategic Planning and Business Case Development Guide

discussion on strategic technology alignment, and then focuses on IT delivery methods relative to human resources, applications/systems, and infrastructure areas. For each of these areas, the Guidance addresses applicability according to each IT maturity level.

Chapter 5 provides helpful navigational tips for the in-depth material provided in the appendices.

The appendices provide greater detail for the topics addressed in the Guidance and a functional tool in the form of a structured set of templates. These templates guide the user through a step-by-step process of defining appropriate IT delivery methods based on a strategic evaluation of his/her unique stakeholder needs and the overall airport goals. For further investigations into the subject matter, a list of useful resources is also provided.

To derive the greatest benefit from this Guidance, the user needs to understand how to navigate the document to find relevant information. To that extent, Table 1 provides a quick reference for where to start to achieve the desired results.

CHAPTER 3

Understanding Small Airport IT

The first step in understanding how to make the best use of this Guidance is to understand the subject airport's unique characteristics within the key differentiating attributes of small airports. These defining attributes have an impact on the applicability of differing IT delivery methods that are presented and include airport ownership, airport management culture, availability of financial resources, and availability of local support resources. Each one of these areas is discussed in terms of their differing types, and the opportunities and challenges they present on the IT delivery methods available.

The second step is to assess the subject airport's IT maturity level, which has a direct impact on the capabilities of the airport to effectively implement a given IT delivery method. To that extent, the maturity levels are first defined, then discussed in terms the opportunities and challenges they present on the available delivery methods.

Key Differentiators of Small Airports

The unique attributes of each airport must be taken into consideration when evaluating alternative IT delivery methods. While two airports may be similar in size and type of operation, the available IT delivery methods may be drastically different. Considerations such as the owner of the airport, the management culture, and the availability of financial and IT support resources all have a significant impact on both what options are available and what has the highest likelihood of success. In understanding and planning for these key differentiators, the airport manager should conduct a thorough business case to ensure that options are considered and the best overall solution is selected.

The following sections describe the primary unique attributes found in small airports. At the end of these descriptions, the opportunities and challenges associated with each of these attributes are presented.

Airport Ownership: Municipality vs. Authority

Airport ownership is a critical factor in development of a strategy for IT delivery methods (IT Strategy). The type of ownership will determine many specific policies and procedures with which the IT Strategy must be aligned. The two primary ownership categories addressed in this Guidance are municipality and authority. Privately owned small airports are most closely aligned with the attributes of authority-owned airports and therefore not discussed independently. A municipality-owned airport is considered to be a department of its city, county, or state and is subject to most, if not all, of that municipality's regulations, policies, and procedures. An authority-owned airport is an independent entity governed by a group of

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directors or commissioners, who are appointed by one or more government officials representing specific state or local regions.

Airport Management Culture: Technologically Conservative vs. Technologically Progressive

The airport management culture with respect to technology is an important factor in development of the IT Strategy. The IT Strategy must be crafted in line with the management culture in order to achieve the greatest opportunity for success. Many nuances exist between differing management styles, but the key differences in approach can be classified as either "technologically conservative" or "technologically progressive." A technologically conservative management culture is one in which the airport management employs the use of technology where required but does not actively pursue the use of technology for creating efficiencies or process improvements. A technologically progressive management culture is one in which the airport management actively seeks opportunities to use technology to create efficiencies and process improvements, as well as enhance safety, security, and customer services.

Availability of Financial Resources: Limited vs. Available

The availability of financial resources to support technology development and sustainability is a limiting factor in determining the available options for providing specific IT services. When a particular option is being evaluated, both capital and the operational and maintenance (O&M) costs must be considered. An airport manager with limited financial resources must be diligent in the development of business cases to adequately justify the funding needed to satisfy a specific stakeholder need. In addition, options must be considered that can take advantage of the available funding mechanisms. If capital funds are more available than O&M funds, outsourcing projects with services included may be the best option. If O&M funds are more readily available, internally provided project delivery and support will likely be more favorable. An airport manager with available financial resources to commit to technology development and sustainability will have a wide range of options available and can make decisions based on other factors, such as the level of benefit and the impact to stakeholders.

Availability of Local Support Resources: Limited vs. Readily Available

The availability of local resources to provide technology support is a limiting factor in determining the available options for providing specific IT services. When a particular option is being evaluated, the requirement for onsite support and the needed service level must be considered. An airport manager with limited local support resources may have difficulty in obtaining the required quality and responsiveness of an outsourced operations and/or maintenance function. In cases where there are few qualified local support resources, the responsiveness for onsite work may suffer due to an imbalance in supply and demand. In cases where the available local support resources are not fully qualified to support the specific system requirements, the quality of the onsite work may suffer and the system may experience ongoing issues. In both of these scenarios, solutions that can be supported remotely or the development of an internal support structure may be favorable. An airport with readily available local support resources will have a wide range of options available and can make decisions based on other factors, such as the costs and the impact to stakeholders.

Summary of Key Opportunities and Challenges

Table 2 presents a summary of the unique opportunities and challenges impacting IT delivery methods for each of the previously defined differentiators.

Table 2. Key differentiators of small airports—opportunities and challenges.

Differentiator	Key Opportunities	Key Challenges
Airport Ownership		
Municipality Owned	• Established IT policies and procedures • Resource sharing and integration potentials • Government procurement pricing	• Resource sharing and integration mandates • Restrictive IT policies and procedures • Inflexible procurement rules
Authority Owned	• Flexible IT policies and procedures • Flexible procurement rules • Autonomy	• Undefined IT policies and procedures • Limited resource sharing opportunities
Airport Management Culture		
Technologically Conservative	• Value provided to existing processes through stable solutions • Control over potentially ineffective technology projects	• Thorough business case requirements • Limited capabilities of airport operational systems • Limited growth opportunities
Technologically Progressive	• Value provided to new processes through new innovations • Understanding of both the risks and value of failure (not all IT initiatives will succeed, but we will learn from all)	• Thorough planning and testing requirements • High levels of agility and responsiveness expected • Potential for ineffective projects due to lack of governance
Availability of Financial Resources		
Limited	• Control over financially burdensome technology projects	• Selected option may not provide the best overall value • Limited capabilities of airport operational systems • Limited growth opportunities
Available	• Best overall value provided to satisfying stakeholder needs	• High expectations for project delivery success • High expectations for service and support • Potential for ineffective projects if business case is not adequate
Availability of Local Support Resources		
Limited	• Outsourcing options are available	• Limited options
Readily Available	• Best overall value provided to satisfying stakeholder needs	• High expectations for service and support

IT Maturity Levels

The maturity level of the airport's IT environment has a direct impact on the capabilities of the airport to effectively implement a given IT delivery method. Simple or outsourced IT delivery methods may be the only way to successfully meet business objectives in an airport with a low level of IT maturity. A greater number of options are available to airports with a high level of IT maturity. Many professional IT consultancies have published IT maturity models that map an organization's maturity progression from non-existent to highly effective. Among those most highly respected is the Gartner IT Infrastructure and Operations (I&O) Maturity Model (D. Scott, J.E. Pultz, E. Holub, T.J. Bittman, and P. McGuckin, *Introducing the Gartner IT Infrastructure and Operations Maturity Model*, Gartner, Inc., October 1, 2007). The Gartner I&O Maturity Model maps four key dimensions across six levels and defines universally applicable objectives for each. Gartner I&O dimensions are people, process, technology, and business management. The six levels are defined below as presented in Gartner's I&O Maturity Model. Following these definitions is a comparative list of the opportunities and challenges associated with each of the six levels of IT maturity.

Level 0: Survival

At Level 0, there is little to no focus on IT infrastructure and operations. At this level, no IT standards exist and IT planning is not conducted. Airport IT requirements are typically provided by electronics or maintenance technicians led by a manager of another airport division such as operations, maintenance, or finance. Technology systems consist of desktop computers and the few required operational systems, such as closed-circuit television system (CCTV) cameras, access control, and paging systems. Infrastructure is made up of independent cabling systems and network switches are installed in an unplanned manner to support systems where they are located.

Level 1: Awareness

At Level 1, there is realization that infrastructure and operations are critical to the business and the airport manager is beginning to take actions (in people/organization, process, and technologies) to gain operational control and visibility. At this level, no firm IT standards are in place, and planning consists of budgetary requirements. Airport IT requirements are provided through trained computer and network technicians led by a technology manager who reports up through another airport division. Technology systems include more advanced business applications and minimally complex airport special systems, such as parking revenue control systems. Infrastructure is made up of independent cabling systems and network switches are installed in an unplanned manner to support systems where they are located.

Level 2: Committed

At Level 2, the airport manager is progressing to a managed IT environment and providing day-to-day IT support processes. The airport manager has improved success in project management to become more customer-centric and to increase customer satisfaction. At this level, strategic planning is conducted and high-level project plans are defined to support budgeting. Airport IT is driven through a defined IT division with trained staff in all of the key areas of responsibility and defined processes for support and project delivery. Technology systems are standardized and procured through defined requirements. Airport special systems are still few but may begin to include customer-centric services such as multi-user flight information display systems (MUFIDS). Infrastructure cabling and network switches are migrated to an airport-wide integrated communications system.

Level 3: Proactive

At Level 3, the airport manager is gaining efficiencies and service quality through standardization; policy development; governance structures; and implementation of proactive, cross-departmental processes, such as change and release management. At this level, strategic and master planning are performed and strict IT standards and policies are adopted and enforced. Airport IT has a defined governance structure through which key performance indicators are monitored and ongoing IT value is assessed. The IT division is led by a director with staff that operates under predictable and consistent processes. Technology systems are centrally managed and monitored for performance. Airport special systems include expanded operational and customer-centric services to improve operational efficiencies and customer service. A fully redundant and managed airport-wide integrated communications system is in operation.

Level 4: Service Aligned

At Level 4, the airport manager is managing IT like a customer-focused business that is a proven, competitive, and trusted IT service provider. At this level, strategic and master planning are addressed as an ongoing process rather than a recurring event and IT functions are highly integrated and automated. Airport IT has a mature governance structure and the IT organization is led by an assistant airport director or chief information officer and focused on meeting stakeholder needs through a service delivery approach. Technology systems are defined within a comprehensive technology architecture. Airport special systems are aligned with stakeholder needs.

Level 5: Business Partnership

At Level 5, the airport IT organization is a trusted partner to the business for increasing the value and competitiveness of business processes, as well as the business as a whole. At this level, the IT organization functions at optimal levels and is focused on identifying and leveraging innovative opportunities to add value to the airport. Airport strategic and master planning is conducted with IT as a contributing partner and the airport business objectives are defined based on an understanding of what IT can provide.

Summary of Key Opportunities and Challenges

Table 3 compares the six levels of IT maturity in terms of the unique opportunities and challenges they present on available IT delivery methods.

Common Small Airport Profile

A large percentage of small airports can be described by the profile of having a technologically conservative management culture with limited financial resources and limited local IT support resources functioning at IT Maturity Level 0 or 1. This profile is common in small airports that are in rural markets with limited growth and minimal non-aeronautical revenue. The maturity level is driven by a lack of specific drivers forcing the establishment of strict standards and policies. These airports are focused on providing the basic IT services needed to maintain the day-to-day operations within the airport. Typically, this level of IT operational performance is deemed to be adequate by the airport business units because the requirements placed on IT are minimal and the basic needs are being met. These airports often view the investment in the development of the IT organization through strategic planning, creation of standards and policies, and system integration as not being justifiable based on the expected benefit to be received within that specific airport environment.

The focus within these airports should be on identifying, understanding, and mitigating the IT-related risks associated with business continuity. In most cases, the airport business and operational divisions have come to rely on IT services for communication and performance of basic job duties, without ensuring the stability and resiliency of the systems that provide them. As a result, events such as a power outage, an email server failure, or the loss of an IT employee can have a significant impact on the day-to-day operations within the airport. IT delivery methods that have proven to show value in these scenarios include the use of a technically oriented IT manager who is capable of maintaining either key systems or network infrastructure with the assistance of one or two staff resources who can support the systems or network components that the manager does not. In addition, some increasingly mission-critical systems, such as email,

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Table 3. IT maturity levels—opportunities and challenges.

Maturity Level	Key Opportunities	Key Challenges
Level 0: Survival	• Low expectations mean that simple and low-cost solutions will suffice • Outsourcing options are available	• Lack of planning requires starting from beginning each time • Lack of trained staff limits options • Poor infrastructure limits options • Lack of dedicated management to oversee operation
Level 1: Awareness	• Dedicated management to oversee operations • Expectations are still relatively low and some simple and low-cost solutions will suffice • Outsourcing options are available	• Lack of planning requires starting from beginning each time • Poor infrastructure limits options • New applications are not based on standards
Level 2: Committed	• Improved alignment with the airport business objectives • Improved budgeting • Increased options due to internal support capabilities • Increased business case focus due to standards and defined requirements	• Increased expectations of business units and customers requires higher level of support • Increased focus on project delivery success • Airport processes beginning to rely on technology for operations
Level 3: Proactive	• Increase in value proposition to business units and customers • Increased options due to internal support capabilities • Increased business case focus due to standards and defined requirements • Increased control due to policies and standards • Long-term vision through Master Plan • Improved service response and system uptime due to managed support processes	• Increased accountability to governance through key performance indicators • Increased expectations of business units and customers requires higher level of support • Dependency on project delivery success • Airport and customers processes rely on technology for business continuity
Level 4: Service Aligned	• Strong governance to guide projects and maintenance • Focus on stakeholder needs • Enabling airport to provide value to customers • Continuous improvement through life cycle planning • Highly reliable IT services	• New skills and abilities required to provide customer-oriented service • Business units and customers require maximum level of service and support • Airport and customers dependent on technology for project delivery and business continuity
Level 5: Business Partnership	• Focus on providing long-term business value to the airport	• Airport is dependent on technology for future development

are becoming good candidates for outsourcing to a third party to improve the reliability of the services and reduce the internal support burden.

Outlier Small Airport Profile

A less commonly seen profile in small airports is one that has a technologically progressive management culture, available financial resources, and readily available local support resources. These airports are often functioning at IT Maturity Level 2 or 3 due to external factors that necessitate technological progress, the availability of resources to implement new initiatives, and a management team that encourages IT development. Typically, an airport of this type is located near a metropolitan area or has a significantly sized constituency that both utilizes air travel and generates non-aeronautical revenue, such as a corporate presence or university. Definable stakeholder needs, such as competitive advantage over automobile transportation or

improved customer service, are key drivers for increasing the level of IT management, planning, and structure within these airports.

The focus within these airports should be on aligning technology objectives with business objectives and ensuring that IT initiatives produce the optimum balance between benefits, resource efficiency, and risk. These airports are in a favorable position to be able to thoroughly evaluate a wide range of options and select those that provide the greatest overall value with respect to benefits achieved and stakeholder impact. As a result, the IT services provided at these airports enable greater efficiency and effectiveness of the business and operational functions throughout the airport as well as enhanced services for airline tenants, concessionaires, and passengers. IT delivery methods that have proven to show value in these scenarios begin with a strategic or process-oriented IT manager or director who provides IT leadership over a trained technical staff. Consultants are often used for support in planning, business analysis tasks such as feasibility studies or systems requirements, and project implementation oversight. Based on the value proposition, non-airport-specific systems, such as email, payroll, or human resources, may be outsourced to third parties to maximize the IT resource efficiency.

CHAPTER 4

Delivery Methods and Practices of Small Airport IT

Recent IT Trends and Importance of Collaboration

The most recent *Airport IT Trends Survey 2013*—commissioned by SITA in partnership with *Airline Business* magazine and Airports Council International (ACI)—revealed that IT spending had been cautious in 2012, but the outlook for 2013 indicated expectations for greater levels of IT investment. According to the survey, responses from 173 airports resulted in the following major investment drivers:

- Improving passenger experience
- Reducing the cost for airport operations
- Improving workforce productivity

The survey also revealed the following general trends:

- Strategies for passenger communication/interaction is focusing on mobile applications and social media channels.
- Self-service is growing and evolving, also moving toward mobility.
- Business intelligence and collaborative decision making are seen as key values for adopting geo-location to improve passenger journey.

In addition to these IT trends, there are ongoing changes to rules and regulations by external governing bodies that affect airport systems, such as with cyber security, Americans with Disabilities Act (ADA)/accessibility, and Payment Card Industry (PCI) Data Security Standard (DSS). Of particular note, the PCI security standards council, an assembly of major credit card companies (Visa, MasterCard, American Express, etc.), was formed to manage the ongoing evolution of the PCI-DSS. The PCI-DSS is a standard that was developed to safeguard customer information and prevent credit card fraud. PCI-DSS compliance is required in order to process credit cards. PCI compliance is required for organizations that collect, process, store, or transmit cardholder data and the PCI-DSS addresses airport areas beyond simply the point of sale, such as the data network.

In support of these trends and regulatory issues, small airports can greatly benefit from collaboration with peers and primary stakeholders. Collaborative efforts are easily facilitated through industry associations such as the ACI and the American Association of Airport Executives (AAAE). ACI's Business Information Technology (ACI-BIT) Committee provides a focus on IT issues and has put forth a concerted effort to engage small airports in recent years. Through collaborative efforts such as this, small airport IT managers can gain extensive insight into general information, best practices, and new developments.

Strategic Technology Alignment

Strategic Technology Alignment is the basis for moving from IT Maturity Level 1 to Level 2, as it provides the needed linkage of the IT program to the objectives of the airport business units. In small airports, this becomes necessary when stakeholder needs dictate a level of accountability for IT service and support. To effectively align the technology program with the airport manager's mission, vision, values, and objectives, the user must take a strategic approach to understand the current business objectives, the basis for changes in the environment, and the specific needs of the stakeholders.

The first step in establishing alignment between IT and the airport manager's business objectives is the creation of an IT Strategic Plan. The IT Strategic Plan defines the direction needed to develop the IT program over a long-term period of time in accordance with the long-term direction for the airport. The IT Strategic Plan details the enabling processes that must be implemented to achieve the IT goals. The IT Strategic Plan should address key enablers, such as organizational structures, high-priority policies, or near-term projects at a high level, but does not provide long-term project planning. The IT Strategic Plan should be addressed from the perspective of a planning life cycle where it is reevaluated and updated annually to ensure ongoing alignment with the airport manager's priorities. IT strategic planning is an exercise that can be accomplished with internal airport resources or with the assistance of consultants; however, to be effective, it must be done with significant input from the key airport stakeholders.

The second step in establishing a strategic technology alignment is the development of an IT Master Plan. This tool is commonly used for addressing the specific activities required for the long-term development of the IT program according to the direction provided by the IT Strategic Plan. The IT Master Plan should address all of the enablers with sufficient detail for the airport manager to scope and budget new projects for the upcoming three to five years and longer-term projects and initiatives at a high level. As with the IT Strategic Plan, the IT Master Plan is part of a planning life cycle and should be updated on a consistent schedule in order to provide greater detail to the longer-term initiatives as they enter the three- to five-year range.

For an IT master planning program to be successful, it must have three core components: (1) support and direction from key stakeholders, (2) initiatives based on practical issues being experienced on a regular basis or well-defined long-term benefits, and (3) an implementable plan.

Appendix A presents a methodology for systematically defining an overall IT strategy and laying out a long-term plan for project implementation.

Alignment with IT Maturity Level

Table 4 identifies the level of IT maturity at which each of the steps in strategic technology alignment typically becomes relevant.

Human Resources

IT human resources can be grouped into the categories of governance, management, operations and maintenance support, and project delivery. In airports of all sizes, the governance and management functions should be provided through airport staff resources in most cases. Operations and maintenance support functions can be satisfied by a range of options including

Table 4. Strategic technology alignment and IT maturity level.

Strategic Technology Alignment	Level 0: Survival	Level 1: Awareness	Level 2: Committed	Level 3: Proactive	Level 4: Service Aligned	Level 5: Business Partnership
IT Strategic Plan			X	X	X	X
IT Master Plan				X	X	X

airport staff, contracted resources, or resources shared with another entity, such as another city department. Project delivery is often executed with a combination of resources including airport staff, contracted vendors, and consultants. Depending on the scope and complexity, a project could be fully executed internally or almost completely outsourced. A detailed discussion on each of the functions mentioned here is provided in Appendix B.

Each of the noted IT delivery methods is described in the following section; a summary evaluation of each IT delivery method according to general benefits, risks, and cost considerations follows. Also included is a comparison of the various IT services noted in terms of their applicability to the six levels of IT maturity previously discussed.

Alternative IT Delivery Methods

Airport Staff Resources

Airport staff resources include full-time and part-time employees whose job duties are exclusively directed by and for the sole benefit of the airport.

Contracted Resources

Contracted resources include general IT service firms, specific IT product or service vendors, and IT consulting firms. Depending on the nature of the agreement(s), these resources may be onsite full-time, onsite when needed, or completely remote.

- **General IT service firms** perform a range of standard IT system installation, operation, and maintenance duties according to a contracted service-level agreement.
- **Specific IT product or service vendors** perform the full range of installation, operation, and maintenance functions for a specific airport system that they are certified to support according to a contracted service-level agreement.
- **IT consulting firms** provide a range of specialty services across disciplines including business analysis, planning, design, program management, and implementation oversight.

Shared Resources

Shared resources include collaborative use of employees from another entity whose job duties are not exclusively directed by and for the sole benefit of the airport but rather are directed by a collaborative reporting structure between the airport manager and the other entity. For example, the resource may be an employee of the city IT department or the port authority and designated for assignment to the airport.

IT Delivery Option Evaluation

Table 5 identifies general benefits, risks, and cost considerations of the various IT delivery methods.

Table 5. Delivery methods—human resources—benefits, risks, and cost considerations.

Delivery Methods	Benefits	Risks	Cost Considerations
Airport Staff Resources	• Reduced capital costs • Reduced support costs	• May not have specific expertise • May not be able to get staff positions allocated	• Operating budget • Long-term commitment • Cost factors: o Salary or hourly rate o Benefits o Supplies/equipment o Office space o Telecommunications o Management o Human resources support
Contracted Resources: General IT Services Firm	• Reduced time requirement • Legally bound to performance • Definable level of service	• May not have specific expertise • Procurement requirements • May not have control over time/availability	• Operating or capital budget • Short-term commitment • Cost factors: o Fixed fee or hourly rate o Contingency markup o Supplies/equipment o Office space o Telecommunications o Management o Legal support o Procurement support
Contracted Resources: Specific IT Product or Service Vendor	• Reduced time requirement • Specific expertise • Legally bound to performance • Definable level of service	• Expensive • Procurement requirements • May not have control over time/availability	• Operating or capital budget • Short-term commitment • Cost factors: o Fixed fee or hourly rate o Travel expenses o Contingency markup o Supplies/equipment o Office space o Telecommunications o Management o Legal support o Procurement support
Contracted Resources: Consulting Firm	• Reduced time requirement • Specific expertise • Legally bound to performance • Definable level of service	• Expensive • Procurement requirements • May not have control over time/availability	• Operating or capital budget • Short-term commitment • Cost factors: o Fixed fee or hourly rate o Travel expenses o Contingency markup o Supplies/equipment o Office space o Telecommunications o Management o Legal support o Procurement support
Shared Resources	• Reduced capital costs • Reduced support costs	• May have limited control over functionality • May not have specific expertise • Potential for divergent interests • May not have control over time/availability	• Operating or capital budget • Short-term commitment • Cost factors: o Salary or hourly rate o Benefits o Supplies/equipment o Office space o Telecommunications o Management time

Table 6. Human resources IT functions and IT maturity level.

Human Resources Functions/Activities	Level 0: Survival	Level 1: Awareness	Level 2: Committed	Level 3: Proactive	Level 4: Service Aligned	Level 5: Business Partnership
Governance			X	X	X	X
Management		X	X	X	X	X
Operations and Maintenance Support						
Hardware Maintenance	X	X	X	X	X	X
End-User Support	X	X	X	X	X	X
System/Network Administration	X	X	X	X	X	X
Application Development		X	X	X	X	X
Project Delivery						
Project Management Processes						
Initiation			X	X	X	X
Planning		X	X	X	X	X
Execution	X	X	X	X	X	X
Controlling				X	X	X
Closing				X	X	X
Project Delivery Methods						
Professional Services			X	X	X	X
Design-Bid-Build			X	X	X	X
Design-Build		X	X	X	X	X
Prequalified Task Order				X	X	X
Project Resources						
Airport Staff Resources	X	X	X	X	X	X
Contracted Resources		X	X	X	X	X
Shared Resources	X	X	X	X	X	X

Alignment with IT Maturity Level

Table 6 identifies the level of IT maturity at which each of the various IT human resource functions and activities typically becomes relevant. In other words, it shows (by the way of "X") at which level each element typically becomes relevant.

For example, an airport that is currently functioning at Level 0, Survival, would like to gain greater control over the management of IT. Currently, the IT division is managed by the director of operations in an ad-hoc manner with no significant structure. Taking action to address IT management through the hiring of a dedicated resource and making that person responsible for implementing IT policies and procedures would move this airport to IT Maturity Level 1, Awareness, with respect to the IT management function. It is expected that an airport will have functions at different IT maturity levels at all times and will be progressing each upward based on the priorities of the airport. More detailed discussion on each of these functions is provided in Appendix B.

Applications/Systems

Airport applications and systems represent a range of technology solutions that are categorized as office productivity, enterprise systems, airport special systems, building technology/facility systems, and safety and security systems. A detailed discussion on each of the applications/systems mentioned here is provided in Appendix C.

Each of the IT delivery methods associated with applications and systems is described in the following section. Summary evaluations of each IT delivery method according to (1) general benefits, risks, and cost considerations and (2) scalability, integration, and dependencies follow. Also included is a comparison of the various applications/systems noted in terms of their applicability to the six levels of IT maturity previously discussed.

Alternative IT Delivery Methods

There are many different IT delivery methods associated with applications and systems. These include purchase off the shelf, internal or external development, onsite or remotely (cloud) hosted subscriptions/licenses, shared collaboration with another entity, and freeware/open source.

Purchase Off the Shelf

Sometimes referred to as COTS (commercial off the shelf), this IT delivery method deals with pre-built, factory-packaged, non-customized, and easy to install software applications generally provided by a third-party vendor. COTS can be purchased, leased, or licensed to companies and the general public.

Development—Internal vs. External

Application/system development in general refers to the process of defining, designing, testing, and implementing a new application/system.

This development can occur internally using an organization's own IT resources. It usually includes some level of customization based on specific needs and requirements. Formalized standards and procedures ought to be developed as they guide the application/system's processing functions. Leadership must define and implement these standards and develop a suitable system development life cycle methodology in order to properly govern the process of developing, acquiring, implementing, and maintaining these applications/systems.

Applications/system development can also be done externally by hiring a third-party vendor. In this case the responsibility of system customization and the development and related standards and procedures lies with the vendor. A hybrid approach, where internal and external development is combined, is also an option.

Subscription (License)—Hosted Onsite vs. Remote (Internet/Cloud)

Onsite hosting means that the required hardware to run the system is physically located at the airport. Often locally installed hardware is a capital expenditure, where the airport manager owns the system hardware and is responsible for the system maintenance, repairs, and replacement. However, in a hardware license relationship, the hardware can reside locally at the airport but the airport manager will not own the hardware or have responsibility for the system maintenance, repairs, and replacements.

In the context of a remotely hosted system, "internet" and "cloud" are synonymous as this is effectively what is referred to as "cloud computing." Cloud computing refers to software applications and servers that are accessed and interfaced remotely over the internet. Specific capabilities are sold as a service with a guaranteed level of functionality and availability. Cloud computing can be the delivery method for a number of airport business solutions such as office productivity software, email and calendar services, and enterprise systems (i.e., parking control systems, accounting, human resources, etc.). It can even serve as an "infrastructure" solution, termed "infrastructure as a service," through the provision of primary and secondary backup storage solutions for electronic files and other uses. Cloud computing is a shift from capital expenditure models to operational

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expenditure models. The service provider owns, maintains, updates, and replaces the software and hardware as needed. Cloud computing has become a mainstream method for accessing data and receiving required services, and several airports have implemented some level of cloud computing. However, many are still skeptical of the levels of reliability and security of having data stored offsite by a vendor. Although cloud computing as a service is relatively new, many of the technological advancements [i.e., virtual private network (VPN)] used to achieve these solutions have been in use since the late 1990s/early 2000s.

All subscription/licensing models can be hosted either onsite or remotely. In general, in a subscription/licensing model, a customer pays a subscription fee to have access to a certain product/service. There are differing model types, including a perpetual license, annual subscription, and per use. Perpetual licensing includes a one-time payment to use an application without any expiration date. Annual support, updates, and upgrades are not included and can range around 20 percent of total cost of purchase. Annual subscriptions require recurring payments for one year and generally include support, updates, and upgrades in addition to the cost of the license itself. The per-use model requires an airport to pay for only what is used.

Share (Collaboration with Another Entity)

At times, airport managers can share applications/systems with other entities. For example, a city-owned airport, as compared to an authority, can use a city-wide human resource system. It is also possible for an airport manager to share resources with outside external entities, such as a shared geographic information system with emergency providers (police, fire, medical). In case of such collaboration, the owner of the system must be clearly established to properly allocate staff and other resource commitments and responsibilities.

Open Source/Freeware

Although these two terms are not interchangeable, they do overlap to a good extent. The following is a brief overview.

Freeware refers to software that is free of cost and can be used, at least for personal and non-commercial use, without restriction for an indefinite amount of time. Depending on the author's licensing terms, freeware may require a license fee if used commercially. Some freeware is proprietary, which means the source code may be inaccessible to the user, but not necessarily. If freeware is free of charge and open source, it is often called "free software" or "free and open source software" (FOSS).

Open source software (OSS) can be free or purchased at-cost. This depends on the underlying license. If there is a dual license, OSS can be free to some users and at-cost for others. The software code for OSS is open—thereby allowing users to use and modify the application—and can also be redistributed. The driver behind OSS is the creation of developer communities to accelerate innovation and development by sharing the modifications, which often include new features and patches. OSS is the opposite of proprietary software, whose software code is closed, and which can be free or purchased at-cost.

A related concept is commercial open source software (COSS), which is usually free and open source, but only offered with limited functionality. A full-featured version is then available for purchase.

IT Delivery Option Evaluation

Tables 7 and 8 identify the general benefits, risks, and cost considerations and the scalability, integration opportunities, and dependencies, respectively, of the various IT delivery methods.

Table 7. Delivery methods—applications/systems—benefits, risks, and cost considerations.

IT Delivery Methods	Benefits	Risks	Cost Considerations*
Purchase off the Shelf	• Hosting options (onsite/offsite) • Can use capital funds • Support options (staff/contract) • Reduced time requirement • Potentially greater quality	• Potentially expensive • May provide limited functionality • May require staff or contractor for configuration	• Planning/Design – Low • Implementation – Moderate • Operations/Maintenance – Moderate
Develop—Internal	• Hosting options (onsite/offsite) • Reduced capital costs • Reduced support costs • Customizable	• Requires staff with expertise • May require extensive time • May provide limited functionality	• Planning/Design – Moderate • Implementation – Low • Operations/Maintenance – Low
Develop—External	• Hosting options (onsite/offsite) • Can use capital funds • Potentially greater quality • Customizable • Support options (staff/contract)	• Requires contractor • Potentially expensive • May require extensive time	• Planning/Design – High • Implementation – High • Operations/Maintenance – High
Subscription (License)—Hosted Onsite	• Reduced capital costs • Support options (staff/contract) • Reduced time requirement • Potentially greater quality	• May require supporting hardware and infrastructure • Requires onsite support • Total cost of ownership could be higher	• Planning/Design – Low • Implementation – Low • Operations/Maintenance – Moderate
Subscription (License)—Remote (Internet/Cloud)	• Limited hardware onsite • Reduced capital costs • Reduced time requirement	• May require staff or contractor for configuration • May provide limited functionality • May have limited control over performance	• Planning/Design – Low • Implementation – Low • Operations/Maintenance – Moderate
Share (Collaborative with Another Entity)	• Hosting options (onsite/offsite) • Reduced or eliminated costs	• Potential for divergent interests • May have limited control over functionality and performance	• Planning/Design – Low • Implementation – Low • Operations/Maintenance – Low
Open Source/Freeware	• Hosting options (onsite/offsite) • Reduced or eliminated costs	• Limited functionality • Limited support options	• Planning/Design – Low • Implementation – Low • Operations/ Maintenance – Low

*Applicability to the IT delivery method is rated as low, moderate, or high.

Common criteria are listed within cost considerations, scalability, integration, and dependencies columns, and each criterion is noted as low, moderate, or high depending on its applicability to the specific IT delivery method.

Alignment with IT Maturity Level

In the same fashion as in Table 6, Table 9 identifies the level of IT maturity at which each of the various applications and systems typically becomes relevant. For example, generally, when an airport begins to consider cloud computing, a geographic information system (GIS), and/or an airport operational database, it is pursuing Level 3. This does not mean that a Level 1 airport

Table 8. Delivery methods—applications/systems—scalability, integration, and dependencies.

Delivery Methods	Scalability*	Integration*	Dependencies*
Purchase off the Shelf	• Not Scalable – Moderate • Dynamic Scalability on Demand – Low • Upgrade Existing System – High • Replace Existing System – Moderate	• Processes – Moderate • System Functionality – Moderate • Data – Moderate • Network – High	• Airport Processes – Moderate • Human Resources – Moderate • Other Systems – Moderate • Hardware/Infrastructure – High
Develop—Internal	• Not Scalable – Low • Dynamic Scalability on Demand – Moderate • Upgrade Existing System – Moderate • Replace Existing System – Moderate	• Processes – High • System Functionality – High • Data – High • Network – High	• Airport Processes – High • Human Resources – High • Other Systems – Moderate • Hardware/Infrastructure – High
Develop—External	• Not Scalable – Low • Dynamic Scalability on Demand – Moderate • Upgrade Existing System – Moderate • Replace Existing System – High	• Processes – High • System Functionality – High • Data – High • Network – High	• Airport Processes – High • Human Resources – Low • Other Systems – Moderate • Hardware/Infrastructure – High
Subscription (License)—Hosted Onsite	• Not Scalable – Low • Dynamic Scalability on Demand – Moderate • Upgrade Existing System – Moderate • Replace Existing System – Low	• Processes – Moderate • System Functionality – Moderate • Data – Moderate • Network – High	• Airport Processes – Moderate • Human Resources – Moderate • Other Systems – Moderate • Hardware/Infrastructure – High
Subscription (License)—Remote (Internet/Cloud)	• Not Scalable – Low • Dynamic Scalability on Demand – Moderate • Upgrade Existing System – Moderate • Replace Existing System – Low	• Processes – Moderate • System Functionality – Moderate • Data – Moderate • Network – High	• Airport Processes – Moderate • Human Resources – Low • Other Systems – Moderate • Hardware/Infrastructure – Moderate
Share (Collaborative with Another Entity)	• Not Scalable – Moderate • Dynamic Scalability on Demand – Moderate • Upgrade Existing System – Moderate • Replace Existing System – Moderate	• Processes – Moderate • System Functionality – Moderate • Data – Moderate • Network – Moderate	• Airport Processes – Moderate • Human Resources – Moderate • Other Systems – Moderate • Hardware/Infrastructure – Moderate
Open Source/Freeware	• Not Scalable – High • Dynamic Scalability on Demand – Low • Upgrade Existing System – Moderate • Replace Existing System – High	• Processes – Low • System Functionality – Low • Data – Low • Network – Moderate	• Airport Processes – Moderate • Human Resources – Moderate • Other Systems – Moderate • Hardware/Infrastructure – Moderate

*Applicability to the IT delivery method is rated as low, moderate, or high.

Table 9. Applications/systems and IT maturity levels.

Applications/Systems	Level 0: Survival	Level 1: Awareness	Level 2: Committed	Level 3: Proactive	Level 4: Service Aligned	Level 5: Business Partnership
Office Productivity						
Desktop Computing	X	X	X	X	X	X
Mobile Computing				X	X	X
Cloud Computing				X	X	X
Enterprise Systems						
Financial, Human Resource, and Lease Management Systems		X	X	X	X	X
Parking Revenue and Control System		X	X	X	X	X
Point-of-Sales System		X	X	X	X	X
Asset and Computerized Maintenance Management Systems				X	X	X
Geographic Information System				X	X	X
Electronic Document/Content Management System				X	X	X
Airport Special Systems						
Electronic Visual Information Display System/Flight Information Display System/Dynamic Signage			X	X	X	X
Airport Operational Database and Data Warehousing				X	X	X
Common Use Systems				X	X	X
Local Departure Control System				X	X	X
Passenger Self-Service				X	X	X
Passenger Self-Tagging				X	X	X
Off-Airport Check-in and Bag Drop				X	X	X
Automated Baggage Processing				X	X	X
Gate Information Display Systems				X	X	X
Resource Management Systems				X	X	X
Building Technology/Facility Systems						
Building Management Systems				X	X	X
Visual Docking Guidance Systems				X	X	X
Automated Vehicle Identification				X	X	X
Digital Wayfinding Signage				X	X	X
Safety and Security Systems						
Access Control Systems	X	X	X	X	X	X
Closed-Circuit Television System	X	X	X	X	X	X
Lightning Detection Systems	X	X	X	X	X	X
Visual Paging				X	X	X
Incident Management Systems				X	X	X
Video Analytics				X	X	X
Integrated Security Systems				X	X	X

would not have a GIS, for example, but research has found that generally Level 1 airports do not. More detailed discussion on each of these applications/systems is provided in Appendix C.

Infrastructure

Airport infrastructure represents the components required for communication between systems and categorized as (1) infrastructure convergence and network systems/services and (2) wireless systems. A detailed discussion on each of the infrastructure components mentioned here is provided in Appendix D.

Each of the IT delivery methods associated with infrastructure components systems is described in the following section. Summary evaluations of each IT delivery method according to (1) general benefits, risks, and cost considerations and (2) scalability, integration, and dependencies follow. Also included is a comparison of the various infrastructure components noted in terms of their applicability to the six levels of IT maturity previously discussed.

Alternative IT Delivery Methods

The two primary delivery methods associated with infrastructure components are centered on the question of whether to purchase or lease. A third option exists where an airport might share these components with another entity.

Purchasing vs. Leasing

Traditionally, airport managers have strongly leaned toward buying hardware equipment and infrastructure components because their useful life is generally longer than their associated capital value. In recent years, more and more airport managers are opting for the leasing option since many components can be cycled out rather frequently (three years for servers, for example), thereby enabling an airport to reduce risks associated with aging equipment.

The decision to buy or lease, however, is still one of "personal" preference. A major factor is an airport manager's general approach to capital outlay and asset life span cost management. With a purchase, a larger upfront investment is required because assets are owned. With that said, the airport manager incurs costs associated with operating, managing, and maintaining it. Leasing, on the other hand, involves a lower upfront cost, but possibly higher (yet predictable) monthly expenses, as components are "rented" and operating and maintenance support costs are built into the monthly fee.

There are other factors and related benefits and risks for each option. These are addressed in detail throughout the hardware equipment and infrastructure component discussion later in Appendix D.

Share (Collaboration with Another Entity)

As with applications and systems, entities can share hardware equipment and infrastructure components, if they are operating under one umbrella, such as an airport that functions as a city department. Remote connections can be established to jointly connect to a common server, for example. In case of such collaboration, the owner of the server, in this example, needs to be clearly established in order to properly allocate staff and other resource commitments and responsibilities.

IT Delivery Option Evaluation

Tables 10 and 11 identify general benefits, risks, and cost considerations and the scalability, integration opportunities, and dependencies, respectively, of the various IT delivery methods.

Table 10. Delivery methods—infrastructure—benefits, risks, and cost considerations.

Delivery Methods	Benefits	Risks	Cost Considerations*
Purchase	• Hosting options (onsite/offsite) • Can use capital funds • Support options (staff/contract)	• May require supporting hardware and infrastructure • May require onsite support	• Planning/Design – High • Implementation – High • Operations/Maintenance – Moderate
Lease	• Hosting options (onsite/offsite) • Reduced capital costs • Support options (staff/contract)	• Total cost of ownership could be higher • May require onsite support • May have limited control over performance	• Planning/Design – High • Implementation – Moderate • Operations/Maintenance – High
Share (Collaborative with Another Entity)	• Hosting options (onsite/offsite) • Reduced or eliminated costs	• Potential for divergent interests • May have limited control over performance	• Planning/Design – Moderate • Implementation – Moderate • Operations/Maintenance – Low

*Applicability to the IT delivery method is rated as low, moderate, or high.

Table 11. Delivery methods—infrastructure—scalability, integration, and dependencies.

Delivery Methods	Scalability*	Integration*	Dependencies*
Purchase	• Not Scalable – Low • Dynamic Scalability on Demand – Moderate • Upgrade Existing Hardware/ Infrastructure – High • Replace Existing Hardware/ Infrastructure – Moderate	• Processes – High • Hardware/Infrastructure Functionality – High • Data – High • Network – High	• Airport Processes – High • Human Resources – High • Systems – Low • Other Hardware/ Infrastructure – High
Lease	• Not Scalable – Low • Dynamic Scalability on Demand – High • Upgrade Existing Hardware/ Infrastructure – Moderate • Replace Existing Hardware/ Infrastructure – Low	• Processes – High • Hardware/Infrastructure Functionality – High • Data – High • Network – High	• Airport Processes – Moderate • Human Resources – Low • Systems – Low • Other Hardware/ Infrastructure – High
Share (Collaborative with Another Entity)	• Not Scalable – High • Dynamic Scalability on Demand – Moderate • Upgrade Existing Hardware/ Infrastructure – High • Replace Existing Hardware/ Infrastructure – Moderate	• Processes – Moderate • Hardware/Infrastructure Functionality – Moderate • Data – Moderate • Network – Moderate	• Airport Processes – Moderate • Human Resources – Moderate • Systems – Low • Other Hardware/ Infrastructure – High

*Applicability to the IT delivery method is rated as low, moderate, or high.

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Common criteria are listed within cost considerations, scalability, integration, and dependencies columns, and each criterion is noted as low, moderate, or high depending on its applicability to the specific IT delivery method.

Alignment with IT Maturity Level

Table 12, as with Tables 6 and 9, identifies the level of IT maturity at which each of the infrastructure components typically becomes relevant. Detailed discussion on each of these components is provided in Appendix D.

Table 12. Hardware and infrastructure and IT maturity levels.

Infrastructure	Level 0: Survival	Level 1: Awareness	Level 2: Committed	Level 3: Proactive	Level 4: Service Aligned	Level 5: Business Partnership
Infrastructure Convergence and Network Systems/Services						
Converged Physical IT Infrastructure			X	X	X	X
Common Network Equipment			X	X	X	X
Infrastructure as a Service				X	X	X
Cable Management and Intelligent Patching Systems				X	X	X
Network Management Systems				X	X	X
Wireless Systems/Services						
Private Mobile Radio Systems	X	X	X	X	X	X
Wireless Local Area Network	X	X	X	X	X	X
Distributed Antenna Systems				X	X	X
Location Awareness				X	X	X
Radio Frequency Identification (RFID)				X	X	X

CHAPTER 5

Guidance for In-Depth Evaluation

It is important to understand the structural approach of the appendices to effectively navigate the in-depth material provided. The following sections briefly describe the content of the four detailed-evaluation appendices in order to present the flow of the relevant information.

Strategic Technology Alignment

Appendix A addresses a strategic planning process to methodically arrive at the final decisions based on a thorough understanding of how these decisions will affect the airport manager's long-term vision. This appendix provides the basis for completing Template 2 of the Strategic Planning and Business Case Development Guide located in Appendix E.

Human Resources, Applications/Systems, and Infrastructure

Appendices B through D address descriptions and evaluations of various IT services and systems in the areas of human resources, applications and systems, and infrastructure. For consistency, the material evaluated in these three appendices is organized using the same framework. First the various IT delivery methods are described. Then each appendix identifies how the six evaluation aspects (benefits, risks, cost considerations, scalability, integration, and dependencies) apply to the topic of the appendix. These evaluation aspects are then mapped (in table format) directly to each alternative delivery option. These three appendices provide the basis for completing Template 3 of the Strategic Implementation and Business Case Development Guide in Appendix E.

All three appendices evaluate various IT delivery methods according to the noted six evaluation aspects. To help the user avoid duplication of content related to cost considerations, scalability, integration, and dependencies in each appendix, definitions and sample uses are provided here:

- **Cost Considerations:** The various IT delivery methods are evaluated based on how each affects cost. This evaluation is done by addressing three major cost consideration categories: planning/design, implementation, and operations/maintenance.
  - ***Planning and Design***-related costs are centered on human resources expenditures, covering various support functions performed by internal airport staff and/or external resources.
  - ***Implementation*** costs are usually the largest expense associated with an application/system project. These expenses are typically associated with the procurement of systems and infrastructure components as well as human resource support for installation, configuration,

integration, data migration or conversion, customization, reporting, testing, training, documentation, and project management.
  - ***Operations/Maintenance*** costs are generally related to managing, operating, supporting, and maintaining the systems and associated hardware and infrastructure.
- **Scalability:** As stakeholder needs, airport goals, and IT goals change, human resources, applications/systems, and infrastructure need the flexibility to keep up with these changes. This flexibility can be achieved through the concept of scalability. Scalability is the ability to handle a growing amount of work in a capable manner or the ability to expand to accommodate that growth. Scalability is considered a relevant aspect as it allows an airport manager to make an investment with confidence knowing obsolescence can be mitigated. For the purpose of this Guidance, each IT delivery method is evaluated considering these scalability parameters:
  - Not Scalable (no improvement or upgrade available or possible)
  - Dynamically Scalable on Demand (features/capabilities only added when needed)
  - Upgrade (upgrade to a recently released enhanced version of existing system/hardware)
  - Replacement (replacing an existing system/hardware with a new/different system/hardware with more applicable/relevant features)

  Note: These parameters have been adapted to reflect the nature of human resources in Appendix B, since scalability is generally a technical term.
- **Integration:** Although human resources can be "integrated" as discussed in Appendix B, such integration differs from system/hardware integration. In the past, airport divisions met their own requirements through manual stand-alone systems. Although systems may become more automated over time, such improvements through automation do not necessarily mean that the systems have been integrated, or even communicate with each other—even when these systems contain common data. It is typical in small airports to find independent systems and supporting hardware. This approach reflects an environment that has developed individual requirements for technology support over a period of time and has not yet shown significant benefit in integration of systems. The majority of modern airport systems contain common data, such as flight schedule and resource allocation data for the airport. This opens up opportunities for integration, based on a single source of data using a common airport-wide network infrastructure. This common airport-wide network could, for example, eliminate the need for redundant data entry, thereby integrating and improving related processes across different airport divisions and functions. A systems integration strategy using current industry standards ensures maximum interoperability between the existing and future airport systems in addition to yielding significant improvements in other areas. To this extent, the evaluation of the IT delivery methods in Appendices C and D considers the integration opportunities in regard to the following:
  - Processes
  - System/hardware functionality
  - Data
  - Network
- **Dependencies:** Airport IT projects are strongly affected by the airport operational environment. Proper planning and management of dependencies within the operational environment make a substantial difference in the success of the IT project. Dependencies can be defined as the relationships that link the order in which activities are carried out. There exist internal (airport) and external (outside) process and resource dependencies within the project framework. Dependencies may also exist outside of the project framework, such as from other projects. For the purpose of providing practical guidance to an airport, the Guidance evaluates the various IT delivery methods by addressing these four dependency categories:
  - Airport processes
  - Human resources

- Systems
- Hardware/infrastructure

Within each category, dependencies can be internal and/or external as well as in project and/or out of project.

As the applicable IT delivery methods differ between the appendices, specific details for benefits and risks are discussed within the appendices themselves and therefore do not require a definition here.

APPENDIX A

Strategic Technology Alignment

Overview

In order to effectively align the technology program with the airport manager's mission, vision, values, and objectives, the user must take a strategic approach to understand the current business objectives, the basis for changes in the environment and the specific needs of the stakeholders. This appendix presents a methodology for systematically defining an overall IT strategy and laying out a long-term plan for project implementation.

IT Strategic Planning

The first step in establishing alignment between IT and the airport manager's business objectives is the creation of an IT Strategic Plan. The IT Strategic Plan defines the direction needed to develop the IT program over a long period of time in accordance with the long-term direction for the airport. The IT Strategic Plan details the enabling processes that must be implemented to achieve the IT goals. The IT Strategic Plan may address key enablers, such as organizational structures, high-priority policies, or near-term projects at a high level, but does not provide long-term project planning. The IT Strategic Plan should be addressed from the perspective of a planning life cycle where it is reevaluated and updated annually to ensure ongoing alignment with the airport manager's priorities. IT strategic planning is an exercise that can be accomplished with internal airport resources or with the assistance of consultants; however, to be effective, it must be done with significant input from the key airport stakeholders.

Multiple standards exist within the IT industry that provide a framework for the governance and management of IT, including ITIL, TOGAF, PMBOK, PRINCE2, COSO, ISO, and COBIT. Each of these has a specific focus area in providing guidance, but all are general in nature and not necessarily directly applicable to the airport industry. The information in these standards can provide guidance, and strict adherence to any of these is not necessary to achieve the intended outcome. The user should assess this against his/her own environment and guiding principles to maximize the benefit. Appendix F provides a resource list covering these standards as well as some other useful resources.

Figure A1. COBIT 5 strategic planning methodology.

The following methodology for determining the baseline IT strategy requirements is based on ISACA's *COBIT 5 Framework for the Governance and Management of Enterprise IT* (ISACA 2012) because its focus is most directly in line with the intent of this Guidance. ISACA is an independent, nonprofit, global association, engaged in the development, adoption and use of globally accepted, industry-leading knowledge and practices for information systems. COBIT 5 is an IT industry best practice that focuses on aligning technology programs with an organization's business objectives in order to minimize IT-related risks and maximize the benefits of technology. This methodology uses a cascading approach, as shown in Figure A1, to identify the enabling IT processes required to ultimately meet the stakeholders' needs. This methodology is rather complex in nature, and is presented here as a basis for understanding. A set of templates are provided in Appendix E, Strategic Planning and Business Case Development Guide, that will walk the user through a simple step-by-step approach to defining an IT Strategic Plan that is appropriate for the specific user's airport.

Stakeholder Needs

The overall purpose of the airport IT organization is to create value for its stakeholders. This is done by creating benefits with an efficient use of resources while optimizing risk. In order to do this effectively, the stakeholder needs (SNs) must be defined. Once understood, a set of specific airport goals can be correlated to provide a focused set of priorities. A general set of IT stakeholder needs include the following (ISACA 2012, pp. 55–56 © 2012 ISACA. All rights reserved. Used with permission.):

SN01 Value from the use of IT
SN02 User satisfaction with the quality of IT service
SN03 Managed performance of IT
SN04 Implementation of new technology for new strategic opportunity
SN05 An appropriately built and structured IT department
SN06 Managed dependency on external providers
SN07 Managed IT outsourcing agreements
SN08 Assurance over external providers
SN09 Management of control requirements for information
SN10 Management of all IT-related risk
SN11 An efficient and resilient IT operation
SN12 Control over the cost of IT
SN13 Effective and efficient use of IT resources
SN14 Effective and efficient use of sourcing options
SN15 Adequate number of IT staff
SN16 Developed and maintained IT staff skills
SN17 Managed IT staff performance
SN18 Assurance over IT
SN19 Securely processed information
SN20 Improved business agility through a flexible IT environment
SN21 Delivered promises from IT projects
SN22 IT support for the execution of business strategy
SN23 Managed IT criticality in sustaining the enterprise
SN24 Understanding of business processes dependent on IT and their requirements

SN25 Understanding of IT operational and project budget requirements
SN26 Understanding of the balance between IT support/maintenance and value creation
SN27 Sufficient IT resources and infrastructure available to meet required strategic objectives
SN28 Timely IT decisions
SN29 Transparency for the total IT effort and investment
SN30 IT support for enterprise regulation and service-level compliance
SN31 Understanding of IT regulation requirements compliance

Airport Goals

Once the stakeholder needs have been defined, the relevant airport goals (AGs) which satisfy these needs will be revealed. Each of these airport goals will then correlate to primary and secondary IT goals. A general set of airport goals include the following (ISACA 2012, pp. 55–56 © 2012 ISACA. All rights reserved. Used with permission.):

Financial

AG01 Provide value to airport stakeholders through financial investments
AG02 Provide competitive products and services for airlines and passengers
AG03 Provide managed risk through safeguarding airport assets
AG04 Maintain compliance with external laws and regulations
AG05 Maintain financial transparency

Customer

AG06 Maintain a customer-oriented service culture
AG07 Maintain business service continuity and availability
AG08 Provide agile responses to a changing aviation environment
AG09 Make information-based strategic decisions
AG10 Optimize airline and passenger service delivery costs

Internal

AG11 Optimize airport-wide process functionality
AG12 Optimize airport-wide process cost
AG13 Manage airport-wide change programs
AG14 Maximize airport operational and staff productivity
AG15 Maintain compliance with internal airport policies

Development

AG16 Maintain skilled and motivated airport staff
AG17 Maintain an innovative airport culture

Table A1 depicts the correlation of stakeholder needs to airport goals. Templates for self-evaluation are provided in Appendix E, Strategic Planning and Business Case Development Guide.

IT Goals

Once the airport goals have been defined, the relevant IT goals (ITG) that support the airport goals emerge and should be assessed. Each of these IT goals will then correlate to primary and secondary enabling processes. A general set of IT goals include the following (ISACA 2012, p. 50 © 2012 ISACA. All rights reserved. Used with permission.):

Financial

ITG01 Alignment of IT and business strategy
ITG02 IT compliance and support for business compliance with external laws and regulations

Table A1. Correlation of stakeholder needs to airport goals.

	AG01	AG02	AG03	AG04	AG05	AG06	AG07	AG08	AG09	AG10	AG11	AG12	AG13	AG14	AG15	AG16	AG17
SN01	X	X				X	X						X			X	X
SN02	X	X				X	X						X			X	X
SN03		X			X				X	X	X	X		X			
SN04	X	X						X					X			X	X
SN05								X		X	X	X		X	X	X	
SN06			X	X						X							
SN07			X	X						X							
SN08			X	X						X							
SN09				X					X						X		
SN10			X				X		X						X		
SN11					X		X										
SN12										X		X		X			
SN13										X		X		X			
SN14										X		X		X			
SN15										X		X		X			
SN16										X		X		X			
SN17										X		X		X			
SN18				X											X		
SN19				X			X								X		
SN20	X							X								X	X
SN21	X	X	X					X			X	X	X				
SN22	X	X	X					X			X	X	X				
SN23	X	X					X										
SN24	X	X									X	X					
SN25					X					X		X		X			
SN26		X	X									X					
SN27		X			X					X		X					
SN28	X	X			X			X									
SN29		X		X	X										X		
SN30				X											X		
SN31				X											X		

Source: ISACA (2012), pp. 55–56.

ITG03 Commitment of executive management for making IT-related decisions
ITG04 Managed IT-related business risk
ITG05 Realized benefits from IT-enabled investments and service portfolio
ITG06 Transparency of IT costs, benefits, and risk

Customer

ITG07 Delivery of IT services in line with business requirements
ITG08 Adequate use of applications, information, and technology solutions

Internal

ITG09 IT agility
ITG10 Security of information, processing infrastructure, and applications
ITG11 Optimization of IT assets, resources, and capabilities
ITG12 Enablement and support of business processes by integrating applications and technology into business processes
ITG13 Delivery of projects delivering benefits on time and on budget and meeting requirements and quality standards
ITG14 Availability of reliable and useful information for decision making
ITG15 IT compliance with internal policies

Development

ITG16 Competent and motivated business and IT personnel
ITG17 Knowledge, expertise, and initiatives for business innovation

Table A2 depicts the correlation of airport goals to IT goals. Templates for self-evaluation are provided in Appendix E: Strategic Planning and Business Case Development Guide.

Table A2. Correlation of airport goals to primary (P) and secondary (S) IT-related goals.

	ITG 01	ITG 02	ITG 03	ITG 04	ITG 05	ITG 06	ITG 07	ITG 08	ITG 09	ITG 10	ITG 11	ITG 12	ITG 13	ITG 14	ITG 15	ITG 16	ITG 17
AG01	P		P		P	S	P	S	S		P	S	P	S		S	S
AG02	P		S		P		P	S	P		S	P	S	S		S	P
AG03	S	S	S	P		S	S	S	S	P		S	S	S	S	P	
AG04		P		S			S			P				S	S		
AG05						P											
AG06	P				S		P	S	S			S	S			S	S
AG07	S			P			S	S		P				P			
AG08	P		S	S	S		P		P		S	S				S	P
AG09	P		S			S	S	S						P			S
AG10	S			P	S	P		S			P	S	S				
AG11	P		S		S		P	P	P		S	P		S			S
AG12	S				P	P	S	S			P	S	S				
AG13	P		P	S			S		S		S	S	P				S
AG14					S			P	S		S	S				P	
AG15		P		S						P					P		
AG16	S		S	S			S	S	S							P	S
AG17	S		S		S		S	S	P		S	S				S	P

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Enabling Processes

Once the IT-related goals have been defined, the enabling processes that support them emerge and should be assessed. The defined primary and secondary enabling processes provide the foundation on which a fully aligned IT strategy can be created. A general set of enabling processes include the following (ISACA 2012, p. 52–53. © 2012 ISACA. All rights reserved. Used with permission):

Evaluate, Direct, and Monitor (EDM)

EDM01 Ensure governance framework setting and maintenance
EDM02 Ensure benefits delivery
EDM03 Ensure risk optimization
EDM04 Ensure resource optimization
EDM05 Ensure stakeholder transparency

Align, Plan, and Organize (APO)

APO01 Manage the IT management framework
APO02 Manage strategy
APO03 Manage enterprise architecture
APO04 Manage innovation
APO05 Manage portfolio
APO06 Manage budget and costs
APO07 Manage human resources
APO08 Manage relationships
APO09 Manage service agreements
APO10 Manage suppliers
APO11 Manage quality
APO12 Manage risk
APO13 Manage security

Build, Acquire, and Implement (BAI)

BAI01 Monitor programs and projects
BAI02 Manage requirements definition

BAI03 Manage solutions identification and build
BAI04 Manage availability and capacity
BAI05 Manage organizational change enablement
BAI06 Manage changes
BAI07 Manage change acceptance and transitioning
BAI08 Manage knowledge
BAI09 Manage assets
BAI10 Manage configuration

Deliver, Service, and Support (DSS)

DSS01 Manage operations
DSS02 Manage service requests and incidents
DSS03 Manage problems
DSS04 Manage continuity
DSS05 Manage security services
DSS06 Manage business process controls

Monitor, Evaluate, and Assess (MEA)

MEA01 Monitor, evaluate, and assess performance and conformance
MEA02 Monitor, evaluate, and assess the system of internal control
MEA03 Monitor, evaluate, and assess compliance with external requirements

Tables A3 and A4 depict the correlation of IT-related goals to enabling processes. Templates for self-evaluation are provided in Appendix E: Strategic Planning and Business Case Development Guide.

Strategic Alignment Example

Figures A2 through A4 provide an example of the evaluation of one specific stakeholder need for alignment of IT enabling processes. This example assumes a stakeholder need of "Value from the use of IT." This one stakeholder need gives rise to seven relevant airport goals. Further

Table A3. Correlation of IT-related goals to primary (P) and secondary (S) enabling processes EDM and APO.

	EDM 01	EDM 02	EDM 03	EDM 04	EDM 05	APO 01	APO 02	APO 03	APO 04	APO 05	APO 06	APO 07	APO 08	APO 09	APO 10	APO 11	APO 12	APO 13
ITG01	P	P	S	S	S	P	P	P	S	P	S	S	P	S		S		
ITG02	S		S		S	P						S			S	S	P	P
ITG03	P	S	S	S	P	S	S	S		S	S	S	S					
ITG04	S		P	S		S	S	S	S	S	S	S	S	S	P	S	P	P
ITG05	S	P		S			S	S	P	P	P		S	S	S	P		
ITG06	S	P	P	S	P			S		S	P		S	S	S		P	P
ITG07	P	P	S	S	P	S	P	S		S	S	S	P	P	P	P	S	S
ITG08		S	S	S			S	S	P	S	S		S	S	S	S	S	S
ITG09	S			P		P	S	P	P	S		S		S	P	S	S	
ITG10	S		P			S		S				S		S	S		P	P
ITG11	S	S		P		P	S	P	P	S	S	P	S	S	S	S		
ITG12	S	S				S	S	S	S				P					
ITG13	S	S	S	S	S	S	S			P	S	P	S	S	S	P	P	
ITG14	S	S	S		S	S	S	S	S					P	S	S	S	P
ITG15	S		P		S	P	S					S	S	S	S	S	S	
ITG16	S	S	S	P		P	S					P	S			S	S	
ITG17	S	P	S	S	S	P	P	S	P	S		P	P		S	S	S	

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Table A4. Correlation of IT-related goals to primary (P) and secondary (S) enabling processes BAI, DSS, and MEA.

	BAI 01	BAI 02	BAI 03	BAI 04	BAI 05	BAI 06	BAI 07	BAI 08	BAI 09	BAI 10	DSS 01	DSS 02	DSS 03	DSS 04	DSS 05	DSS 06	MEA 01	MEA 02	MEA 03
ITG01	P	P	S		S			S						S	S		S		
ITG02		S							S	P	S		S	S	P	S	S	P	P
ITG03	S	S			S	S											S		
ITG04	P	S	S	S		P	S		S	S	P	P	P	P	P	P	P	P	P
ITG05	P	S	S	S	S	S	S	S			S		S	S			S		S
ITG06	S								P	S							S	S	
ITG07	S	P	P	P	S	P	S	S	S		P	P	P	P	S	P	P	S	S
ITG08	S	S	S	S	P	S	P	S		S	S	S	S	S	S	S	S	S	
ITG09		S		S	S	S	S	P	S	S	S		S	S			S		
ITG10		S				P		S	S	S	S	S		S	P	S	S	S	S
ITG11	S	S	S	P	S	S		S	P	P	P		P	S	S	S	P		
ITG12		P	S		S	S	P						S	S	S	S			
ITG13	P	S	S	S	P	S	S										S		
ITG14		S	S	P		S	S	S	S	P	S	S	P	P	S	S	S	S	
ITG15						S	S		S	S	S	S	S	S	S	S	P	P	S
ITG16	S							S			S			S		S	S		
ITG17	S	S	S	S	P	S	S	P			S	S	S	S		S	S	S	S

Source: ISACA (2012), p. 52–53. © 2012 ISACA. All rights reserved. Used with permission.

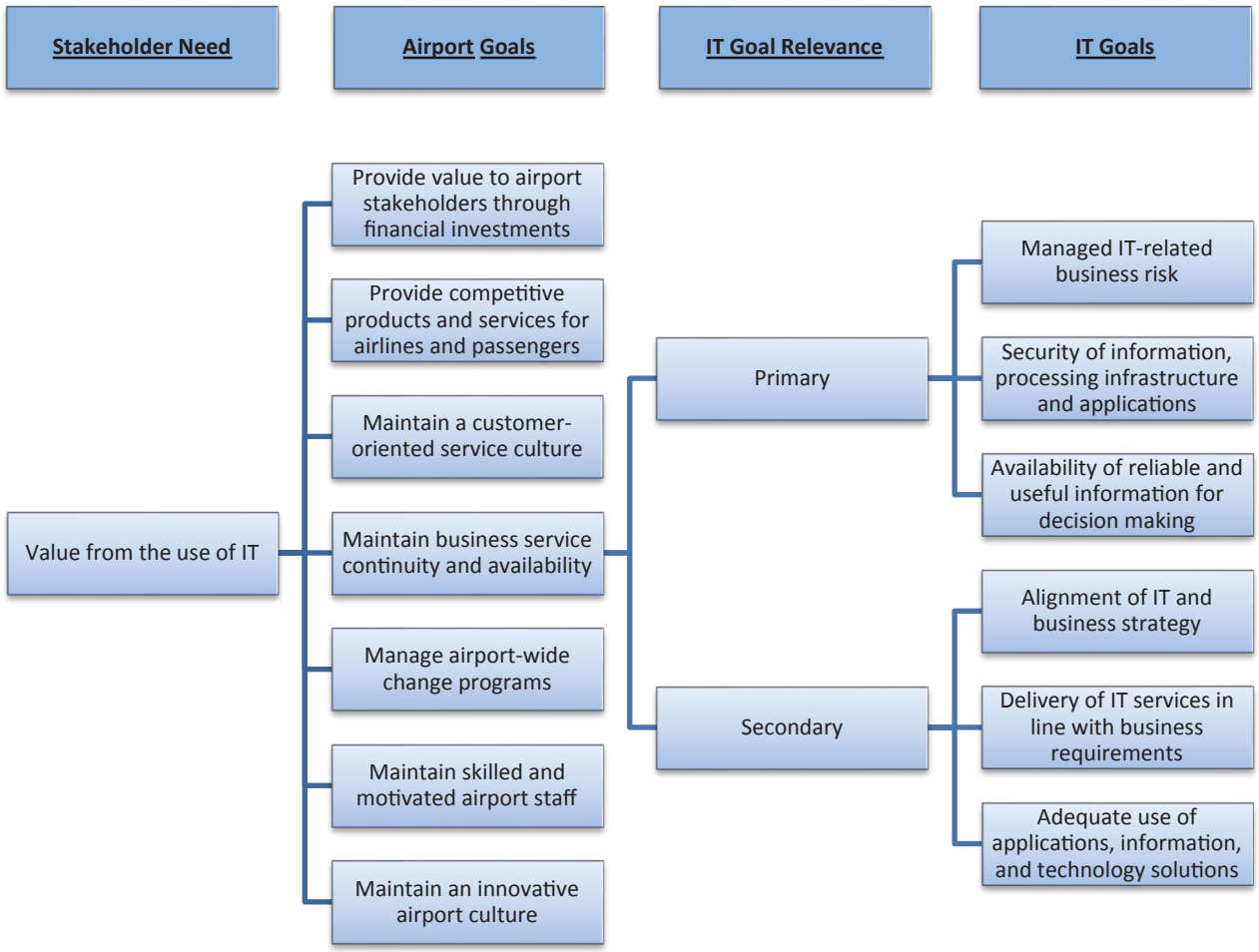

Figure A2. Strategic alignment example—from stakeholder need to IT goals.

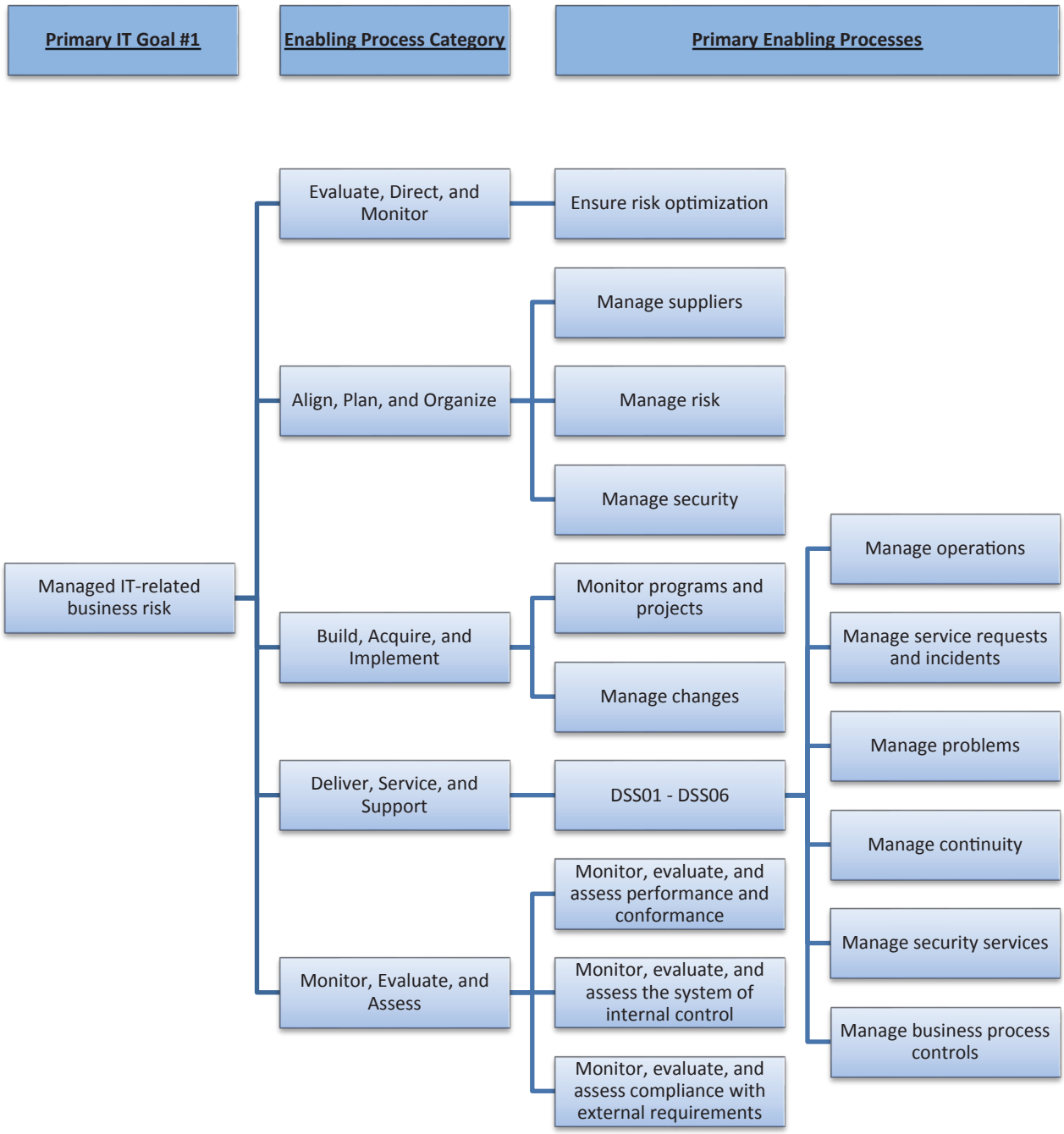

Figure A3. Strategic alignment example—primary enabling processes for first primary IT goal.

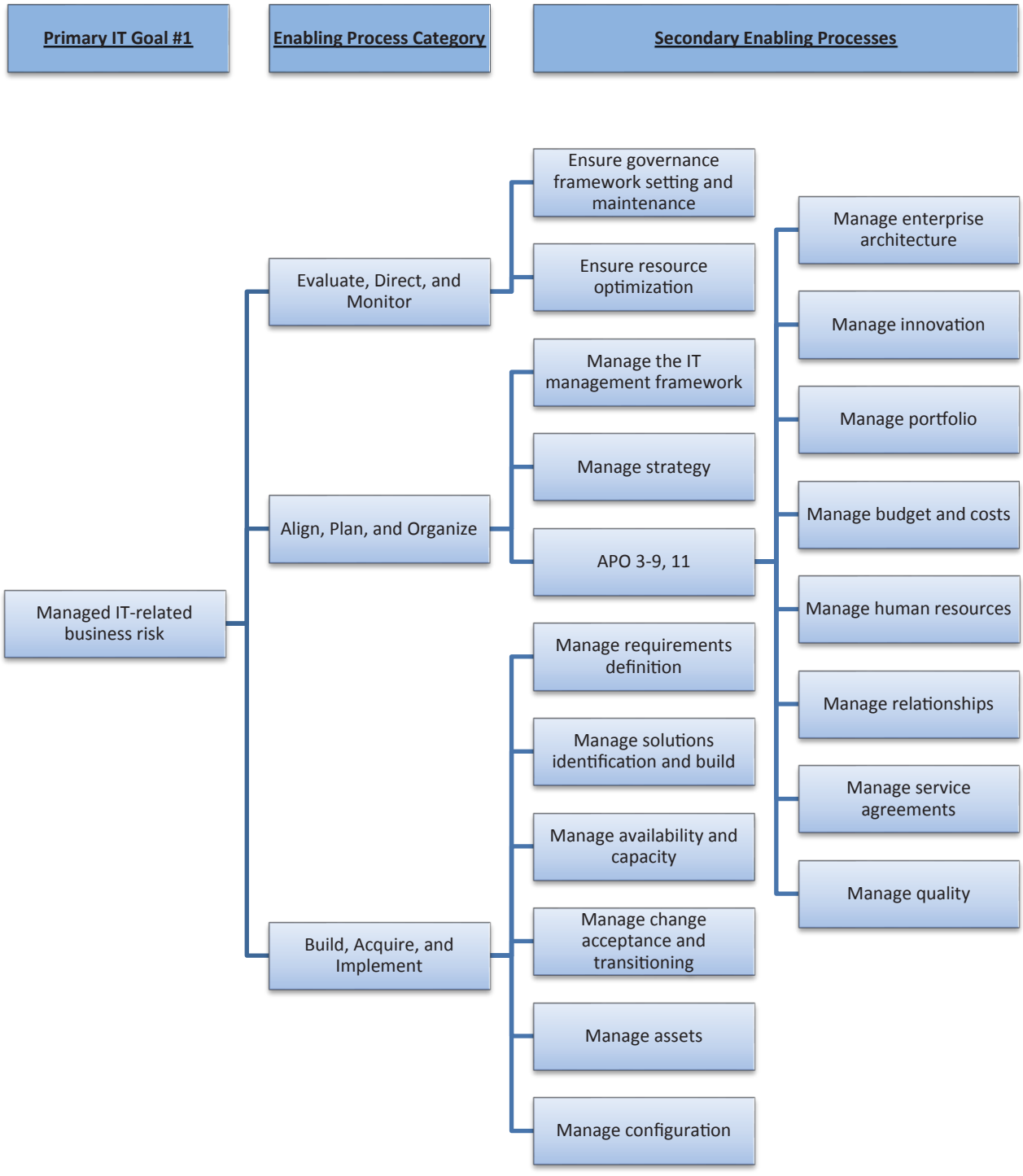

Figure A4. Strategic alignment example—secondary enabling processes for first primary IT goal.

evaluating just one of these goals, "maintain business service continuity and availability" reveals three primary IT goals and three secondary IT goals.

Each IT goal is then broken down into enabling processes. Using the first primary IT goal as an example reveals relevant processes within each of the five enabling process categories. Within each of these, there are fifteen primary enabling processes (Figure A3) and eighteen secondary enabling processes (Figure A4). As a result, in order to meet the stakeholder need for value from the use of IT, thirty-three specific enabling processes should be addressed by the IT Strategic Plan.

IT Master Planning

The IT Master Plan is the tool commonly used for addressing the specific activities required for the long-term development of the IT program according to the direction provided by the IT Strategic Plan. The IT Master Plan should address all of the enablers with sufficient detail for the airport manager to scope and budget new projects for the upcoming three to five years with longer-term projects and initiatives being addressed at a higher level. As with the IT Strategic Plan, the IT Master Plan is part of a planning life cycle and should be updated on a consistent schedule in order to provide greater detail to the longer-term initiatives as they enter the three- to five-year range.

For an IT master planning program to be successful, it must have three core components: support and direction from key stakeholders, initiatives based on practical issues being experienced on a regular basis or well-defined long-term benefits, and an implementable plan.

Stakeholder buy-in and support are necessary elements to avoid experiencing failure with many of the IT Master Plan initiatives and potentially the program itself. For IT improvements and changes to be adopted and sustained, the impacted stakeholders as well as the overall IT governance stakeholders must be actively involved and on-board with the initiatives being developed from the very beginning. To gain this level of support, the IT Master Plan initiatives need to be linked directly to clearly defined stakeholder needs. This is easily accomplished if an adequate level of effort is invested in developing an IT Strategic Plan and the identified IT goals and enabling processes have been accepted by management as priorities to be resolved.

The initiatives being addressed by the IT Master Plan need much more than a link to stakeholder needs for the program to be successful. The IT goals and enabling processes defined in the IT Strategic Plan must be expressed in terms of practical issues that stakeholders experience on a regular basis or well-defined long-term benefits in order to justify the investment of resources to accomplish a new initiative. Typical issues identified in COBIT 5 (ISACA 2012. © 2012 ISACA. All rights reserved. Used with permission) include the following:

- Business frustration with failed initiatives, rising IT costs, and a perception of low business value
- Significant incidents related to IT risk, such as data loss or project failure
- Outsourcing service delivery problems, such as consistent failure to meet agreed-on service levels
- Failure to meet regulatory or contractual requirements
- IT limiting the airport's innovation capabilities and business agility
- Regular audit findings about poor IT performance or reported IT quality of service problems
- Hidden and rogue IT spending
- Duplication or overlap between initiatives or wasting resources, such as premature project termination
- Insufficient IT resources, staff with inadequate skills or staff burnout/dissatisfaction
- IT-enabled changes failing to meet business needs and delivered late or over budget

- Airport executives or senior managers who are reluctant to engage with IT, or a lack of committed and satisfied sponsors for IT
- Complex IT operating models

In addition, changes in the internal or external environment may present issues that necessitate and justify new IT initiatives. Examples include the following:

- Changes in airport leadership
- Airport-wide projects
- Marketing strategies
- Changes in regulatory compliance requirements
- Airline mergers
- Economic downturn
- Technology advancements
- Consultant assessments or studies
- Changes in IT vendor or provider business models

In order to turn specific instigating issues into implementable initiatives, a valid business case must be developed for each. This business case should first define the specific issue to be addressed; describe the current conditions in terms of financial, operational, stakeholder, and staff impact; associate it with the relevant enabling processes, IT goals, airport goals, and stakeholder needs; and describe the parameters relative to addressing this issue.

Once the issue has been thoroughly analyzed, the status quo should be evaluated against the available options. In doing so, the business case must define for each, the benefits in terms of financial, operational, stakeholder, and staff; the costs and funding plan; the feasibility of success; the risks, issues, and assumptions relative to implementation; and both short-term and long-term stakeholder impacts. This process, if completed with thorough and accurate information, should provide clear justification for maintaining the status quo or investing in a specific initiative.

Finally, an integrated project plan should be developed based on further evaluation of each selected initiative to determine:

- Relative priority
- Resource requirements
- Stakeholder coordination and collaboration requirements
- Project requirements
- Dependencies
- Risks mitigation requirements
- Opportunities for economies of scale and scope

Reference

ISACA (2012). *COBIT 5 Framework for the Governance and Management of Enterprise IT.* Rolling Meadows, IL. http://www.isaca.org/COBIT/Pages/Product-Family.aspx

APPENDIX B

Human Resources

Overview

This appendix addresses the human resource aspects of airport IT. First, it addresses the alternative IT delivery methods available and provides the details of specific associated benefits, risks, cost considerations, scalability, integration, and dependencies.

Next, it provides a discussion on the IT governance and management functions, both of which should be provided through airport resources. It describes the role of each along with specific responsibilities and the relevance to small airports. Also, it addresses the operations and maintenance, and project delivery functions, both of which have various IT delivery methods. Within each of these functions, the discussion is grouped into specific roles and responsibilities of human resources found to be implemented at airports of varies sizes.

Alternative IT Delivery Methods

The following sections describe the IT delivery methods associated with human resources.

Airport Staff Resources

Airport staff resources include full-time and part-time employees whose job duties are exclusively directed by and for the sole benefit of the airport.

Contracted Resources

Contracted resources include general IT service firms, specific IT product or service vendors, and IT consulting firms:

- **General IT service firms** perform a range of standard IT system installation, operation, and maintenance duties according to a contracted service-level agreement.

- **Specific IT product or service vendors** perform the full range of installation, operation, and maintenance functions for a specific airport system that they are certified to support according to a contracted service-level agreement.
- **IT consulting firms** provide a range of specialty services across disciplines including business analysis, planning, design, program management, and implementation oversight.

Depending on the nature of the agreement(s), these resources may be onsite full-time, onsite when needed, or completely remote.

Shared Resources

Shared resources include collaborative use of employees from another entity whose job duties are not exclusively directed by and for the sole benefit of the airport but rather are directed by a collaborative reporting structure between the airport manager and the other entity. For example, the resource may be an employee of the city IT department or the port authority and designated for assignment to the airport.

Evaluation Criteria

Benefits & Risks

A general set of benefits and risks associated with various IT delivery methods for human resources is provided in Table B1. Please note that not all benefits and risks apply to all IT delivery methods. A specific breakdown will be provided within each delivery option section.

Cost Considerations

Cost considerations for the IT human resource delivery methods are addressed from the perspectives of budget type (capital vs. operating), commitment level (long term vs. short term), and cost factors (specific cost items to account for). Specific cost considerations that are generally applicable to a resource type (delivery method) may or may not be applicable to a specific resource (individual) based on the terms of engagement.

Table B1. Delivery methods—human resources—general benefits and risk.

Benefit/Risk	Description
Benefits	*Some alternative IT delivery methods can benefit an airport in regard to:*
Reduced time requirement	… achieving objectives in less time
Specific expertise	… having the required expertise to deliver the expected results
Legally bound to performance	… having legal obligations to provide the expected results
Definable level of service	… enabling a specific service quality expectation
Reduced capital costs	… saving in capital costs
Reduced support costs	… saving in support cost
Risks	*Some alternative IT delivery methods can challenge an airport in regard to:*
May not have specific expertise	… possibly not having required expertise to perform the specific functions needed
May not be able to get staff positions allocated	… successfully allocating required staff positions
Expensive	… facing high costs
Potential for divergent interests	… possibly not having the level of focus required for the specific responsibilities due to competing interests
Procurement requirements	… developing specific procurements requirements
May not have control over time/availability	… possibly lacking control over resource time and availability

Scalability

As stakeholder needs, airport goals, and IT goals change, and the IT organization progresses to new levels of maturity, human resources must be able to change with it. A human resource's ability to adapt to these changing conditions is achieved through the concept of scalability. Scalability, in simple terms, is the ability to handle an increasing or more complex level of work within the same area of scope, without a loss of quality. Cost impacts may or may not be tied to scalable resources based on the specific terms of engagement. This factor is an important consideration in assessing differing options to ensure that the planned future capacity is accounted for.

Each IT human resource delivery option will be evaluated according to the following: not scalable (no significant additional or more complex workload will be accomplished); dynamically scalable on demand (can perform additional and/or more complex workload when needed); existing resource investment (can perform additional and/or more complex workload with investment); and additional resource (new resource required for additional and/or more complex workload).

Integration

Integration of human resources into the airport's overall operation is an important factor to consider. The integration level of the IT human resource delivery methods will be evaluated according to the following: tight (close coordination on a daily basis), moderate (direct coordination on a regular basis), loose (infrequent coordination only when required), and none (independent from airport operations).

Dependencies

The unique structure of each airport will influence the dependencies that each IT human resource delivery option will have. The dependencies of the IT human resource delivery methods will be evaluated according to the following categories: airport processes, other human resources, systems, and hardware/infrastructure.

Overview Summary

In an effort to consolidate the above information, Tables B2 and B3 map the benefits, risks, and cost considerations as well as scalability, integration opportunities, and dependencies respectively to the various delivery methods.

IT Governance

According to COBIT 5,

> *Governance ensures that stakeholder needs, conditions, and options are evaluated to determine balanced, agreed-on enterprise objectives to be achieved; setting direction through prioritization and decision making; and monitoring performance and compliance against agreed-on direction and objectives.* (ISACA 2012, p. 14.)

In an airport environment, IT governance should be provided by the executive-level stakeholders who are responsible for ensuring that the airport goals are achieved. With these stakeholders providing direction, IT goals and enabling processes will be established and prioritized such that the ultimate stakeholder needs are addressed. IT governance is responsible for the evaluating, directing, and monitoring processes shown in Table B4.

Many small airports do not have an established framework for IT governance. The common practices in place today reflect an evolutionary approach to implementing technology in support

Table B2. Delivery methods—human resources—benefits, risks, and cost considerations.

Delivery Methods	Benefits	Risks	Cost Considerations
Airport Staff Resources	• Reduced capital costs • Reduced support costs	• May not have specific expertise • May not be able to get staff positions allocated	• Operating Budget • Long-Term Commitment • Cost Factors: o Salary or Hourly Rate o Benefits o Supplies/Equipment o Office Space o Telecommunications o Management o HR Support
Contracted Resources: General IT Services Firm	• Reduced time requirement • Legally bound to performance • Definable level of service	• May not have specific expertise • Procurement requirements • May not have control over time/availability	• Operating or Capital Budget • Short-Term Commitment • Cost Factors: o Fixed Fee or Hourly Rate o Contingency Markup o Supplies/Equipment o Office Space o Telecommunications o Management o Legal Support o Procurement Support
Contracted Resources: Specific IT Product or Service Vendor	• Reduced time requirement • Specific expertise • Legally bound to performance • Definable level of service	• Expensive • Procurement requirements • May not have control over time/availability	• Operating or Capital Budget • Short-Term Commitment • Cost Factors: o Fixed Fee or Hourly Rate o Travel Expenses o Contingency Markup o Supplies/Equipment o Office Space o Telecommunications o Management o Legal Support o Procurement Support
Contract Resources: Consulting Firm	• Reduced time requirement • Specific expertise • Legally bound to performance • Definable level of service	• Expensive • Procurement requirements • May not have control over time/availability	• Operating or Capital Budget • Short-Term Commitment • Cost Factors: o Fixed Fee or Hourly Rate o Travel Expenses o Contingency Markup o Supplies/Equipment o Office Space o Telecommunications o Management o Legal Support o Procurement Support
Shared Resources	• Reduced capital costs • Reduced support costs	• May not have specific expertise • Potential for divergent interests • May not have control over time/availability	• Operating or Capital Budget • Long-Term or Short-Term Commitment • Cost Factors: o Salary or Hourly Rate o Benefits o Supplies/Equipment o Office Space o Telecommunications o Management Time

Table B3. Delivery methods—human resources—scalability, integration, and dependencies.

Delivery Methods	Scalability	Integration	Dependencies
Airport Staff Resources	• Not Scalable • Existing Resource Investment • Additional Resource	• Tight	• Airport Processes • Other Human Resources • Systems • Hardware/Infrastructure
Contracted Resources: General IT Services Firm	• Not Scalable • Dynamically Scalable on Demand • Additional Resource	• Tight • Moderate • Loose • None	• Airport Processes • Other Human Resources • Systems • Hardware/Infrastructure
Contracted Resources: Specific IT Product or Service Vendor	• Not Scalable • Dynamically Scalable on Demand • Additional Resource	• Tight • Moderate • Loose • None	• Airport Processes • Other Human Resources • Systems • Hardware/Infrastructure
Contract Resources: Consulting Firm	• Not Scalable • Dynamically Scalable on Demand • Additional Resource	• Tight • Moderate • Loose	• Airport Processes • Other Human Resources • Systems • Hardware/Infrastructure
Shared Resources	• Not Scalable • Dynamically Scalable on Demand • Existing Resource Investment • Additional Resource	• Tight • Moderate • Loose • None	• Airport Processes • Other Human Resources • Systems • Hardware/Infrastructure

Table B4. Evaluate, direct, and monitor processes.

Process ID	Process	Process Description
EDM01	Ensure Governance Framework Setting and Maintenance	Analyze and articulate the requirements for the governance of enterprise IT, and put in place and maintain effective enabling structures, principles, processes, and practices, with clarity of responsibilities and authority to achieve the enterprise's mission, goals, and objectives.
EDM02	Ensure Benefits Delivery	Optimize the value contribution to the business from the business processes, IT services, and IT assets resulting from investments made by IT at acceptable costs.
EDM03	Ensure Risk Optimization	Ensure that the enterprise's risk appetite and tolerance are understood, articulated and communicated, and that risk to enterprise value related to the use of IT is identified and managed.
EDM04	Ensure Resource Optimization	Ensure that adequate and sufficient IT-related capabilities (people, process, and technology) are available to support enterprise objectives effectively at optimal cost.
EDM05	Ensure Stakeholder Transparency	Ensure that enterprise IT performance and conformance measurement and reporting are transparent, with stakeholders approving the goals and metrics and the necessary remedial actions.

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of operational needs over time, the result of which is an IT environment composed of independent systems that each have somewhat unique requirements for operation, administration, maintenance, and support. While this is not uncommon in small airports, it is often the cause of much of the inefficiency, ineffectiveness, and instability of the IT function and a significant source of stress and dissatisfaction by stakeholders.

IT Management

According to COBIT 5,

Management plans, builds, runs, and monitors activities in alignment with the direction set by the governance body to achieve the enterprise objectives. (ISACA 2012. © 2012 ISACA. All rights reserved. Used with permission.)

In an airport environment, IT management is provided by a team who is responsible for ensuring that the IT goals are achieved. Depending on the size of the airport and the maturity level of the IT function, IT management may be performed by a single individual or a group with a defined leader who reports to the executive level. IT management is responsible for the following processes:

- Aligning, Planning, and Organizing (APO) processes shown in Table B5
- Building, Acquiring, and Implementing (BAI) processes shown in Table B6
- Delivering, Servicing, and Supporting (DSS) processes shown in Table B7
- Monitoring, Evaluating, and Assessing (MEA) processes shown in Table B8

Table B5. Align, plan, and organize processes.

Process ID	Process	Process Description
APO01	Manage the IT Management Framework	Clarify and maintain the governance of enterprise IT mission and vision. Implement and maintain mechanisms and authorities to manage information and the use of IT in the enterprise in support of governance objectives in line with guiding principles and policies.
APO02	Manage Strategy	Provide a holistic view of the current business and IT environment, the future direction, and the initiatives required to migrate to the desired future environment. Leverage enterprise architecture building blocks and components, including externally provided services and related capabilities to enable nimble, reliable and efficient response to strategic objectives.
APO03	Manage Enterprise Architecture	Establish a common architecture consisting of business process, information, data, application, and technology architecture layers for effectively and efficiently realizing enterprise and IT strategies by creating key models and practices that describe the baseline and target architectures. Define requirements for taxonomy, standards, guidelines, procedures, templates, and tools, and provide a linkage for these components. Improve alignment, increase agility, improve quality of information, and generate potential cost savings through initiatives such as re-use of building block components.
APO04	Manage Innovation	Maintain an awareness of information technology and related service trends, identify innovation opportunities, and plan how to benefit from innovation in relation to business needs. Analyze what opportunities for business innovation or improvement can be created by emerging technologies, services or IT-enabled business innovation, as well as through existing established technologies and by business and IT process innovation. Influence strategic planning and enterprise architecture decisions.
APO05	Manage Portfolio	Execute the strategic direction set for investments in line with the enterprise architecture vision and the desired characteristics of the investment and related services portfolios, and consider the different categories of investments and the resources and funding constraints. Evaluate, prioritize and balance programs and services, managing demand within resource and funding constraints, based on their alignment with strategic objectives, enterprise worth and risk. Move selected programs into the active services portfolio for execution. Monitor the performance of the overall portfolio of services and programs, proposing adjustments as necessary in response to program and service performance or changing enterprise priorities.
APO06	Manage Budget and Costs	Manage the IT-related financial activities in both the business and IT functions, covering budget, cost, and benefit management, and prioritization of spending through the use of formal budgeting practices and a fair and equitable system of allocating costs to the enterprise. Consult stakeholders to identify and control the total costs and benefits within the context of the IT strategic and tactical plans, and initiate corrective action where needed.
APO07	Manage Human Resources	Provide a structured approach to ensure optimal structuring, placement, decision rights, and skills of human resources. This includes communicating the defined roles and responsibilities, learning and growth plans, and performance expectations, supported with competent and motivated people.
APO08	Manage Relationships	Manage the relationship between the business and IT in a formalized and transparent way that ensures a focus on achieving a common and shared goal of successful enterprise outcomes in support of strategic goals and within the constraint of budgets and risk tolerance. Base the relationship on mutual trust, using open and understandable terms and common language and a willingness to take ownership and accountability for key decisions.

Table B5. (Continued).

Process ID	Process	Process Description
APO09	Manage Service Agreements	Align IT-enabled services and service levels with enterprise needs and expectations, including identification, specification, design, publishing, agreement, and monitoring of IT services, service levels, and performance indicators.
APO10	Manage Suppliers	Manage IT-related services provided by all types of suppliers to meet enterprise requirements, including the selection of suppliers, management of relationships, management of contracts, and reviewing and monitoring of supplier performance for effectiveness and compliance.
APO11	Manage Quality	Define and communicate quality requirements in all processes, procedures and the related enterprise outcomes, including controls, ongoing monitoring, and the use of proven practices and standards in continuous improvement and efficiency efforts.
APO12	Manage Risk	Continually identify, assess, and reduce IT-related risk within levels of tolerance set by enterprise executive management.
APO13	Manage Security	Define, operate and monitor a system for information security management.

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Table B6. Build, acquire and implement processes.

Process ID	Process	Process Description
BAI01	Manage Programs and Projects	Manage all programs and projects from the investment portfolio in alignment with enterprise strategy and in a coordinated way. Initiate, plan, control, and execute programs and projects, and close with a post-implementation review.
BAI02	Manage Requirements Definition	Identify solutions and analyze requirements before acquisition or creation to ensure that they are in line with enterprise strategic requirements covering business processes, applications, information/data, infrastructure, and services. Coordinate with affected stakeholders the review of feasible options including relative costs and benefits, risk analysis, and approval of requirements and proposed solutions.
BAI03	Manage Solutions Identification and Build	Establish and maintain identified solutions in line with enterprise requirements covering design, development, procurement/sourcing, and partnering with suppliers/vendors. Manage configuration, test preparation, testing, requirements management and maintenance of business processes, applications, information/data, infrastructure, and services.
BAI04	Manage Availability and Capacity	Balance current and future needs for availability, performance, and capacity with cost-effective service provision. Include assessment of current capabilities, forecasting of future needs based on business requirements, analysis of business impacts, and assessment of risk to plan and implement actions to meet the identified requirements.
BAI05	Manage Organizational Change Enablement	Maximize the likelihood of successfully implementing sustainable enterprise-wide organizational change quickly and with reduced risk, covering the complete life cycle of the change and all affected stakeholders in the business and IT.
BAI06	Manage Changes	Manage all changes in a controlled manner, including standard changes and emergency maintenance relating to business processes, applications, and infrastructure. This includes change standards and procedures, impacts, prioritization and authorization, emergency changes, tracking, reporting, closure, and documentation.
BAI07	Manage Change Acceptance and Transitioning	Formally accept and make operational new solutions, including implementation planning, system and data conversion, acceptance testing, communication, release preparation, promotion to production of new or changed business processes and IT services, early production support, and a post-implementation review.
BAI08	Manage Knowledge	Maintain the availability of relevant, current, validated, and reliable knowledge to support all process activities and to facilitate decision making. Plan for the identification, gathering, organizing, maintaining, use, and retirement of knowledge.
BAI09	Manage Assets	Manage IT assets through their life cycle to make sure that their use delivers value at optimal cost, they remain operational (fit for purpose), they are accounted for and physically protected, and those assets that are critical to support service capability are reliable and available. Manage software licenses to ensure that the optimal number are acquired, retained, and deployed in relation to required business usage, and the software installed is in compliance with license agreements.
BAI10	Manage Configuration	Define and maintain descriptions and relationships between key resources and capabilities required to deliver IT-enabled services, including collecting configuration information, establishing baselines, verifying and auditing configuration information, and updating the configuration repository.

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Table B7. Deliver, service, support processes.

Process ID	Process	Process Description
DSS01	Manage Operations	Coordinate and execute the activities and operational procedures required to deliver internal and outsourced IT services, including the execution of pre-defined standard operating procedures and the required monitoring activities.
DSS02	Manage Service Requests and Incidents	Provide timely and effective response to user requests and resolution of all types of incidents. Restore normal service; record and fulfil user requests; and record, investigate, diagnose, escalate, and resolve incidents.
DSS03	Manage Problems	Identify and classify problems and their root causes and provide timely resolution to prevent recurring incidents. Provide recommendations for improvements.
DSS04	Manage Continuity	Establish and maintain a plan to enable the business and IT to respond to incidents and disruptions in order to continue operation of critical business processes and required IT services and maintain availability of information at a level acceptable to the enterprise.
DSS05	Manage Security Services	Protect enterprise information to maintain the level of information security risk acceptable to the enterprise in accordance with the security policy. Establish and maintain information security roles and access privileges and perform security monitoring.
DSS06	Manage Business Process Controls	Define and maintain appropriate business process controls to ensure that information related to and processed by in-house or outsourced business processes satisfies all relevant information control requirements. Identify the relevant information control requirements and manage and operate adequate controls to ensure that information and information processing satisfy these requirements.

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Table B8. Monitor, evaluate, and assess processes.

Process ID	Process	Process Description
MEA01	Monitor, Evaluate and Assess Performance and Conformance	Collect, validate, and evaluate business, IT, and process goals and metrics. Monitor that processes are performing against agreed-on performance and conformance goals and metrics and provide reporting that is systematic and timely.
MEA02	Monitor, Evaluate and Assess the System of Internal Control	Continuously monitor and evaluate the control environment, including self-assessments and independent assurance reviews. Enable management to identify control deficiencies and inefficiencies and to initiate improvement actions. Plan, organize, and maintain standards for internal control assessment and assurance activities.
MEA03	Monitor, Evaluate and Assess Compliance with External Requirements	Evaluate that IT processes and IT-supported business processes are compliant with laws, regulations, and contractual requirements. Obtain assurance that the requirements have been identified and complied with, and integrate IT compliance with overall enterprise compliance.

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Many small airport managers do not have a robust IT management structure providing the formal level of management described in these processes. Regardless, most are functioning adequately, even though they seem to stay in "reactionary mode" more than they would prefer. This is because the majority of these processes are being performed, out of necessity, in an unmanaged and informal manner. In order to move beyond a reactionary mode into what is described in the Guidance as "IT Maturity Level 3: Proactive," airport IT management must adopt an intentional approach to formally addressing these processes.

Consultant support is commonly used for assistance in the development of new processes as well as the execution of high-level tasks that require subject matter expertise for which the IT management resources either do not have the time or capability to perform. Many airport managers leverage consultant support for strategic and master plan development, business case development, specific assessments and studies, project planning and management, and implementation oversight.

Operations and Maintenance Support

Operations and maintenance support refers to the workload necessary to provide IT services and keep systems functioning as required. This includes providing operational value to systems and networks through daily administration, monitoring, updating, backing up, and developing application, as well as resolving problems through hardware repair and replacement, end-user support, and application support. In a small airport environment, there is typically significant overlap of responsibilities among resources, with the limiting factor being the overall skill set. Operations and maintenance support options are addressed below based on typical skill set groupings, including hardware maintenance, end-user support, software/network administration, and application development. Table B9 provides a quick reference followed by a brief description of each to provide greater detail.

Hardware Maintenance

Hardware maintenance provides the ongoing maintenance and repair services required to keep technology hardware components functioning as required. It is a standard IT support requirement for all and is typically conducted onsite. The extent to which it is needed and the appropriate IT delivery method are determined by the airport's size and complexity.

Airport Staff Resources

Airports of all sizes widely use full-time staff resources to provide hardware maintenance. IT technicians are readily available resources in most locations. While this role may be filled with resources that are hired with all of the relevant skills necessary, hardware maintenance is an area where individuals with limited experience can be trained and developed in-house.

Table B9. Overview—operations and maintenance support.

	Airport Staff Resources	Contracted Resources	Shared Resources
Hardware Maintenance	• Entry-level opportunity with training • Part-time or shared with other duties • Full-time	• General IT service firms • Full-time onsite • Time and materials • Specific IT product or service vendors • Annual fixed cost • Time and materials	• Viable for typical IT hardware components
End-User Support (Help Desk)	• Entry-level opportunity with training • Part-time or shared with other duties • Full-time	• General IT service firms • Full-time onsite • Outsourced call center • Specific IT product or service vendors • Annual fixed cost • Time and materials	• Viable for typical IT software applications and hardware components
System/Network Administration	• Experienced with specialized training • Part-time or shared with other duties • Full-time	• General IT service firms • Full-time • Outsourced call center • Specific IT product or service vendors • Annual fixed cost • Time and materials	• Viable for typical IT software applications and network components
Application Development	• Experienced with specialized training • Part-time or shared with other duties • Full-time	• General IT service firms • Full-time • Time and materials • Project fixed cost • Specific IT product or service vendors • Annual fixed cost	• Viable for typical IT software applications

Contracted Resources

General IT service firms provide hardware maintenance services through a variety of options ranging from full-time onsite resources to time and materials on an as-needed basis. This is a viable option for providing hardware maintenance in some airport environments that do not have need for a full-time technician or have a business case that supports outsourcing. A contracted technician's hourly rate will typically be higher than that of a full-time technician, but the overall value can be greater if the workload is performed more efficiently through outsourcing. This service can be bundled into a "managed services" agreement with other IT services to provide specific services on an ongoing basis according to an agreed-upon response and resolution period.

Specific IT product or service vendors provide hardware maintenance for equipment that requires specific skills and, potentially, certifications. Typically, this would be components of a special system such as security access control or fire alarm monitoring. Depending on the system, there may be code or regulatory requirements that necessitate the use of a particular service provider. Agreements with these vendors are typically on a multi-year, fixed-cost support agreement but may also be provided through time and materials as needed.

Consulting firms do not provide hardware maintenance services.

Shared Resources

Shared resources may be used to provide hardware maintenance in certain environments. Depending on the organizational structure of the airport, opportunities may exist for IT technicians to be shared between different departments of closely tied organizations. Sharing of resources is a viable option when dealing with typical IT hardware, such as computers, printers, and network switches. However, airport special systems require specific skills that other closely tied organizations do not possess.

End-User Support

End-user support, also known as "help desk support," provides the routine services required to assist end-users with IT-related needs. The role provides two major functions, problem resolution and ad hoc training. It is a standard IT support requirement for all airports and is provided over the phone, through email, and in person. The extent to which it is needed and the appropriate IT delivery method are determined by the airport's size and complexity.

Airport Staff Resources

Airports of all sizes widely use full-time staff resources to provide end-user support. This role requires knowledge of a wide range of general IT applications and hardware, but typically serves as the first point of contact to the end-users and will refer difficult issues to a more experienced technician to solve. As such, this is a position that can be shared with other duties if not needed full-time, and is also an area where individuals with limited experience can be trained and developed.

Contracted Resources

General IT service firms provide end-user services through a variety of options ranging from full-time onsite resources to shared-use call centers around the world. This is a viable option for providing end-user support in some airport environments that do not have need for a full-time end-user support technician or have a business case that supports outsourcing. A contracted technician's hourly rate will typically be higher than that of a full-time technician,

but the overall value can be greater if the workload is performed more efficiently through outsourcing. This service can be bundled into a "managed services" agreement with other IT services to provide specific services on an ongoing basis according to an agreed-upon response and resolution period.

Specific IT product or service vendors provide end-user support for software applications or hardware components that require specific skills and, potentially, certifications. Typically, this would be components of a special system such as common/shared-use applications or parking revenue control systems. Agreements with these vendors is typically on a multi-year, fixed-cost support agreement but may also be provided through time and materials as needed.

Consulting firms do not provide end-user support services.

Shared Resources

Shared resources may be used to provide end-user support in certain environments. Depending on the organizational structure of the airport, opportunities may exist for IT technicians to be shared between different departments of closely tied organizations. Sharing of resources is a viable option when dealing with typical IT software applications and hardware components, such as office productivity packages and computers. However, airport special systems typically require specific skills that other closely tied organizations do not possess.

System/Network Administration

System and network administration provides the ongoing application-level support required to keep IT services up and running. This includes routine tasks within software applications or hardware configurations that require specific training. It is a standard IT support requirement and can be provided remotely in many cases but may require onsite presence when direct access to a specific piece of hardware is required. The extent to which this support is needed and the appropriate IT delivery method are determined by the airport's size and complexity.

Airport Staff Resources

Airports of all sizes often use full-time staff resources to provide system and network administration. This role requires expertise in specific IT applications and hardware, typically provided through formal training. System and network administration duties use different skill sets and are not typically performed by the same resource. Often, a system administrator will provide this role for multiple systems within the IT environment; however, large environments will have specialists for different systems.

Contracted Resources

General IT service firms provide system administration services through a variety of options ranging from full-time onsite resources to shared-use call centers around the world. This is a viable option for providing system or network administration support in some airport environments that do not have need for a full-time system or network administrator or have a business case that supports outsourcing. A contracted administrator's hourly rate will typically be higher than that of a full-time administrator, but the overall value can be greater if the workload is performed more efficiently through outsourcing. This service can be bundled into a "managed services" agreement with other IT services to provide specific services on an ongoing basis according to an agreed-upon response and resolution period.

Specific IT product or service vendors provide system administration support for software applications that require specific skills and, potentially, certifications. Typically, this would

be components of a special system such as an airport operational database. Agreements with these vendors are typically on a multi-year, fixed-cost support agreement but may also be provided through time and materials as needed.

Consulting firms do not provide system administration services.

Shared Resources

Shared resources may be used to provide system or network administration in certain environments. Depending on the organizational structure of the airport, opportunities may exist for system administrators to be shared between different departments of closely tied organizations. Sharing of resources is a viable option when dealing with typical IT software applications and network components such as email packages and network switches. However, airport special systems typically require specific skills that other closely tied organizations do not possess.

Application Development

Application development provides the software-based development required to enable specific IT services, such as web development, database design, or custom application configuration. It is a common IT support requirement for airports and can typically be provided remotely unless direct access to a specific piece of hardware requires onsite presence. The extent to which it is needed and the appropriate IT delivery method are determined by the airport's size and complexity.

Airport Staff Resources

Some airports use staff resources to provide application development to some extent. This role requires expertise in specific IT applications, typically provided through formal training.

Contracted Resources

General IT service firms provide application development services through a variety of options ranging from full-time onsite resources to time and materials on an as-needed basis to fixed cost on a project basis. This is a viable option for providing application development in some airport environments that do not have need for full-time developers or have a business case that supports outsourcing. A contracted developer's hourly rate will typically be higher than that of a full-time developer, but the overall value can be greater if the workload is performed more efficiently through outsourcing. This service can be bundled into a "managed services" agreement with other IT services to provide specific services on an ongoing basis according to an agreed-upon response and resolution period.

Specific IT product or service vendors provide application development support for software applications that require specific skills and, potentially, certifications. Typically, this would be components of a special system such as a multi-user flight information system. Agreements with these vendors are typically on a multi-year, fixed-cost support agreement but may also be provided through time and materials as needed or fixed cost on a project basis.

Consulting firms do not provide application development services.

Shared Resources

Shared resources may be used to provide application development in certain environments. Depending on the organizational structure of the airport, opportunities may exist for application developers to be shared between different departments of closely tied organizations. Sharing of

resources is a viable option when dealing with typical IT software applications, such as websites and databases. However, airport special systems typically require specific skills that other closely tied organizations do not possess.

Project Delivery

Project delivery, for the purpose of this Guidance, refers to the workload necessary to support the end-to-end project life cycle. This typically includes effort by multiple resources both within and outside of the airport, such as airport staff (management, specific divisional stakeholders, and IT resources), consultants, general IT service firms, specific product or service vendors, and shared resources from partnering entities. In many cases, small projects for which the airport manager has the complete set of necessary skills will be executed internally. Formal execution of the complete project life cycle is typically seen in airports that have reached the Level 2 stage of IT maturity. Airports below Level 2 adhere to many of the principles required to implement the project; however, principles and processes that are required for ensuring the most efficient and effective outcomes are often underutilized due to resource constraints or lack of understanding of the value the principles and processes provide. Project delivery is addressed here in terms of the five standard project management processes: initiating, planning, execution, controlling, and closing. Across each of these, the following nine areas will be discussed: scope, time, cost, quality, communications, human resources, procurement, integration, and risk. Appendix A addresses strategic planning and master planning and references the need to develop a business case and project plan as master plan initiatives move forward.

Project Management Processes

Initiating

Initiating a project is focused on defining a business case scope to address the stakeholder needs. This initiation process documents a description of the issue to be addressed and evaluates options against the status quo. It assesses the issue against the IT Strategic Plan; measures feasibility; determines high-level assumptions, risks, issues, and impacts; evaluates the benefits against the costs; and establishes a funding plan. Typically, this process either validates that the status quo is acceptable or gives rise to a new project.

Planning

During the planning phase, each of the areas addressed by the business case will be further developed and the specific plan that will guide the execution and controlling of the project will be created. The following areas are addressed during planning:

- **Scope:** Scope planning and scope definition
- **Time:** Activity definition, activity sequencing, activity duration estimating, and schedule development
- **Cost:** Resource planning, cost estimating, and cost budgeting
- **Quality:** Quality planning
- **Communications:** Communications planning
- **Human Resources:** Organizational planning and staff acquisition
- **Procurement:** Procurement planning and solicitation planning
- **Integration:** Project plan development
- **Risk:** Risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, and risk response planning

The planning phase lays the groundwork for the project to be executed and controlled in an efficient and effective manner. The overall outcome of the project is highly dependent on the completeness and quality of the effort put into planning.

Execution

During the execution phase, the project moves forward according to the project plan defined in the planning phase. The following areas are addressed during execution:

- **Integration:** Project plan execution
- **Quality:** Quality assurance
- **Human Resources:** Team development
- **Communications:** Information distribution
- **Procurement:** Solicitation, source selection, and contract administration

During a typical airport system or infrastructure project, this includes design, development, testing, and implementation by a vendor or contractor. The extent to which design and development are necessary depends on the customized nature of the project.

Controlling

The controlling phase is a series of processes that overlap the execution. It ensures that the project is executed according to the project plan and facilitates adjustments where necessary. The following areas are addressed during controlling:

- **Communications:** Performance reporting
- **Integration:** Integrated change control
- **Scope:** Scope verification and scope change control
- **Time:** Schedule control
- **Cost:** Cost control
- **Quality:** Quality control
- **Risk:** Risk monitoring and control

The controlling processes are often the areas that are underutilized due to resource constraints or lack of understanding of the value they provide. During the course of the project, the effort associated with closely monitoring the performance and risk issues and the management of change control can be seen as unnecessary and overly burdensome when it "feels" like everything is running smoothly. When a project begins to veer off course and its risks begin to materialize, it is often not obvious because the individuals in control of the problem areas believe they can recover and get back on track. In most cases this is possible and the risks are mitigated. However, when the risks cannot be mitigated and issues arise it may be too late to resolve them without a negative impact to the project. In this case, changes to scope, cost, time, or quality may be necessary.

Closing

The closing phase deals with the formal acceptance and closure of a project after all project activities have been completed to the satisfaction of the airport. The following areas are addressed during closing:

- **Procurement:** Contract closeout
- **Communications:** Administrative closure

The closing phase is another area in which significant value can be lost. By the time the project activities are complete, resources are quickly released and reassigned to the next project, particularly in the case where a project has gone over budget or beyond its schedule. Unfortunately, what

results is a lack of adequate administrative closure. During this process, two key components need to be completed; project archives and lessons learned. Development of project archives is the creation of an organized set of documentation on the project. When this is adequately done, these archives become a valuable resource for future projects to reference. Development of lessons learned is a critical need, especially when the project experienced challenges. The lessons learned enables the evaluation of circumstances that created the challenges and leads to process change that will mitigate these challenges in the future.

Project Delivery Methods

Project delivery methods can be broken down into four distinct categories that cover most any large airport IT project. These include professional services, design-bid-build, design-build, and prequalified task order. In the airport industry, these services are primarily obtained through either a sole-source engagement or competitive solicitation process using a request for proposals (RFP), request for qualifications (RFQ), or request for bid (RFB).

Solicitation Methods

Sole-source engagements are typically only used when a specific provider is needed to perform a defined scope of work, for a dollar amount below the airport manager's procurement threshold, requiring competitive bidding. The specific scope, schedule, and budget are negotiated directly with the provider and may require approval from the executive management or the board/city council depending on the entity's procurement rules.

RFP solicitations are used to competitively select a provider based on a proposed approach and cost for providing the solution, using multiple evaluation criteria to determine the contract award. Evaluation criteria are provided in the RFP in general terms including qualifications, experience, approach, and price. Additional criteria may be included addressing specific requirements defined in the RFP such as use of local, small, minority, disadvantaged, or veteran-owned businesses. Point allocations are typically defined for each category based on the relative value that each category provides to the airport. The RFP should include the following:

- Background information needed to provide perspective for the project
- Project scope clearly stating in-scope, out-of-scope, and optional elements
- Requirements for meeting in-scope elements (the level of specificity determines the level of potential variance in proposed solutions)
- Solicitation schedule of events
- Evaluation criteria
- Proposal response requirements including contact information, question and answer instructions, proposal development and submission requirements, and other procedural requirements

The RFP process may include a required or optional "pre-bid" meeting to review specific information presented in the RFP and to address questions from the interested proposers. Responses to questions are generally published for all proposers in the form of an addendum to the RFP. Upon reviewing the submitted proposals, the evaluation committee may choose to create a "shortlist" of the top proposals and have the proposers attend an interview onsite to address specific questions regarding the proposed solution. In some cases, where there may be ambiguity or inconsistency among proposed solutions, the evaluation committee may request a best and final offer (BAFO) giving the proposer or proposers an opportunity to formally clarify specific identified concerns with the proposal. The BAFO is not intended to allow proposers to change the proposed solution or to drive down the proposed costs but rather to provide clarity and consistency for an equivalent evaluation.

RFQ solicitations are used to competitively select a provider based on qualifications, experience, and approach to providing a particular solution, using multiple evaluation criteria to determine the contract award. Unlike the RFP, cost is not a factor in the RFQ process, and evaluation criteria typically include qualifications, experience, and approach. Additional criteria may be included addressing specific requirements defined in the RFP such as use of local, small, minority, disadvantaged, or veteran-owned businesses. Point allocations are typically defined for each category based on the relative value that each category provides to the airport. The RFQ places a greater importance on obtaining the best firm to do the work with the understanding that the scope, schedule, and cost will be subject to negotiation. The RFQ should include the following:

- Background information needed to provide perspective for the project
- Project scope clearly stating in-scope, out-of-scope, and optional elements
- High-level requirements for meeting in-scope elements
- Solicitation schedule of events
- Evaluation criteria
- Response requirements including contact information, question and answer instructions, response development and submission requirements, and other procedural requirements

The RFQ process may include a required or optional "pre-bid" meeting to review specific information presented in the RFQ and to address questions from the interested respondents. Responses to questions are generally published for all respondents in the form of an addendum to the RFQ. Upon reviewing the submitted responses, the evaluation committee may choose to create a "shortlist" of the respondents deemed to be most qualified and have the respondents attend an interview onsite to address specific questions regarding the proposed solution. The evaluation committee will then score the respondents based on the qualifications, experience, and approach. Additional points may be added to any of the respondents based on meeting additional criteria that support the local contracting goals of the organization. A final selection will be made based on the highest overall score, which may or may not be the most qualified respondent, depending on the impact of the additional criteria. The airport manager will enter into negotiations for the scope, schedule, and cost with the selected firm prior to contracting. If negotiations are unsuccessful, the airport manager may invite the second highest ranked firm to negotiate or may cancel the solicitation and restart the process.

An *RFB* may also be referred to as a request for pricing, request for quotation, or invitation for bid (IFB). RFB solicitations are used when detailed specifications are provided by the airport for an exact required scope of work and typically used for specific products rather than services. RFBs may require experience and reference detail in order to qualify firms against a base set of criteria; however, the final selection is typically made based on the lowest cost among qualified bidders. The RFB should include the following:

- Background information needed to provide perspective for the project
- Project scope clearly stating in-scope, out-of-scope, and optional elements
- Detailed specifications for meeting in-scope elements
- Solicitation schedule of events
- Proposal response requirements including contact information, question and answer instructions, bid response and submission requirements, and other procedural requirements

Professional Services

Professional services contracts are typically used for consulting support as either a fixed cost for a fixed scope or a time and materials basis. Depending on the cost of the engagement, these services may be procured as a sole-source through discretionary funds or bid as an RFP or RFQ. Services typically provided include owner's representative/implementation oversight, construction

administrator or manager, program or project manager, subject matter expert, planning, business analysis, testing, and quality management. Consultants engaged under a professional services contract are frequently used in conjunction with a design-bid-build, design-build, or contractor pre-selection type contract because they act as an agent of the owner, working in the interest of the airport, to ensure that the project meets its objectives.

Design-Bid-Build

A design-bid-build contract is a traditional project delivery approach in which a design team is first engaged to develop a design and specifications. A vendor or contractor is then solicited to bid on the project based on the design and specifications for a specific fixed cost. The design team is often retained to act as the airport manager's agent during the implementation.

Design-Build

A design-build project delivery approach is one in which a single entity is engaged to provide both the design and build/implementation of a project. The selected entity may be a single firm or a team that includes both a design component and a build/implementation component. As part of this approach, there is no specific airport manager's agent who is working in the sole interest of the airport.

Prequalified Task Order

A prequalified task order project delivery approach is one in which one or more entities are selected through a competitive qualifications process to provide services on a task order basis. As tasks are scoped and funded, qualified firms are either directly selected and negotiated with for a specific scope or asked to provide a proposal to be evaluated against other qualified firms. This approach may be used to provide professional services, design services, or build/implementation services.

Table B10 provides an overview of the key opportunities and key challenges regarding project delivery methods.

Project Resources

Airport Staff Resources

Many airport managers use staff resources to provide project delivery functions to some extent. This role requires expertise in specific project management or IT systems, which are typically provided through formal training or gained through experience.

Contracted Resources

General IT service firms provide project delivery functions tied to general IT services. These resources could be engaged through any of the noted delivery methods and can be effective in supplementing airport staff resources with specific technical expertise. This is a viable option for providing project design and implementation expertise in some airport environments that do not have need for full-time technical resources with that specific expertise or have a business case that supports outsourcing. This service can be bundled into a "managed services" agreement with other IT services to provide specific services on an as-needed basis for an agreed-upon rate.

Specific IT product or service vendors provide project delivery support for IT projects that require specific skills and, potentially, certifications. Typically, this would be a proprietary system that was provided by that unique vendor. These projects would typically be contracted as a design-bid-build or design-build under a fixed-cost-for-fixed-scope model.

Table B10. Overview—project delivery methods.

	Key Opportunities	Key Challenges
Professional Services	• Work in the sole interest of the airport manager • Expertise in the specific area needed • Controllable costs • Scalable and flexible resources allow for quick scope change	• Added cost to projects • Additional procurement cycle • Additional contract to manage • RFP solicitation format may not result in the most qualified resource due to scoring impacts of low bid and disadvantaged business enterprise (DBE) contracting goals
Design-Bid-Build	• Designer is selected for expertise in the specific area needed • Designer is not conflicted with build and acts in best interests of the airport • Vendor bids competitively on detailed specifications • Designer supports airport during construction	• Designer is focused on technical design and may not fully understand or evaluate non-technical stakeholder needs • Lengthy process due to sequential activities and additional procurement cycle • RFP solicitation format may not result in the most qualified design resource due to scoring impacts of low bid and DBE contracting goals
Design-Build	• Fast delivery system • Single point of accountability • Early cost and schedule commitment	• No airport manager's agent • Conflict of interest between design and build • Non-competitive build costs • Hidden reductions in quality to protect profit margin • Incomplete design when build cost commitments are made results in probable change orders or quality reduction • Lack of owner input and control
Prequalified Task Order	• Saves time and internal resource costs by reducing procurement cycles • Enables continuity of resources across projects	• Lack of competitive bidding for each task results in potential for higher costs for services

Consulting firms provide a significant level of project delivery services. All professional services noted above can be obtained through consulting firms, yet the resources may be engaged through any of the noted delivery methods independently or as part of a design or build team. Consultant resources can be effective in supplementing airport staff resources with specific expertise. This is a viable option for providing project design and implementation expertise in airport environments that do not have need for full-time resources with that specific expertise or have a business case that supports outsourcing.

Shared Resources

Shared resources can be an effective means of providing general IT or consulting-related project delivery services. Depending on the availability of resources with the needed expertise, this could be an effective means for supplementing airport staff resources.

Reference

ISACA (2012). *COBIT 5 Framework for the Governance and Management of Enterprise IT.* Rolling Meadows, IL. http://www.isaca.org/COBIT/Pages/Product-Family.aspx

APPENDIX C

Applications/Systems

Overview

This appendix first introduces the IT delivery methods associated with applications and systems. It then discusses benefits, risks, cost considerations, scalability, integration, and dependencies, before mapping these to the specific IT delivery method. The following IT application/system categories are addressed in this appendix: office productivity, enterprise systems, airport special systems, building technology/facility systems, and safety and security systems. Within each of these broad categories, the discussion is then grouped into specific types of applications/systems found to be implemented at airports of varies sizes.

Alternative IT Delivery Methods

There are many different IT delivery methods associated with applications and systems. These include purchase off the shelf, internal or external development, onsite or remotely (cloud) hosted subscriptions/licenses, shared collaboration with another entity, or freeware/open source.

Purchase off the Shelf

Sometimes referred to as COTS (commercial off the shelf), this IT delivery method deals with pre-built, factory-packaged, non-customized, and easy-to-install software applications generally provided by a third-party vendor. COTS can be purchased, leased, or licensed to companies and the general public.

Development—Internal vs. External

Application/system development in general refers to the process of defining, designing, testing, and implementing a new application/system.

This development can occur internally using an organization's own IT resources. It usually includes some level of customization based on specific needs and requirements. Formalized standards and procedures ought to be developed as they guide the application/system's processing functions. Leadership must define and implement these standards and develop a suitable system development life cycle methodology in order to properly govern the process of developing, acquiring, implementing, and maintaining these applications/systems.

Applications/system development can also be done externally by hiring a third-party vendor. In this case the responsibility of system customization and the development and related standards and procedures lies with the vendor. A hybrid approach, where internal and external development is combined, is also an option.

Subscription (License)—Hosted Onsite vs. Remote (Internet/Cloud)

Onsite hosting means that the hardware required to run the system is physically located at the airport. Often locally installed hardware is a capital expenditure, where the airport manager owns the system hardware and is responsible for the system maintenance, repairs, and replacement. However, in a hardware license relationship, the hardware can reside locally at the airport, but the airport manager will not own the hardware or have responsibility for the system maintenance, repairs, and replacements.

In the context of a remotely hosted system, "internet" and "cloud" are synonymous as this is effectively what is referred to as "cloud computing." Cloud computing refers to software applications and servers that are accessed and interfaced remotely over the internet. Specific capabilities are sold as a service with a guaranteed level of functionality and availability. Cloud computing can be the delivery method for a number of airport business solutions such as office productivity software, email and calendar services, and enterprise systems (i.e., parking control systems, accounting, human resources, etc.). It can even serve as an "infrastructure" solution, termed "infrastructure as a service" (IaaS), through the provision of primary and secondary backup storage solutions for electronic files and other uses. Cloud computing is a shift from capital expenditure models to operational expenditure models. The service provider owns, maintains, updates, and replaces the software and hardware as needed. Cloud computing has become a mainstream method for accessing data and receiving required services, and several airports have implemented some level of cloud computing. However, many are still skeptical of the levels of reliability and security of having data stored offsite by a vendor. Although cloud computing as a service is relatively new, many of the technological advancements [i.e., virtual private network (VPN)] used to achieve these solutions have been in use since the late 1990s/early 2000s.

All subscription/licensing models can be hosted either onsite or remotely. In general, in a subscription/licensing model, a customer pays a subscription fee to have access to a certain product/service. There are differing model types, including a perpetual license, annual subscription, and per use. Perpetual licensing includes a one-time payment to use an application without any expiration date. Annual support, updates, and upgrades are not included and can range around 20 percent of total cost of purchase. Annual subscriptions require recurring payments for one year and generally include support, updates, and upgrades in addition to the cost of the license itself. The per-use model requires an airport to only pay for what is used.

Share (Collaboration with Another Entity)

At times, airport managers can share applications/systems with other entities. For example, a city-owned airport, as compared to an authority, can use a city-wide human resource system. It is also possible for an airport manager to share resources with outside external entities, such as a

shared geographic information system with emergency providers (police, fire, medical). In case of such collaboration, the owner of the system must be clearly established to properly allocate staff and other resource commitments and responsibilities.

Open Source/Freeware

Although these two terms are not interchangeable, they do overlap to a good extent. The following is a brief overview.

Freeware refers to software that is free of cost and can be used, at least for personal and non-commercial use, without restriction for an indefinite amount of time. Depending on the author's licensing terms, freeware may require a license fee if used commercially. Some freeware is proprietary, which means the source code may be inaccessible to the user, but not necessarily. If freeware is free of charge and open source, it is often called "free software" or "free and open source software" (FOSS).

Open source software (OSS) can be free or purchased at cost. This depends on the underlying license. If there is a dual license, OSS can be free to some users and at cost for others. The software code for OSS is open, thereby allowing users to use and modify the application, and can also be redistributed. The driver behind OSS is the creation of developer communities to accelerate innovation and development by sharing the modifications, which often include new features and patches. OSS is the opposite of proprietary software, whose software code is closed, and which can be free or purchased at cost.

A related concept is commercial open source software (COSS), which is usually free and open source, but only offered with limited functionality. A full-featured version is then available for purchase.

Evaluation Criteria

Benefits and Risks

Although the benefits and risks associated with various delivery methods in regard to applications/systems listed in the first column of Table C1 are fairly self-explanatory, a short description is provided in column two. Please note, that not all benefits and risks apply to all IT delivery methods.

Cost Considerations

The above-mentioned IT delivery methods are also evaluated as high, moderate, and low, relative to one another, based on cost impacts in these areas:

- **Planning/Design:** During this phase, the primary cost considerations are centered on human resources in the form of consultants and airport staff support. Details are discussed in the main body of the report and Appendix B under Project Delivery.
- **Implementation:** This cost category includes both the procurement/purchase of an application/system as well as the human resources efforts (as discussed in the main body of the report and Appendix B) associated with it, including installation, configuration, integration, data migration or conversion, customization, reporting, testing, training, documentation, and project management efforts.
- **Operations and Maintenance Costs:** These generally include costs associated with managing, administering, and maintaining the systems. This includes human resource costs, as well as licensing fees, utilities, spare parts, and consumables.

Table C1. Delivery methods—applications/systems—benefits and risk.

Benefit/Risk	Description
Benefits	*Some alternative IT delivery methods can benefit an airport in regard to:*
Hosting options (onsite/offsite)	… choosing whether to opt for onsite or offsite hosting
Can use capital funds	… funding the project using the capital budget
Support options (staff/contract)	… choosing whether to opt for using internal or contracted staff
Reduced time requirement	… shortening the associated project life cycle
Potentially greater quality	… potentially experiencing better, improved quality
Customizable	… choosing and controlling customization features
Limited hardware onsite	… keeping the onsite hardware to a required minimum
Reduced operating and maintenance cost	… saving in operating and maintenance costs
Reduced capital costs	… saving in capital costs
Reduced support costs	… saving in support cost
Reduced or eliminated costs	… potentially eliminating costs altogether
Risks	*Some alternative IT delivery methods can challenge an airport in regard to:*
May provide limited functionality	… possibly providing only a limited set of features
May have limited control over functionality	… possibly having less control over certain functionalities
May have limited control over performance	… possibly having less control over the performance
May require staff or contractor for configuration	… possibly having to engage additional staff/contractor resources for system configuration efforts
Requires staff with expertise	… having staff with enough related experience available
Requires contractor	… having to hire contractor resources
Requires onsite support	… having onsite support resources available
Limited support options	… being constrained to choose support options
May require onsite support	… possibly having onsite support resources available
May not have specific expertise	… possibly not having required expertise to perform the specific functions needed
May not be able to get staff positions allocated	… successfully allocating required staff positions
May require supporting hardware and infrastructure	… possibly having to purchase needed hardware/infrastructure components
Total Cost of Ownership (TCO) could be higher	… facing increased TCO relative to other options
Expensive	… facing high costs
Potentially expensive	… possibly facing high costs
Potential for divergent interests	… may face conflicting stakeholder requirements
Procurement requirements	… developing specific procurements requirements
May require extensive time	… possibly longer project life cycle
May not have control over time/availability	… possibly lacking control over resource time and availability

Scalability

Each application/system delivery option is evaluated as high, moderate, and low, relative to one another, according to the following: Not scalable (no improvement or upgrade available or possible); dynamically scalable on demand (features/capabilities only added when needed); existing system upgrade (upgrade to a more recently released enhanced version of existing system); and existing system replacement (new/different system with more applicable/relevant features).

Integration

As discussed in the main body of the report, to an increasing degree, systems can be integrated with other systems across the airport. The various delivery methods are evaluated as high, moderate, and low, relative to one another, considering the integration opportunities with regard to processes, system functionality, data, and network considerations.

Dependencies

As with the other appendices, for the purpose of providing practical guidance to an airport, this appendix evaluates the various applications/system IT delivery methods as high, moderate, and low, relative to one another, according to these four dependency categories:

airport processes, human resources, other systems, and hardware/infrastructure. Within each, dependencies can be internal and/or external as well as in project and/or out of project, as discussed above.

Overview Summary

In an effort to consolidate the foregoing information, Tables C2 and C3 map the benefits, risks, and cost considerations as well as scalability, integration, and dependencies to the various IT delivery methods.

Office Productivity

This section covers the solutions for achieving and providing the platforms for what is often termed "office productivity." It is the work most associated with the development of content through the use of such software applications as word processors, spreadsheet applications,

Table C2. Delivery methods—applications/systems—benefits, risks, and cost considerations.

Delivery Methods	Benefits	Risks	Cost Considerations
Purchase Off the Shelf	• Hosting options (onsite/offsite) • Can use capital funds • Support options (staff/contract) • Reduced time requirement • Potentially greater quality	• Potentially expensive • May provide limited functionality • May require staff or contractor for configuration	• Planning/Design – Low • Implementation – Moderate • Operations/Maintenance – Moderate
Develop—Internal	• Hosting options (onsite/offsite) • Reduced capital costs • Reduced support costs • Customizable	• Requires staff with expertise • May require extensive time • May provide limited functionality	• Planning/Design – Moderate • Implementation – Low • Operations/Maintenance – Low
Develop—External	• Hosting options (onsite/offsite) • Can use capital funds • Potentially greater quality • Customizable • Support options (staff/contract)	• Requires contractor • Potentially expensive • May require extensive time	• Planning/Design – High • Implementation – High • Operations/Maintenance – High
Subscription (License)—Hosted Onsite	• Reduced capital costs • Support options (staff/contract) • Reduced time requirement • Potentially greater quality	• May require supporting hardware and infrastructure • Requires onsite support • TCO could be higher	• Planning/Design – Low • Implementation – Low • Operations/Maintenance – Moderate
Subscription (License)—Remote (Internet/Cloud)	• Limited hardware onsite • Reduced capital costs • Reduced time requirement	• May require staff or contractor for configuration • May provide limited functionality • May have limited control over performance	• Planning/Design – Low • Implementation – Low • Operations/Maintenance – Moderate
Share (Collaborative with Another Entity)	• Hosting options (onsite/offsite) • Reduced or eliminated costs	• Potential for divergent interests • May have limited control over functionality and performance	• Planning/Design – Low • Implementation – Low • Operations/Maintenance – Low
Open Source/Freeware	• Hosting options (onsite/offsite) • Reduced or eliminated costs	• Limited functionality • Limited support options	• Planning/Design – Low • Implementation – Low • Operations/ Maintenance – Low

Table C3. Delivery methods—applications/systems—scalability, integration, and dependencies.

Delivery Methods	Scalability	Integration	Dependencies
Purchase off the Shelf	• Not Scalable – Moderate • Dynamic Scalability on Demand – Low • Upgrade Existing System – High • Replace Existing System – Moderate	• Processes – Moderate • System Functionality – Moderate • Data – Moderate • Network – High	• Airport Processes – Moderate • Human Resources – Moderate • Other Systems – Moderate • Hardware/Infrastructure – High
Develop—Internal	• Not Scalable – Low • Dynamic Scalability on Demand – Moderate • Upgrade Existing System – Moderate • Replace Existing System – Moderate	• Processes – High • System Functionality – High • Data – High • Network – High	• Airport Processes – High • Human Resources – High • Other Systems – Moderate • Hardware/Infrastructure – High
Develop—External	• Not Scalable – Low • Dynamic Scalability on Demand – Moderate • Upgrade Existing System – Moderate • Replace Existing System – High	• Processes – High • System Functionality – High • Data – High • Network – High	• Airport Processes – High • Human Resources – Low • Other Systems – Moderate • Hardware/Infrastructure – High
Subscription (License)—Hosted Onsite	• Not Scalable – Low • Dynamic Scalability on Demand – Moderate • Upgrade Existing System – Moderate • Replace Existing System – Low	• Processes – Moderate • System Functionality – Moderate • Data – Moderate • Network – High	• Airport Processes – Moderate • Human Resources – Moderate • Other Systems – Moderate • Hardware/Infrastructure – High
Subscription (License)—Remote (Internet/Cloud)	• Not Scalable – Low • Dynamic Scalability on Demand – Moderate • Upgrade Existing System – Moderate • Replace Existing System – Low	• Processes – Moderate • System Functionality – Moderate • Data – Moderate • Network – High	• Airport Processes – Moderate • Human Resources – Low • Other Systems – Moderate • Hardware/Infrastructure – Moderate
Share (Collaborative with Another Entity)	• Not Scalable – Moderate • Dynamic Scalability on Demand – Moderate • Upgrade Existing System – Moderate • Replace Existing System – Moderate	• Processes – Moderate • System Functionality – Moderate • Data – Moderate • Network – Moderate	• Airport Processes – Moderate • Human Resources – Moderate • Other Systems – Moderate • Hardware/Infrastructure – Moderate
Open Source/Freeware	• Not Scalable – High • Dynamic Scalability on Demand – Low • Upgrade Existing System – Moderate • Replace Existing System – High	• Processes – Low • System Functionality – Low • Data – Low • Network – Moderate	• Airport Processes – Moderate • Human Resources – Moderate • Other Systems – Moderate • Hardware/Infrastructure – Moderate

presentation development, email, calendar management, etc. and this section addresses the solutions for providing staff with the tools to perform this work.

Desktop Computing

Desktop computing is a term that generally refers to larger more complex computer work usually performed at a desk rather than on a mobile device due to the complexity and need for more computing "power" and the larger "real estate" provided by a larger monitor. Much of this work is performed using what is known as productivity software (such as Microsoft® Office and Lotus Notes) for word processing, spreadsheet development, presentation development, etc. As laptops have become more powerful, this term has become broader to include work performed in productivity software regardless of whether it was performed using a laptop or a larger desktop computer.

Historically, the productivity software suite was installed locally on a desktop workstation using CDs or DVDs. It then became common to upload software from an enterprise server, owned by the organization and managed by its IT staff. Basic software images (replicas of a computer's programs, files, and configurations) are loaded onto the workstations remotely over the network to ensure every computer in the organization is set up with the appropriate software and configuration for the user. Ongoing updates are pushed out on a regularly scheduled interval to ensure the users have the latest security enhancements and security programs, most updated software supported by the organization, and so on. Users' daily working files are typically stored on the server, enabling backup and shared access of the files throughout the organization. Installation of these products using CDs, DVDs, and servers has been in use for more than 10 years in varying capacities.

Potential IT delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Share (Collaborative with Another Entity)
- Open Source/Freeware

Mobile Computing

Just as desktop computing speaks to computer work usually performed at a desk, mobile computing speaks to computer work performed on a mobile computer (mobile device) regardless of the location and typically refers specifically to tablets and smartphones. Benefits of mobile computing is that it provides "anywhere" access to a user's organizational information (email, calendar, working files) allowing the user to maximize their productivity while on the go. Innovation is increasingly making these mobile devices more powerful and able to handle more computing tasks though they are generally hindered by their size and means for inputting information. Mobile devices use Wi-Fi, cellular, and satellite connectivity to establish a two-way secure data connection to the organization's information where it resides. Mobile computing has been around for more than 10 years in various degrees; however, it was around 2003 that BlackBerry smartphones started offering email, text messaging, web browsing, and other wireless information services, effectively launching the mobile computing industry known today.

Potential IT delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)
- Open Source/Freeware

Cloud Computing

For airports, office productivity cloud computing is in the form of productivity suites such as Microsoft 365 and Google® Apps but can also include file storage and backup services that generally are handled locally by large organizations. Cloud computing as a productivity suite was generally introduced in 2006 through Google Apps and has continued to grow as Microsoft and other vendors begin offering similar services.

Potential delivery methods include the following:

- Subscription (License)—Remote (Internet/Cloud)

Enterprise Systems

This section addresses enterprise systems which are large-scale software applications that support business processes, data/information flows, and reporting for relatively complex organizations. Many of these systems can be implemented through a fully integrated package of modular solutions that maintains consistency among each module and uses a common database. They are able to harness enterprise-wide information more easily and ensure consistency of data. In these ways they differ from the common independent systems for enterprise functions that small airports tend to use.

Financial, Human Resource, and Lease Management Systems

Financial management systems include both financial accounting and management accounting functions. Financial accounting consists of general ledger, payables, receivables, fixed assets, cash management, and financial consolidation. Management accounting consists of budgeting, costing, cost management, and activity-based costing.

Human resources management systems typically provide functions for payroll, benefits, recruiting, training, diversity management, 401(k), retirement, and separation.

Lease management systems provide functions for agreement management, activity statistics, and tenant billing.

These management systems perform the functions by becoming a central repository for all related information across the enterprise. Given the correct inputs or information by aviation staff, the system is able to provide the appropriate calculations and analysis and likewise automate a number of processes. Traditionally, these solutions have been procured as capital expenditures with hardware residing locally, but now these services can be procured in a cloud-based model to work as described in the section on cloud computing.

Potential delivery methods include the following:

- Purchase off the Shelf
- Develop—Internal
- Develop—External
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)

Parking Revenue and Control System

A parking revenue and control system (PARCS) is a software and hardware solution that manages access to and payment and revenue control for parking at an airport. Its focus in this area provides the airport operator simplified administration of its parking operations,

reduces accounting fees, and enables more efficient use of parking resources. Additional benefits include features for customer convenience such as space selection guidance, pre-booking of parking, credit card in and out payment options, and pay on foot. It can expedite entry and egress, maximize space availability, and facilitate all types of revenue and customer service opportunities. PARCS is a highly mature solution that has been growing in functionality as technological advancements are made. Scheidt & Bachmann, a pioneering company in the area of PARCS, started incorporating microprocessors into their solution in the late 1960s.

Potential delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)

Point-of-Sales System

Point-of-sales (PoS) systems are made up of hardware and software and are used to complete retail transactions. They have largely replaced cash registers. The PoS has evolved to include functionality and processes such as credit card processing, employee time tracking, and gift card activation. In addition to processing sales, PoS systems are used today for accounting, inventory management, and client relationship management among many other things. Software-run PoS systems were introduced in the early 1990s running on a Microsoft Windows platform.

Potential delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)

Asset and Computerized Maintenance Management Systems

An asset management system is software that provides the ability to manage a variety of assets, such as heating, ventilation, and air conditioning (HVAC), fleet vehicles, airport landscape machinery, airfield assets, plumbing, and electrical assets. Most sizeable airports have implemented some computerized maintenance management system (CMMS) to log, track, monitor, maintain, report, and provide alerts regarding maintenance-related activities at the airport and to facilitate automation of business processes. The CMMS can assist in service-level agreement management and alert facilities and maintenance staff to potential customer service agreement violations. It can preserve institutional knowledge and provide data for trend analysis and service-level performance management. A CMMS can provide web access for web-based tracking using an internet browser and can have the capability of integrating with mobile devices. CMMS functionality will overlap with other airport systems (purchasing, property, documentation, drawings, geographic information system, etc.).

Potential delivery methods include the following:

- Purchase off the Shelf
- Develop—Internal
- Develop—External
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)

Geographic Information System

A geographic information system (GIS) is a system of integrated hardware, software, and data to capture, manage, analyze, and display geographically referenced information. A GIS produces maps, reports, and charts that allow users to view, understand, interpret, and visualize data regarding the information they have geographically referenced. This might include land platting information, outside plan infrastructure management, locations of fire hydrants, management of noise regulations, and analyzing annual capital improvement plans. Information can be input into the system in many different ways—manually for older information, electronically from real-time input streams such as satellite data feeds, in table form for population information, etc. Some small airports are currently using freely accessible maps (with mixed results) from Google Maps, Google Earth, and other web-based resources on an as-needed basis. The modern version of GIS was first developed in the 1980s and has continued to develop in sophistication.

Potential delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)
- Open Source/Freeware

Electronic Document/Content Management System

An electronic document/content management system (EDMS) is a software solution for the management of electronic files or content. The technology was birthed out of a need to manage electronic documentation but has broadened to include all manner of electronic content (i.e., photos, audio files, video files, blogs, etc.) as industry continues to develop and broaden its use of various types of content. An EDMS acts as a central repository for the organization's electronic content; can be configured to manage accessibility permissions, and retention and archiving policies for various documentation types; and can automate business workflow processes by electronically routing files for review and authorization as configured. An EDMS provides the automated intelligence for management of documentation that is lacking in standard network file folder structures where individuals can name and manage documentation of their own accord. A well-deployed EDMS can provide increased efficiency of hardware such as storage drives (mitigates duplication of files) and increased efficiency and productivity of staff. It is likely an EDMS would be a part of an overall enterprise systems solution such as those listed in this section.

Potential delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)
- Open Source/Freeware

Airport Special Systems

This section covers systems that are uniquely applied in airports, such as electronic visual information display system (EVIDS)/flight information display system (FIDS)/dynamic signage, airport operational database/data warehousing, common use, local departure control, passenger self-services, passenger self-tagging, off-airport check-in and bag drop, baggage processing, gate information display, resource management system, and ramp services management.

EVIDS/FIDS/Dynamic Signage

Multi-user information display systems (flight, baggage, ramp, etc.) have become common in airports of all sizes in recent years. In small airports, these systems are often the first special system to be implemented, providing consolidated flight and baggage carrousel information to passengers. Multi-user information displays are an essential component of the common use environment. These systems are primarily driven by business need, with regard to the type of information to be displayed to the traveling public, and for airline/airport operations.

Dynamic signage is being used more often to manage and direct passenger and staff flows and are used widely for advertising delivered to passengers along with informational data. Displays are being used more frequently by security or other control authority agencies at security checkpoints for guiding and informing passengers proceeding through the queue. They are also being used more often for safety-related paging, such as for fire and emergency evacuation, as well as with audio/public announcement, weather, news, and other general information.

Potential delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)

Airport Operational Database and Data Warehousing

An airport operational database (AODB) is a database software solution that is the central repository for all airport-related data (e.g., flight schedules, baggage system information, resource allocation and usage information) which drives many critical systems and processes and can be used for generating historical reports, predicting future needs, analyzing operational efficiency, analyzing key performance indicators (KPIs), and supporting other management requirements. The AODB uses an information broker/message broker (IB/BM) to enable the integration of the AODB and other systems, as well as the transfer of information between the various systems.

Data warehousing is a database software solution that provides support to the AODB by offloading the reporting and analysis tasks such as general reporting, operations planning queries, historical data analysis, KPI monitoring, data mining, and other less essential operational queries. Data warehousing is a customized portal to provide operational and financial data and tools to drill down into data and to do ad hoc queries and reports.

Potential delivery methods include the following:

- Develop—Internal
- Develop—External
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)

Common Use and Shared Tenant Systems

Common use systems are agent-facing passenger processing systems based on a client-server architecture that enable multiple different airlines to log in and perform passenger processing functions at the same check-in or gate positions. There are currently two separate approaches for providing this type of system: The International Air Transport Association (IATA) Common Use Passenger Processing System (CUPPS) and shared tenant systems.

CUPPS is an IATA initiative that overhauls the common use terminal equipment (CUTE) standard, IATA Recommended Practice 1797. It is a software and hardware solution whose objective is to create a common, standardized system and platform upon which airlines can

operate a CUPPS-certified flight operations application(s) across multiple vendor platforms at multiple different airports without significant customization. The CUPPS-standardized platforms are commonly implemented at international airports due to the strong support of many international airlines.

Shared tenant systems are non-IATA-compliant solutions that provide the same multi-user passenger processing functionality through an independent platform. These systems enable the airline's passenger processing applications to be directly ported to the common use position using virtualized workstations. Many small airports prefer shared tenant systems for the cost-effectiveness.

Using common use equipment (ticket counters, gate counters, boarding door podiums, back wall signs, etc.) in an airport maximizes use of space for an airport manager, allows dynamic reconfiguration of airport space for use by any airline, and enables introduction of new airlines with minimal effort. It effectively increases the capacity of the airport without construction of new gate concourses, terminals, or check-in counters by maximizing the usage of the current facilities.

Potential delivery methods include the following:

- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)

Local Departure Control System

A departure control system (DCS) automates the processing of an airline's airport management operations (baggage processing, production of boarding passes, boarding load control, etc.). However, smaller start-up airlines and aircraft charters do not necessarily have a DCS that can be employed across its many airports. In this instance it may be advantageous for the airport manager to provide a local DCS which can be enabled as a standalone system or as a part of a common use environment to provide an alternative to the manual boarding process for these clients allowing them to support automated or electronic boarding procedures. It can also be used as a backup in the event of a common use system failure. PC-based DCSs have been in use for more than 25 years.

Potential delivery methods include the following:

- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)

Passenger Self-Service

Passenger self-service speaks to the initiative to streamline the movement of passengers from curb to gate, minimize the need for agents, and reduce queues. It is used in both traditional and common use environments. Current types of self-service initiatives revolve around kiosks for dispensing boarding passes and bag tags, selling upgraded services to passengers, providing information through dynamic signage, enabling services through the internet and mobile devices, reporting mishandled or lost baggage, and automated (self-service) boarding gates. Passenger self-service has been around for about 10 years with the advent of the airline-provided kiosks for self-service printing of boarding passes.

Potential delivery methods include the following:

- Purchase off the Shelf
- Develop—Internal
- Develop—External
- Subscription (License)—Hosted Onsite

- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)

Passenger Self-Tagging

Passenger self-tagging (PST) enables passengers to deliver their bags to an authorized check-in agent tagged and ready for acceptance, thus speeding up the check-in process. At the airport, the passenger uses self-service kiosks for check-in and bag tag printing. At present, various offsite options are also under review and consideration, including permanent radio frequency identification (RFID) bag tags and home printing. Observed benefits include significant improvement on check-in times, reductions in mis-tagged bags, and high passenger adoption rate in a short period of time. Airlines and airport managers are installing PST solutions, but at a rate slower than expected. While it is a passenger self-service, it is broken out separately from the passenger self-service section as it is a current trend and warrants a more detailed review.

Potential delivery methods include the following:

- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)

Off-Airport Check-in and Bag Drop

Off-airport check-in and bag drop is self-explanatory in that it speaks to the efforts of moving airport check-in and bag drop off to locations outside of the airport premises. Airport and passenger benefits include alleviation of congestion at ticketing, increase in passenger throughput within current space, improvements in customer service, improvement in speed of passenger clearance through the checkpoint, and an increase in duration of time for baggage screening by airport security. This service requires setting up an off-airport check-in facility but often those costs can be shared with a second party offering the facility as a differentiating service to its customers. This is a service that is currently being tested and has seen some early success, such as with the Orlando International Airport and its Disney off-airport process.

Potential delivery methods include the following:

- Develop—Internal
- Develop—External
- Share (Collaborative with Another Entity)

Automated Baggage Processing

Automated baggage processing includes four optional system components that may be implemented independent of one another or as part of an integrated solution:

- Baggage Sortation—Provides for the automatic verification of baggage and its destination for accurate and efficient routing.
- Baggage Tracking—Provides for the automated tracking of baggage from check-in to final destination.
- Baggage Recovery—Facilitates the efficient recovery of bags due to mishandling or disrupted aircraft operations.
- Baggage Reconciliation—Provides for the identification of passengers that have not yet boarded and prevents their baggage from being loaded.

Integration between bag belt and the baggage sortation systems is particularly important to enable flexibility in a common use environment. Without such a system, the scheduling of check-in and

gate assignments is limited to combinations in which there is direct accessibility between the two. This can be a costly modification, which could reduce the scope of a common use implementation.

Potential delivery methods include the following:

- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)

Gate Information Display Systems

A growing trend with airlines is the provision of airline-specific gate information display systems (GIDS). Airlines are installing GIDS to provide information useful to their traveling public, such as the status of their stand-by list for the current flight, destination weather, and other features. Many of these airlines are also considering their GIDS as a means of airline branding.

In a common use environment, many airport managers identified the need to ensure that airlines have equal facilities available to them, which also enables competition. Airlines operating under common use that do not have a specific GIDS application may request access to a GIDS. In addition, airlines that do have proprietary GIDS would prefer access to their GIDS, even when required to operate in a common use environment.

Potential delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)

Resource Management Systems

A resource management system (RMS) consists of a set of software modules for the planning, assigning, and monitoring of key airport resources, including gate management, check-in space allocation, baggage belt allocation, and personnel (rostering). Interfacing the RMS with an AODB can optimize the use of these resources and provide data needed for collaborative decision making. A RMS is a typical component in a large common use environment; however, in a small common use environment, check-in and gate allocations are often managed with a spreadsheet application.

Potential delivery methods include the following:

- Develop—Internal
- Develop—External
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)

Building Technology/Facility Systems

This section covers building management systems and smart airports, visual docking guidance systems, automated vehicle identification, and digital wayfinding signage.

Building Management Systems and Smart Airports

Building management systems (BMS) are PC-based software application control systems that monitor and control a building's mechanical and electrical equipment. The use of a BMS in airports is not a new concept. However, more advanced uses of BMS enables integration of historically disparate building management systems such that information is shared to minimize the

long-term costs of facility ownership, improve operational performance, increase occupant comfort and satisfaction, manage and minimize energy consumption, and contribute to environmental sustainability. These are a part of the emerging "smart building" trend. Virtually all operational and some special systems can integrate into a BMS. Some small airports have BMS in place for lighting and HVAC controls, which may be capable of expanding to support additional systems.

Potential delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)

Visual Docking Guidance Systems

A visual docking guidance system is made up of software and hardware that provide effective gate-specific guidance to the pilot for the positioning of an aircraft to the final parking position at a gate. The system utilizes a visual sensor(s) at the gate to monitor an aircraft's real-time position as it approaches a gate and provides feedback for any necessary adjustments the pilot needs to make on final gate approach to a designated aircraft stand. The proper positioning of aircraft at the gate ensures it remains clear of obstructions and ensures jet bridges can reach and properly align with the aircraft. These systems are more commonly used in environments where an airport may need to dock in poor weather conditions to avoid having ramp personnel exposed more than necessary. Visual docking guidance systems have been in use since the late 1990s.

Potential delivery methods include:

- Purchase Off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)

Automated Vehicle Identification Systems

Automated vehicle identification (AVI) systems are vehicle tracking systems used for a number of purposes. AVI systems allow vehicles to be processed more quickly at entry and exit points, increase airside security, decrease congestion at entry/exit points to the airports, and increase revenues from commercial vehicles' use of the airport. They also can prevent runway incursions; register visits to airport curbs; and record dwell-times for commercial buses, shuttles, and taxis for billing purposes; as well as enable frequent travelers to pay for parking. RFID tags are placed in vehicles and are read, from a distance, by RFID readers whose systems decipher the tag information in similar fashion as badging systems. These systems have been widely used by toll road authorities and increasingly in airports for more than 15 years.

Potential delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)

Digital Wayfinding Signage

The category of digital wayfinding signage includes all manner of digital displays that work with a PC-based software application to provide wayfinding guidance. This can be roadway

signs and signs within the terminal building and it includes simple LED signs through high-definition video monitors. Digital signage provides the capability of dynamic communications that traditional static signage cannot provide. This flexibility can be used to communicate road closures; directions using text, maps, and video; emergency messaging and other airport-centric information. Digital wayfinding signage is a highly mature technology that continues to evolve with advances in technology. Digital signage is a trend in airports that can help to make the trip inbound and outbound to the airport easier for passengers and can provide flexible communications for the airport. The flexibility of dynamic signage allows interacting with other information systems that display ground transportation systems data. Interaction with intelligent transportation systems technology can help the traveler at the airport simply, efficiently, and interactively evaluate his/her airport ground transportation options. On roadways, dynamic signs can be useful for current conditions, tenant moves, hazard reporting, and other dynamic information.

Potential delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)

Safety and Security Systems

This section covers access control systems (ACS), closed-circuit television (CCTV) systems, lightning detection systems, visual paging, incident management systems, video analytics, and integrated security systems.

Access Control Systems

ACS are a combination of hardware (badge readers, badges, badging stations, fingerprint stations, alarms, etc.) and software that serves to administer access privileges and control access through secured doors and gates. Modern systems are highly scalable to any size airfield or airport with complex security requirements across widespread sites. Electronic access control systems are a highly mature technology that has been in use since the 1960s. These systems can and should evolve as security standards change and new requirements are added. In addition, such systems need to have the capability of integrating to other airport systems (CCTV, emergency notification system, badging, etc.) to form the complete security control system needed by the airport.

Potential delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite

Closed-Circuit Television System

A CCTV system is a closed (private) system of electronic devices consisting of CCTV cameras which capture images, CCTV monitors which display the images, network video recorders to record and call up archived video images, and components to control and position the cameras. The CCTV system provides a visual indication of the current and recorded conditions of the monitored area to improve situational awareness (which accelerates response and management decisions); enhance security access control; deter vandalism, theft, or other crime; and increase overall public and staff safety. CCTV has been in use since the 1940s. The CCTV system, effectively delivered to both operations and security users, can substantially increase the effectiveness of both organizations while also

reducing the total investment cost for these systems. Comprehensive integration of multiple systems can significantly enhance efficiency and provide higher levels of security.

Potential delivery methods include the following:

- Purchase off the Shelf
- Develop—Internal
- Develop—External
- Share (Collaborative with Another Entity)

Lightning Detection Systems

A lightning detection system uses local monitoring devices, commercial lightning detection networks, and other general purpose weather information (including radar data) to predict lightning strikes at an airport. The system is a PC-based software application that consolidates the information and provides the findings in different report formats including maps.

Potential delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)

Visual Paging

Visual paging is a system that uses a software application, video monitors, and PCs to display text versions of audible pages for the hearing impaired and is oftentimes linked to an airport's effort to comply with Americans with Disabilities Act requirements for airport passenger paging. Many common use platforms can interface with existing airport audio paging systems allowing transference of paging data from one system to the other. However, in some cases, the interface functionality is limited in its ability to easily apply sophisticated color/font schemes, based on airport-defined rules such as type or priority of page. Visual paging systems have been in use for greater than 10 years.

Potential delivery methods include the following:

- Purchase off the Shelf
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)

Incident Management Systems

An incident management system (IMS) is a software application that connects to other systems including ACS, CCTV, fire detection, AODB, BMS, and others. It integrates the data from these systems, providing a single interface from which to alert, monitor, control, and log ongoing incidents. The IMS helps airports effectively manage and coordinate response during an emergency or crisis situation. These systems started being used in the mid to late 2000s.

Potential delivery methods include the following:

- Purchase off the Shelf
- Develop—External
- Subscription (License)—Hosted Onsite

- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)

Video Analytics

Video analytics is a trending software technology that is coupled with CCTV systems to evaluate video images from the cameras by analyzing the behavior of objects in the scene and processing the images based on defined scenarios. Video analytics fills in the gap for the high rate of overlooked events by human operators due to manpower costs, boredom, and fatigue. Those scenarios might include identifying incidences of tailgating through doors, recognizing abandoned packages, tracking an image seamlessly from camera to camera, and detecting an intruder approaching or climbing over a perimeter fence. Although security is the leading driver for video analytics, other potential uses might include passenger flows, queue monitoring, and ramp/apron surface movement tracking. Video analytics has been in heavy evolutionary development over the last 10 years. It still holds much promise and is helpful in certain application though it has not yet achieved full maturity.

Potential delivery methods include the following:

- Purchase off the Shelf
- Develop—External
- Subscription (License)—Hosted Onsite
- Subscription (License)—Remote (Internet/Cloud)
- Share (Collaborative with Another Entity)

Integrated Security Systems

The general trend in the industry is toward integration of security systems and distribution of relevant information from those systems to airport management. Systems integration may encompass such systems as the following:

- Access control
- Video motion detection
- Command and control/decision support
- Communications
- Smart fencing
- Ground surveillance radars
- Air traffic management
- Airport operations

Information from these systems can be integrated within a single system, allowing users to identify and respond to potential threats faster and more efficiently, enable security managers the ability to centrally manage all systems under their control, and support management dashboards for real-time alerts to management within the context of their usual desktop working environment.

Potential delivery methods include the following:

- Develop—Internal
- Develop—External

APPENDIX D

Infrastructure

Overview

This appendix first introduces the delivery methods associated with infrastructure. It then discusses benefits, risks, cost considerations, scalability, integration, and dependencies, before mapping these to the specific delivery methods. The following IT infrastructure categories are addressed in this appendix: (1) infrastructure convergence and network systems/services and (2) wireless systems/services. Within each of these broad categories the discussion is then grouped into specific types of infrastructure components found to be implemented at airports of varies sizes.

Alternative IT Delivery Methods

The two primary delivery methods associated with hardware equipment and infrastructure components are centered on the question of whether to purchase or lease. A third option exists where an airport might share these components with another entity, such as a city or state.

Purchasing vs. Leasing

Traditionally, airport managers have strongly leaned toward buying hardware equipment and infrastructure components because their useful life is generally longer than their associated capital value. In recent years, more and more airport managers are opting for the leasing option since many components can be cycled out rather frequently (three years for servers, for example), thereby enabling an airport to reduce risks associated with aging equipment.

The decision to buy or lease, however, is still one of "personal" preference. A major factor is an airport manager's general approach to capital outlay and asset life span cost management. With a purchase, a larger upfront investment is required since assets are owned. With that said, the airport manager incurs costs associated with operating, managing, and maintaining it. Leasing, on the other hand, involves a lower upfront cost, but possibly higher (yet predictable) monthly expenses, as components are "rented," and operating and maintenance support costs are built into the monthly fee.

There are other factors and related benefits and risks for each option. These are addressed in detail throughout the various hardware equipment and infrastructure component discussions later in this appendix.

Share (Collaboration with Another Entity)

As with applications and systems, entities can share hardware equipment and infrastructure components, if they are operating under one umbrella, such as an airport that functions as a city department. Remote connections can be established to jointly connect to a common server, for example. In case of such collaboration, the owner of the server, in this case, needs to be clearly established in order to properly allocate staff and other resource commitments and responsibilities.

Evaluation Criteria

Benefits and Risks

Table D1 lists and describes the benefits and risks associated with infrastructure delivery methods. Please note that not all benefits and risks apply to all delivery methods.

Cost Considerations

The above-mentioned delivery methods are also evaluated as high, moderate, or low, relative to one another, based on how they impact costs in these areas:

- **Planning/Design:** During this phase, the primary cost considerations are centered on human resources in the form of consultants and airport staff support. Details have been discussed in the main body of the report and Appendix B under Project Delivery.
- **Implementation:** This cost category includes both the procurement/purchase of any infrastructure as well as the human resources efforts (as discussed in the main body of the report and Appendix B) associated with it, including installation, configuration, integration, data migration or conversion, customization, reporting, testing, training, documentation, and project management efforts.

Table D1. Delivery methods—hardware equipment/infrastructure—benefits and risks.

Benefit/Risk	Description
Benefits	*Some alternative IT delivery methods can benefit an airport in regard to:*
Hosting options (onsite/offsite)	… choosing whether to opt for onsite or offsite hosting
Can use capital funds	… funding the project using the capital budget
Support options (staff/contract)	… choosing whether to opt for using internal or contracted staff
Reduced capital costs	… saving in capital costs
Reduced or eliminated costs	… potentially eliminating costs altogether
Risks	*Some alternative IT delivery methods can challenge an airport in regard to:*
May require supporting hardware & infrastructure	… possibly having to purchase needed hardware/infrastructure components
May require onsite support	… possibly having onsite support resources available
May have limited control over performance	… possibly having less control over the performance
Total cost of ownership could be higher	… facing increased total cost of ownership relative to other options
Potential for divergent interests	… may face conflicting stakeholder requirements
May have limited control over functionality	… possibly having less control over certain functionalities

- **Operations/Maintenance Costs:** These generally include costs associated with managing, administering, and maintaining the hardware and infrastructure. This includes human resource costs, as well as licensing fees, utilities, spare parts, and consumables.

Scalability

Each infrastructure delivery option is evaluated as high, moderate, or low, relative to one another, according to the following: Not scalable (no improvement or upgrade available or possible); dynamically scalable on demand (features/capabilities only added when needed); existing infrastructure upgrade (upgrade to a more recently released enhanced model of an existing infrastructure component); and existing infrastructure component replacement (new/different component with more applicable/relevant features and capabilities).

Integration

As discussed in the main body of the report, infrastructure components, such as an airport-wide wireless network can support a variety of integration efforts in other areas, such as system and process integration. The various delivery methods are evaluated as high, moderate, or low, relative to one another, considering the integration opportunities with regard to processes, system functionality, data, and network considerations.

Dependencies

As with the other appendices, for the purpose of providing practical guidance to an airport, this appendix evaluates the various infrastructure delivery methods as high, moderate, or low, relative to one another, according to these four dependency categories: airport processes, human resources, systems, and other hardware/infrastructure. Within each, dependencies can be internal and/or external as well as in project and/or out of project, as discussed above.

Overview Summary

In an effort to consolidate the above information, Tables D2 and D3 map the benefits, risks, and cost considerations as well as scalability, integration, and dependencies to the various delivery methods.

Table D2. Delivery methods—hardware equipment/infrastructure—benefits, risks, and cost considerations.

Delivery Methods	Benefits	Risks	Cost Considerations
Purchase	• Hosting options (onsite/offsite) • Can use capital funds • Support options (staff/contract)	• May require supporting hardware and infrastructure • May require onsite support	• Planning/Design – High • Implementation – High • Operations/Maintenance – Moderate
Lease	• Hosting options (onsite/offsite) • Reduced capital costs • Support options (staff/contract)	• TCO could be higher • May require onsite support • May have limited control over performance	• Planning/Design – High • Implementation – Moderate • Operations/Maintenance – High
Share (Collaborative with Another Entity)	• Hosting options (onsite/offsite) • Reduced or eliminated costs	• Potential for divergent interests • May have limited control over performance	• Planning/Design – Moderate • Implementation – Moderate • Operations/Maintenance – Low

Table D3. Delivery methods—hardware equipment/infrastructure—scalability, integration, and dependencies.

Delivery Methods	Scalability	Integration	Dependencies
Purchase	• Not Scalable – Low • Dynamic Scalability on Demand – Moderate • Upgrade Existing Hardware/Infrastructure – High • Replace Existing Hardware/Infrastructure – Moderate	• Processes – High • Hardware/Infrastructure Functionality – High • Data – High • Network – High	• Airport Processes – High • Human Resources – High • Systems – Low • Other Hardware/ Infrastructure – High
Lease	• Not Scalable – Low • Dynamic Scalability on Demand – High • Upgrade Existing Hardware/Infrastructure – Moderate • Replace Existing Hardware/Infrastructure – Low	• Processes – High • Hardware/Infrastructure Functionality – High • Data – High • Network – High	• Airport Processes – Moderate • Human Resources – Low • Systems – Low • Other Hardware/ Infrastructure – High
Share (Collaborative with Another Entity)	• Not Scalable – High • Dynamic Scalability on Demand – Moderate • Upgrade Existing Hardware/Infrastructure – High • Replace Existing Hardware/Infrastructure – Moderate	• Processes – Moderate • Hardware/Infrastructure Functionality – Moderate • Data – Moderate • Network – Moderate	• Airport Processes – Moderate • Human Resources – Moderate • Systems – Low • Other Hardware/ Infrastructure – High

Infrastructure Convergence and Network Systems/Services

This section covers converged physical infrastructure, infrastructure as a service, cable management and intelligent patching systems, network management systems, and common network equipment.

Converged Physical IT Infrastructure

IT systems require some manner of cabled and wireless infrastructure for data transmission to occur and for many years and even today, many IT systems are deployed as discrete systems with discrete IT infrastructures. Convergence of multiple IT systems using a single cabled and wireless infrastructure has been occurring in the aviation industry for more than 10 years. As comfort increases with the approach, there is an ever increasing trend to move more and more IT systems into a single converged physical infrastructure across the airport premises. With current available technologies and industry best practices in security, it is possible to implement a single physical infrastructure at airports with the possible exclusion of the fire alarm system. The trend toward a single physical infrastructure has the following advantages:

- Data can be shared among all airport systems for more efficient operation of the airport.
- One physical infrastructure can support all systems, at lower installation and maintenance cost.
- Common active network equipment can be maintained at lower installation and operation cost.
- Common use systems can be easily supported.

Potential delivery methods include the following:

- Purchase

Common Network Equipment

As discussed in the Converged Physical IT Infrastructure section, IT systems are moving away from discrete IT system installations toward converged systems. This convergence includes the use of network equipment (switches, routers, firewalls, etc.) making them common equipment such that they support multiple systems on a single physical network. This common network equipment infrastructure facilitates many efficiencies, including sharing of data for airport management and common use technologies and providing high availability and scalability of an airport IT infrastructure premises design. Its robustness must be designed for the most demanding system relying on it, but all systems will benefit. It is an essential aspect for the long-term optimization of IT resources.

Potential delivery methods include the following:

- Purchase
- Lease

Infrastructure as a Service

Infrastructure as a service (IaaS) can act as a supplement or a replacement to many of the airport back-end network services that have traditionally been provided locally by airport and city IT staff. Examples of these services include the following:

- Managed local area network (LAN) services
- Internet protocol (IP) virtual private network (VPN) and wide area network (WAN) optimization
- Legacy network migration
- Voice over IP (VoIP) telephony and management of legacy voice services
- CRM solutions, like multimedia contact centers
- Unified communications: messaging, IP telephony, web conferencing, and videoconferencing
- Mobile computing solutions

IaaS is "renting cloud infrastructure (servers, storage and networking) on demand, in a pay-as-you-go model." Generally, benefits of implementing IaaS include lower management costs; high performance on workload access and management; fast deployment of servers enabling rapid reaction to change; high availability and security through choice of SLA and workload residence; improved WAN scalability and heavy content distribution; self-managed and managed virtual private and hybrid cloud hosting solutions; and incorporation of data analytics.

Potential delivery methods include the following:

- Lease
- Share (Collaborative with Another Entity)

Cable Management and Intelligent Patching Systems

Cable management systems (CMSs), in advanced forms, are software applications that facilitate the record keeping and moves, additions, and changes (MACs) to the cable plant and assets. Because a great deal of MACs take place within the airport environment, a CMS solution significantly eases the burden of managing and maintaining the cable plant. An addition that can be made to CMSs is an intelligent patching system. This is a cabling patching solution consisting of software and hardware that complement the CMS by automatically updating the CMS database for MACs. The hardware provides intelligence at the cable patch panels in each of the telecommunications rooms. The cable patch panels send updated information to the CMS when a cable is added or moved to a different port which changes the connectivity "circuit." This

alleviates the need for the technician to manually enter in the data ensuring that the move is captured and correctly recorded in the CMS. Both of these technologies have been around for more than 10 years, however, there has been a surge in their implementation within the last few years.

Implementation of a CMS can be a complex project and is most successfully done in phases. The first phase is generally to implement the CMS. A second phase adds existing assets and a final phase integrates with other systems, e.g., IPS and network management systems.

Potential delivery methods include the following:

- Purchase
- Lease
- Share (Collaborative with Another Entity)

Network Management Systems

A network management system (NMS) manages the many specialized network appliances, security devices, and wireless devices on a typical airport network. A NMS assists the network administrator in many aspects of network management, including configuration management, security breach prevention and network intrusion detection, troubleshooting equipment, monitoring performance, quality of service and utilization, and automating configuration deployment. NMSs have been in use since the inception of networks and continue to grow in capabilities.

Potential delivery methods include the following:

- Purchase
- Lease
- Share (Collaborative with Another Entity)

Wireless Systems/Services

This section covers private mobile radio systems (PMRSs), wireless LANs, distributed antenna systems, location awareness services, and RFID.

Private Mobile Radio Systems

PMRSs are private communications systems that many organizations use as opposed to relying on commercial services as they are believed to be able to provide capabilities, features, and efficiencies that commercial systems cannot. Similarly they are believed to not be as susceptible to peak usage patterns in emergency situations that commercial systems endure. A technology with increasing impact on mobile communications interoperability is the PMRS over IP. This convergence permits direct communications between radios, fixed and mobile phones, PCs, and other communications devices. It provides coordination with incident management systems, cross-channel communications, extended communications interoperability, and improved incident situational awareness. It enables coordination of incident communications by bridging channels or dissimilar devices (e.g., radio, IP, and non-IP phones). Private mobile radio services originated as private land mobile radio services in the 1920s; therefore, the privatization of communications services is extremely established and the service offerings are continuing to evolve.

Potential delivery methods include the following:

- Purchase
- Lease
- Share (Collaborative with Another Entity)

Wireless Local Area Networks

Wireless local area networks (WLANs), more commonly known as Wi-Fi, provide end devices with connectivity to the larger network through the use of Wi-Fi antennas that are physically connected to network switches. Historically end-device connectivity was only achieved through the use of a physical cable. Though connectivity to end devices can be achieved through cellular networks, the terms "WLAN" and "Wi-Fi" speak of the particular connectivity that is specified in the IEEE 802.11 standard and is the connectivity provided through organizational and home networks as opposed to cellular providers. In airports, Wi-Fi is generally provided in two forms. Public Wi-Fi for passengers and operational Wi-Fi for airport operations with the operational Wi-Fi being configured with increased security measures. Operational Wi-Fi can be used to support such applications as the following:

- Computerized maintenance management systems
- Baggage reconciliation and tracking applications
- Retail wireless PoS applications for tenants
- Carrier boarding
- Incident management mobile applications for security

WLANs have been in use since the 802.11 standard was first released in 1997.

Potential delivery methods include the following:

- Purchase
- Lease
- Share (Collaborative with Another Entity)

Distributed Antenna Systems

A distributed antenna system (DAS) is a network of antennas that are connected to a common source and, in airport applications, are used to extend wireless services to building interiors and underground spaces that external antenna signals cannot penetrate. Generally these include cellular and 800 MHz radio (public safety) but a DAS can also support Wi-Fi to a great degree. They are also useful in an airport environment because they can divide the high density of wireless users among a number of smaller antennas versus relying on a larger single antenna to deal with the traffic. Generally, the gaps in cellular connectivity are the driving force for these installations and aviation departments can oftentimes obtain assistance from cellular service providers. DAS installations have been emerging beyond niche markets since around 2008 and are quickly becoming viewed as a necessary part of IT infrastructure in airports, convention centers, stadiums, and other high-density areas.

Potential delivery methods include the following:

- Purchase
- Lease
- Share (Collaborative with Another Entity)

Location Awareness

Location awareness uses wireless technologies [WLAN, RFID, radio frequency devices (transponders), and global positioning systems] to determine the location of resources in real time and to use this location information to improve efficiency of operations. In an airport, services supported by location awareness technology-based services could include the following:

- Trolley and cart management—sending staff to retrieve trolleys/carts only where necessary
- Tracking of airside vehicles for better management of premium space

- Engineering staff allocation
- Aircraft collision detection systems
- Emergency response to alerts
- Tracking of tugs on airfield

There is also the potential to track passenger movements to facilitate locating passengers who are late for boarding or target personalized retail opportunities.

Potential delivery methods include the following:

- Purchase
- Lease
- Share (Collaborative with Another Entity)

Radio Frequency Identification

RFID technology uses tags with embedded microchips that allow the tags to be read from a distance. The tags are externally powered and can be read or written to in order to allow status changes. Primary uses of RFID include AVI and baggage handling systems. The use of RFID bag tags rather than the standard bar-coded bag tags in use today results in fewer mis-sorted/mishandled bags and improved logistics management. This in turn improves operational efficiency and the baggage service to customers. Though the first RFID patent was granted in 1983, it did not start to see widespread application use until the early 2000s.

Potential delivery methods include the following:

- Purchase
- Lease
- Share (Collaborative with Another Entity)

APPENDIX E

Strategic Planning and Business Case Development Guide

Introduction and Instructions

The Strategic Planning and Business Case Development Guide is a structured set of templates that guide the user through a step-by-step process of defining appropriate IT delivery methods based on a strategic evaluation of their unique stakeholder needs and the overall airport goals. It is a functional tool consisting of a set of self-evaluation checklists and templates that are available online (http://www.trb.org/Main/Blurbs/171838.aspx) in printable portable document format (PDF). Based on the content presented in Appendices A through D, this guidance provides a framework to ensure that all IT-related decisions are being made with a focus on creating optimal value by maintaining a balance between realizing benefits and optimizing risk levels and resource use. The primary intent of this guidance is to enable the airport manager to make wise decisions that will

- Achieve strategic goals and business benefits through effective and innovative use of IT;
- Achieve operational excellence through the reliable and efficient application of technology;
- Maintain IT-related risk at an acceptable level;
- Optimize the cost of IT services and technology; and
- Comply with relevant laws, regulations, contractual agreements, and policies.

To accomplish this, the Strategic Planning and Business Case Development Guide walks the user through the following steps:

- Determine the unique characteristics of the airport and the impact they have on the applicability of IT delivery methods
- Define the airport's IT strategic goals and enabling processes relative to its stakeholder needs
- Evaluate the value that differing options provide in meeting the stakeholder needs of the airport
- Assess the readiness level of the airport to implement the chosen option based on defined impacts

The resulting content of Templates 1 and 2 combines to provide the basic detail needed to develop a functional IT Strategic Plan. Template 3 provides a structure for evaluating issues and opportunities to establish IT initiatives either for an IT Master Plan or on an individual case-by-case basis.

Template 1

Step 01: Print all pages of Template 1.

Step 02: Refer to Chapter 3, Understanding Small Airport IT.

Step 03: Using the content in Chapter 3 as a reference, check the box in the Yes/No column that best describes the subject airport for each category of Template 1.

Step 04: Using the key opportunities and key challenges in each section of Chapter 3 as a reference, list actual key opportunities and key challenges experienced for each selected item within each category of Template 1. The items listed in Chapter 3 are generic in nature and may or may not accurately represent the actual conditions in the subject airport.

Step 05: Place Template 1 aside to use as a reference in Template 3.

Template 2

Step 01: Print all pages of Template 2.

Step 02: Refer to Chapter 4, Delivery Methods and Practices of Small Airport IT, and Appendices A and B for reference as needed.

Step 03: Template 2, Part A1—Check the boxes in the Yes/No column that best describe the relevant stakeholder needs of the subject airport.

Step 04: Template 2, Part A2—Using a highlighter, mark the entire row associated with the stakeholder need identification (SN ID) numbers that correlate to the stakeholder needs identified in Part A1.

Step 05: Template 2, Part A3—Transpose the "X" from each highlighted box in Part A2 to the same location in Part A3 under the corresponding airport goals identification (AG ID) number.

Step 06: Template 2, Part B1—Check the boxes in the Yes/No column that correspond with the AG ID numbers for which there is an "X" identified in Part A3.

Step 07: Template 2, Part B2—Using a highlighter, mark the entire row associated with the AG ID numbers that correlate to the airport goals identified in Part B1.

Step 08: Template 2, Part B3—Transpose the "P" and "S" from each highlighted box in Part B2 to the same location in Part B3 under the corresponding IT goal identification (ITG ID) number.

Step 09: Template 2, Part C1—Check the boxes in the Yes/No column that correspond with the ITG ID numbers for which there is a "P" or "S" identified in Part B3.

Step 10: Template 2, Part C2—Using a highlighter, mark the entire row associated with the ITG ID numbers that correlate to the IT goals identified in Part C1 for both charts.

Step 11: Template 2, Part C3—Transpose the "P" or "S" from each highlighted box in Part C2 to the same location in Part C3 under the corresponding enabling process ID (Chart 1: EDM and APO; Chart 2: BAI, DSS, and MEA).

Step 12: Template 2, Parts D1a and D1b—Check the boxes in the Yes/No column that correspond with the enabling process IDs for which there is a "P" or "S" identified in Part C3.

Step 13: Template 2, Parts D2a and D2b—Reference Appendix B sections "IT Governance" and "IT Management" to identify process descriptions that are relevant to the enabling processes identified in Parts D1a and D1b. Using these general descriptions as a reference, create descriptions that are specific and relevant to the subject airport IT function.

Step 14: Place Template 2 aside to use as a reference in Template 3.

Template 3

Step 01: Print all pages of Template 3.

Step 02: Template 3, Part A1—In the Issue Description box, describe the fundamental issue that instigated the need for a business case evaluation.

Step 03: Template 3, Part A1—In the Current Conditions boxes, describe the current conditions surrounding this issue with respect to financial, operational, stakeholder, and staff concerns.

Step 04: Retrieve the completed Template 2 for reference on Parts A2, A3, and A4.

Step 05: Template 3, Part A2—Check the boxes in the Yes/No column that correspond with the ITG IDs that were checked in Template 2, Part C1.

Step 06: Template 3, Part A3—Check the boxes in the Yes/No column that correspond with the AG IDs that were checked in Template 2, Part B1.

Step 07: Template 3, Part A4—Check the boxes in the Yes/No column that correspond with the SN IDs that were checked in Template 2, Part A1.

Step 08: Template 3, Part A5—In the Opportunity Parameters boxes, describe the opportunity parameters that have been identified, including the implementation schedule demands, the opportunity window for solution, supporting evidence that the opportunity is real, and the positive impact on the business.

Step 09: Reference the main body of the report, Appendices B through D, and Template 1 for Parts B1, B2, B3, B4, and B5.

Step 10: Template 3, Part B1—In the Opportunity Description box, describe the option identified for evaluation. Include the general approach and a summary of the key elements of the solution (e.g., people, process, organization, technology).

Step 11: Template 3, Part B1—In the Benefits and Measurement Criteria box, describe the qualitative and quantitative benefits to be achieved by the opportunity in terms of financial, operational, stakeholder, and staff and detail the value in measurement or description (e.g., $, %, # hours, reduction of risk).

Step 12: Template 3, Part B2—In the Cost and Funding Plan box, describe the costs (tangible and intangible) to the airport upon implementation. This should include actual project costs as well as negative impact to the airport and its stakeholders associated with the project delivery (e.g., operational down-time). Define the value of each cost item, identify whether it is budgeted or not, and identify the funding sources with amounts and any relevant notes.

Step 13: Template 3, Part B3—In the Feasibility box, describe the components used to quantify the likelihood of feasibility (e.g., people, processes, assets, technology), providing a rating for each, and describe the method used to determine feasibility (e.g., survey to identify availability of skills to support). A formal feasibility study may be necessary.

Step 14: Template 3, Part B3—In the Risks box, describe the key risks associated with the proposed solution, rate the likelihood of each occurring (very low, low, medium, high, very high), rate the impact on the airport if it does occur (very low, low, medium, high, very high), and define the mitigating actions for each. A formal risk analysis may be necessary.

Step 15: Template 3, Part B3—In the Issues box, describe the high priority issues that currently adversely affect the ability of the proposed option to meet its objectives, rank the priority of each (low, medium, high), and define the resolution actions to be undertaken.

Step 16: Template 3, Part B3—In the Assumptions box, describe the major assumptions associated with the proposed option.

Step 17: Template 3, Part B4—In the Stakeholder Impacts box, describe the major stakeholder impacts in each of the defined areas that are associated with the proposed option.

Step 18: Complete Template 3, Parts B1 through B4 for as many options as are being considered to address the issues described in Part A1.

Step 19: Evaluate all options against one another and rank them in order of favorability.

Step 20: Develop a formal recommendation statement to be submitted for consideration. Include all of the completed templates as supporting documentation.

TEMPLATE 1 – AIRPORT PROFILE
PART A - AIRPORT OWNERSHIP & MANAGEMENT CULTURE

Airport Attributes	Yes/No	Key Opportunities	Key Challenges
Airport Ownership			
Municipality Owned			
Authority Owned			
Airport Management Culture			
Technologically Conservative			
Technologically Progressive			

TEMPLATE 1 – AIRPORT PROFILE
PART B – AVAILABILITY OF FINANCIAL AND SUPPORT RESOURCES

Airport Attributes	Yes/No	Key Opportunities	Key Challenges
Availability of Financial Resources			
Limited Financial Resources			
Available Financial Resources			
Availability of Local Support Resources			
Limited Local Support Resources			
Readily Available Local Support Resources			

TEMPLATE 1 – AIRPORT PROFILE
PART C – MATURITY LEVEL OF IT FUNCTION

Airport Attributes	Yes/No	Key Opportunities	Key Challenges
Maturity Level of IT			
Level 0: Survival			
Level 1: Awareness			
Level 2: Committed			
Level 3: Proactive			
Level 4: Service Aligned			
Level 5: Business Partnership			

TEMPLATE 2 – STRATEGIC PLANNING
PART A1 – STAKEHOLDER NEEDS (SNs)
CHECKLIST

SN ID	Stakeholder Needs Description	Yes/No
SN01	Value from the use of IT	
SN02	User satisfaction with the quality of IT service	
SN03	Managed performance of IT	
SN04	Implementation of new technology for new strategic opportunity	
SN05	An appropriately built and structured IT department	
SN06	Managed dependency on external providers	
SN07	Managed IT outsourcing agreements	
SN08	Assurance over external providers	
SN09	Management of control requirements for information	
SN10	Management of all IT-related risk	
SN11	An efficient and resilient IT operation	
SN12	Control over the cost of IT	
SN13	Effective and efficient use of IT resources	
SN14	Effective and efficient use of sourcing options	
SN15	Adequate number of IT staff	
SN16	Developed and maintained IT staff skills	
SN17	Managed IT staff performance	
SN18	Assurance over IT	
SN19	Securely processed information	
SN20	Improved business agility through a flexible IT environment	
SN21	Delivered promises from IT projects	
SN22	IT support for the execution of business strategy	
SN23	Managed IT criticality in sustaining the enterprise	
SN24	Understanding of business processes dependent on IT and their requirements	
SN25	Understanding of IT operational and project budget requirements	
SN26	Understanding of the balance between IT support/maintenance and value creation	
SN27	Sufficient IT resources and infrastructure available to meet required strategic objectives	
SN28	Timely IT decisions	
SN29	Transparency for the total IT effort and investment	
SN30	IT support for enterprise regulation and service-level compliance	
SN31	Understanding of IT regulation requirements compliance	

TEMPLATE 2 – STRATEGIC PLANNING

PART A2 – STAKEHOLDER NEEDS (SNs) ALIGNED WITH AIRPORT GOALS (AGs)

REFERENCE

	AG01	AG02	AG03	AG04	AG05	AG06	AG07	AG08	AG09	AG10	AG11	AG12	AG13	AG14	AG15	AG16	AG17
SN01	X	X				X	X						X			X	X
SN02	X	X				X	X						X			X	X
SN03		X			X				X	X	X	X		X			
SN04	X	X						X					X			X	X
SN05								X		X	X	X		X	X	X	
SN06			X	X						X							
SN07			X	X						X							
SN08			X	X						X							
SN09				X					X						X		
SN10			X				X		X						X		
SN11					X		X										
SN12										X		X		X			
SN13										X		X		X			
SN14										X		X		X			
SN15										X		X		X			
SN16										X		X		X			
SN17										X		X		X			
SN18				X											X		
SN19				X			X								X		
SN20	X							X								X	X
SN21	X	X	X					X			X	X	X				
SN22	X	X	X					X			X	X	X				
SN23	X	X					X										
SN24	X	X									X	X					
SN25					X					X		X		X			
SN26		X	X									X					
SN27		X			X					X		X					
SN28	X	X			X			X									
SN29		X		X	X										X		
SN30				X											X		
SN31				X											X		

TEMPLATE 2 – STRATEGIC PLANNING

PART A3 – STAKEHOLDER NEEDS (SNs) ALIGNED WITH AIRPORT GOALS (AGs)

WORKSHEET

	AG01	AG02	AG03	AG04	AG05	AG06	AG07	AG08	AG09	AG10	AG11	AG12	AG13	AG14	AG15	AG16	AG17
SN01																	
SN02																	
SN03																	
SN04																	
SN05																	
SN06																	
SN07																	
SN08																	
SN09																	
SN10																	
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SN30																	
SN31																	

TEMPLATE 2 – STRATEGIC PLANNING
PART B1 – AIRPORT GOALS (AGs)
CHECKLIST

AG ID	Airport Goals Description	Yes/No
Financial		
AG01	Provide value to airport stakeholders through financial investments	
AG02	Provide competitive products and services for airlines and passengers	
AG03	Provide managed risk through safeguarding airport assets	
AG04	Maintain compliance with external laws and regulations	
AG05	Maintain financial transparency	
Customer		
AG06	Maintain a customer-oriented service culture	
AG07	Maintain business service continuity and availability	
AG08	Provide agile responses to a changing aviation environment	
AG09	Make information-based strategic decisions	
AG10	Optimize airline and passenger service delivery costs	
Internal		
AG11	Optimize airport-wide process functionality	
AG12	Optimize airport-wide process cost	
AG13	Manage airport-wide change programs	
AG14	Maximize airport operational and staff productivity	
AG15	Maintain compliance with internal airport policies	
Development		
AG16	Maintain skilled and motivated airport staff	
AG17	Maintain an innovative airport culture	

TEMPLATE 2 – STRATEGIC PLANNING

PART B2 – AIRPORT GOALS (AGs) ALIGNED WITH IT GOALS (ITGs)

REFERENCE

	ITG 01	ITG 02	ITG 03	ITG 04	ITG 05	ITG 06	ITG 07	ITG 08	ITG 09	ITG 10	ITG 11	ITG 12	ITG 13	ITG 14	ITG 15	ITG 16	ITG 17
AG01	P		P		P	S	P	S	S		P	S	P	S		S	S
AG02	P		S		P		P	S	P		S	P	S	S		S	P
AG03	S	S	S	P		S	S	S	S	P		S	S	S	S	P	
AG04		P		S			S			P				S	S		
AG05						P											
AG06	P				S		P	S	S			S	S			S	S
AG07	S			P			S	S		P				P			
AG08	P		S	S	S		P		P		S	S				S	P
AG09	P		S			S	S	S						P			S
AG10	S			P	S	P		S			P	S	S				
AG11	P		S		S		P	P	P		S	P		S			S
AG12	S				P	P	S	S			P	S	S				
AG13	P		P	S			S		S		S	S	P				S
AG14					S			P	S		S	S				P	
AG15		P		S						P					P		
AG16	S		S	S			S	S	S							P	S
AG17	S		S		S		S	S	P		S	S				S	P

Legend: Primary (P) and Secondary (S) IT-Related Goals

TEMPLATE 2 – STRATEGIC PLANNING
PART B3 – AIRPORT GOALS (AGs) ALIGNED WITH IT GOALS (ITGs)
WORKSHEET

	ITG 01	ITG 02	ITG 03	ITG 04	ITG 05	ITG 06	ITG 07	ITG 08	ITG 09	ITG 10	ITG 11	ITG 12	ITG 13	ITG 14	ITG 15	ITG 16	ITG 17
AG01																	
AG02																	
AG03																	
AG04																	
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AG11																	
AG12																	
AG13																	
AG14																	
AG15																	
AG16																	
AG17																	

Legend: Primary (P) and Secondary (S) IT-Related Goals

96 Alternative IT Delivery Methods and Best Practices for Small Airports

TEMPLATE 2 – STRATEGIC PLANNING
PART C1 – IT GOALS (ITGs)
CHECKLIST

ITG ID	ITG Description	Yes/No
Financial		
ITG01	Alignment of IT and business strategy	
ITG02	IT compliance and support for business compliance with external laws and regulations	
ITG03	Commitment of executive management for making IT-related decisions	
ITG04	Managed IT-related business risk	
ITG05	Realized benefits from IT-enabled investments and service portfolio	
ITG06	Transparency of IT costs, benefits, and risk	
Customer		
ITG07	Delivery of IT services in line with business requirements	
ITG08	Adequate use of applications, information, and technology solutions	
Internal		
ITG09	IT agility	
ITG10	Security of information, processing infrastructure and applications	
ITG11	Optimization of IT assets, resources and capabilities	
ITG12	Enablement and support of business processes by integrating applications and technology into business processes	
ITG13	Delivery of projects delivering benefits, on time, on budget, and meeting requirements and quality standards	
ITG14	Availability of reliable and useful information for decision making	
ITG15	IT compliance with internal policies	
Development		
ITG16	Competent and motivated business and IT personnel	
ITG17	Knowledge, expertise and initiatives for business innovation	

TEMPLATE 2 – STRATEGIC PLANNING
PART C2 – IT GOALS (ITGs) ALIGNED WITH ENABLING PROCESSES
REFERENCE

	EDM 01	EDM 02	EDM 03	EDM 04	EDM 05	APO 01	APO 02	APO 03	APO 04	APO 05	APO 06	APO 07	APO 08	APO 09	APO 10	APO 11	APO 12	APO 13
ITG01	P	P	S	S	S	P	P	P	S	P	S	S	P	S		S		
ITG02	S		S		S	P						S			S	S	P	P
ITG03	P	S	S	S	P	S	S	S		S	S	S	S					
ITG04	S		P	S		S	S	S	S	S	S	S	S	S	P	S	P	P
ITG05	S	P		S			S	S	P	P	P		S	S	S	P		
ITG06	S	P	P	S	P			S		S	P		S	S	S		P	P
ITG07	P	P	S	S	P	S	P	S		S	S	S	P	P	P	P	S	S
ITG08		S	S	S			S	S	P	S	S		S	S	S	S	S	S
ITG09	S			P		P	S	P	P	S		S		S	P	S	S	
ITG10	S		P			S		S				S		S	S		P	P
ITG11	S	S		P		P	S	P	P	S	S	P	S	S	S	S		
ITG12	S	S				S	S	S	S				P					
ITG13	S	S	S	S	S	S	S			P	S	P	S	S	S	P	P	
ITG14	S	S	S		S	S	S	S	S					P	S	S	S	P
ITG15	S		P		S	P	S					S	S	S	S	S	S	
ITG16	S	S	S	P		P	S					P	S			S	S	
ITG17	S	P	S	S	S	P	P	S	P	S		P	P		S	S	S	

Legend: Primary (P) and Secondary (S) IT-Related Goals

	BAI 01	BAI 02	BAI 03	BAI 04	BAI 05	BAI 06	BAI 07	BAI 08	BAI 09	BAI 10	DSS 01	DSS 02	DSS 03	DSS 04	DSS 05	DSS 06	MEA 01	MEA 02	MEA 03
ITG01	P	P	S		S			S						S	S		S		
ITG02		S							S	P	S		S	S	P	S	S	P	P
ITG03	S	S			S	S											S		
ITG04	P	S	S	S		P	S		S	S	P	P	P	P	P	P	P	P	P
ITG05	P	S	S	S	S	S	S	S			S		S	S			S		S
ITG06	S								P	S							S	S	
ITG07	S	P	P	P	S	P	S	S	S		P	P	P	P	S	P	P	S	S
ITG08	S	S	S	S	P	S	P	S		S	S	S	S	S	S	S	S	S	
ITG09		S		S	S	S	S	P	S	S	S		S	S			S		
ITG10		S				P		S	S	S	S	S		S	P	S	S	S	S
ITG11	S	S	S	P	S	S		S	P	P	P		P	S	S	S	P		
ITG12		P	S		S	S	P						S	S	S	S			
ITG13	P	S	S	S	P	S	S										S		
ITG14		S	S	P		S	S	S	S	P	S	S	P	P	S	S	S	S	
ITG15						S	S		S	S	S	S	S	S	S	S	P	P	S
ITG16	S							S			S			S		S	S		
ITG17	S	S	S	S	P	S	S	P			S	S	S	S		S	S	S	S

Legend: Primary (P) and Secondary (S) IT-Related Goals

TEMPLATE 2 – STRATEGIC PLANNING
PART C3 – IT GOALS (ITGs) ALIGNED WITH ENABLING PROCESSES
WORKSHEET

	EDM 01	EDM 02	EDM 03	EDM 04	EDM 05	APO 01	APO 02	APO 03	APO 04	APO 05	APO 06	APO 07	APO 08	APO 09	APO 10	APO 11	APO 12	APO 13
ITG01																		
ITG02																		
ITG03																		
ITG04																		
ITG05																		
ITG06																		
ITG07																		
ITG08																		
ITG09																		
ITG10																		
ITG11																		
ITG12																		
ITG13																		
ITG14																		
ITG15																		
ITG16																		
ITG17																		

Legend: Primary (P) and Secondary (S) IT-Related Goals

	BAI 01	BAI 02	BAI 03	BAI 04	BAI 05	BAI 06	BAI 07	BAI 08	BAI 09	BAI 10	DSS 01	DSS 02	DSS 03	DSS 04	DSS 05	DSS 06	MEA 01	MEA 02	MEA 03
ITG01																			
ITG02																			
ITG03																			
ITG04																			
ITG05																			
ITG06																			
ITG07																			
ITG08																			
ITG09																			
ITG10																			
ITG11																			
ITG12																			
ITG13																			
ITG14																			
ITG15																			
ITG16																			
ITG17																			

Legend: Primary (P) and Secondary (S) IT-Related Goals

TEMPLATE 2 – STRATEGIC PLANNING
PART D1a – ENABLING PROCESSES (EPs)
CHECKLIST

EP ID	Enabling Process	Yes/No
EDM	**Evaluate, Direct, and Monitor**	
EDM01	Ensure governance framework setting and maintenance	
EDM02	Ensure benefits delivery	
EDM03	Ensure risk optimization	
EDM04	Ensure resource optimization	
EDM05	Ensure stakeholder transparency	
APO	**Align, Plan, and Organize**	
APO01	Manage the IT management framework	
APO02	Manage strategy	
APO03	Manage enterprise architecture	
APO04	Manage innovation	
APO05	Manage portfolio	
APO06	Manage budget and costs	
APO07	Manage human resources	
APO08	Manage relationships	
APO09	Manage service agreements	
APO10	Manage suppliers	
APO11	Manage quality	
APO12	Manage risk	
APO13	Manage security	

TEMPLATE 2 – STRATEGIC PLANNING
PART D1b – ENABLING PROCESSES (EPs)
CHECKLIST

EP ID	Enabling Process	Yes/No
BAI	**Build, Acquire, and Implement**	
BAI01	Monitor programs and projects	
BAI02	Manage requirements definition	
BAI03	Manage solutions identification and build	
BAI04	Manage availability and capacity	
BAI05	Manage organizational change enablement	
BAI06	Manage changes	
BAI07	Manage change acceptance and transitioning	
BAI08	Manage knowledge	
BAI09	Manage assets	
BAI10	Manage configuration	
DSS	**Deliver, Service, and Support**	
DSS01	Manage operations	
DSS02	Manage service requests and incidents	
DSS03	Manage problems	
DSS04	Manage continuity	
DSS05	Manage security services	
DSS06	Manage business process controls	
MEA	**Monitor, Evaluate, and Assess**	
MEA01	Monitor, evaluate, and assess performance and conformance	
MEA02	Monitor, evaluate, and assess the system of internal control	
MEA03	Monitor, evaluate, and assess compliance with external requirements	

TEMPLATE 2 – STRATEGIC PLANNING
PART D2a – ENABLING PROCESSES (EPs)
DESCRIPTIONS

EP ID	Enabling Process	Process Description
EDM	**Evaluate, Direct, and Monitor**	
EDM01	Ensure governance framework setting and maintenance	
EDM02	Ensure benefits delivery	
EDM03	Ensure risk optimization	
EDM04	Ensure resource optimization	
EDM05	Ensure stakeholder transparency	
APO	**Align, Plan, and Organize**	
APO01	Manage the IT management framework	
APO02	Manage strategy	
APO03	Manage enterprise architecture	
APO04	Manage innovation	
APO05	Manage portfolio	
APO06	Manage budget and costs	
APO07	Manage human resources	
APO08	Manage relationships	
APO09	Manage service agreements	
APO10	Manage suppliers	
APO11	Manage quality	
APO12	Manage risk	
APO13	Manage security	

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TEMPLATE 2 – STRATEGIC PLANNING
PART D2b – ENABLING PROCESSES (EPs)
DESCRIPTIONS

EP ID	Enabling Process	Process Description
BAI	**Build, Acquire, and Implement**	
BAI01	Monitor programs and projects	
BAI02	Manage requirements definition	
BAI03	Manage solutions identification and build	
BAI04	Manage availability and capacity	
BAI05	Manage organizational change enablement	
BAI06	Manage changes	
BAI07	Manage change acceptance and transitioning	
BAI08	Manage knowledge	
BAI09	Manage assets	
BAI10	Manage configuration	
DSS	**Deliver, Service, and Support**	
DSS01	Manage operations	
DSS02	Manage service requests and incidents	
DSS03	Manage problems	
DSS04	Manage continuity	
DSS05	Manage security services	
DSS06	Manage business process controls	
MEA	**Monitor, Evaluate, and Assess**	
MEA01	Monitor, evaluate, and assess performance and conformance	
MEA02	Monitor, evaluate, and assess the system of internal control	
MEA03	Monitor, evaluate, and assess compliance with external requirements	

TEMPLATE 3 – BUSINESS CASE DEVELOPMENT GUIDE
PART A1 - ISSUE ANALYSIS: ISSUE DESCRIPTION AND CURRENT CONDITION

Issue Description
Current Conditions
Financial
Operational
Stakeholders
Staff

TEMPLATE 3 – BUSINESS CASE DEVELOPMENT GUIDE
PART A2 - ISSUE ANALYSIS: IT GOALS

IT Goals to be Addressed	Y/N
Financial	
ITG01 Alignment of IT and business strategy	
ITG02 IT compliance and support for business compliance with external laws and regulations	
ITG03 Commitment of executive management for making IT-related decisions	
ITG04 Managed IT-related business risk	
ITG05 Realized benefits from IT-enabled investments and service portfolio	
ITG06 Transparency of IT costs, benefits, and risk	
Customer	
ITG07 Delivery of IT services in line with business requirements	
ITG08 Adequate use of applications, information, and technology solutions	
Internal	
ITG09 IT agility	
ITG10 Security of information, processing infrastructure and applications	
ITG11 Optimization of IT assets, resources and capabilities	
ITG12 Enablement and support of business processes by integrating applications and technology into business processes	
ITG13 Delivery of projects delivering benefits, on time, on budget, and meeting requirements and quality standards	
ITG14 Availability of reliable and useful information for decision making	
ITG15 IT compliance with internal policies	
Development	
ITG16 Competent and motivated business and IT personnel	
ITG17 Knowledge, expertise and initiatives for business innovation	

TEMPLATE 3 – BUSINESS CASE DEVELOPMENT GUIDE
PART A3 - ISSUE ANALYSIS: AIRPORT GOALS

Airport Goals to be Addressed	Y/N
Financial	
AG01 Provide value to airport stakeholders through financial investments	
AG02 Provide competitive products and services for airlines and passengers	
AG03 Provide managed risk through safeguarding airport assets	
AG04 Maintain compliance with external laws and regulations	
AG05 Maintain financial transparency	
Customer	
AG06 Maintain a customer-oriented service culture	
AG07 Maintain business service continuity and availability	
AG08 Provide agile responses to a changing aviation environment	
AG09 Make information-based strategic decisions	
AG10 Optimize airline and passenger service delivery costs	
Internal	
AG11 Optimize airport-wide process functionality	
AG12 Optimize airport-wide process cost	
AG13 Manage airport-wide change programs	
AG14 Maximize airport operational and staff productivity	
AG15 Maintain compliance with internal airport policies	
Development	
AG16 Maintain skilled and motivated airport staff	
AG17 Maintain an innovative airport culture	

TEMPLATE 3 – BUSINESS CASE DEVELOPMENT GUIDE
PART A4 - ISSUE ANALYSIS: STAKEHOLDER NEEDS

Stakeholder Needs to be Addressed	Y/N
SN01 Value from the use of IT	
SN02 User satisfaction with the quality of IT service	
SN03 Managed performance of IT	
SN04 Implementation of new technology for new strategic opportunity	
SN05 An appropriately built and structured IT department	
SN06 Managed dependency on external providers	
SN07 Managed IT outsourcing agreements	
SN08 Assurance over external providers	
SN09 Management of control requirements for information	
SN10 Management of all IT-related risk	
SN11 An efficient and resilient IT operation	
SN12 Control over the cost of IT	
SN13 Effective and efficient use of IT resources	
SN14 Effective and efficient use of sourcing options	
SN15 Adequate number of IT staff	
SN16 Developed and maintained IT staff skills	
SN17 Managed IT staff performance	
SN18 Assurance over IT	
SN19 Securely processed information	
SN20 Improved business agility through a flexible IT environment	
SN21 Delivered promises from IT projects	
SN22 IT support for the execution of business strategy	
SN23 Managed IT criticality in sustaining the enterprise	
SN24 Understanding of business processes dependent on IT and their requirements	
SN25 Understanding of IT operational and project budget requirements	
SN26 Understanding of the balance between IT support/maintenance and value creation	
SN27 Sufficient IT resources and infrastructure available to meet required strategic objectives	
SN28 Timely IT decisions	
SN29 Transparency for the total IT effort and investment	
SN30 IT support for enterprise regulation and service-level compliance	
SN31 Understanding of IT regulation requirements compliance	

TEMPLATE 3 – BUSINESS CASE DEVELOPMENT GUIDE
PART A5 - ISSUE ANALYSIS: OPPORTUNITY PARAMETERS

Opportunity Parameters
Implementation Schedule Demands
Opportunity Window for Solution
Supporting Evidence that Opportunity is Real
Positive Impact on the Business

TEMPLATE 3 – BUSINESS CASE DEVELOPMENT GUIDE
PART B1 – OPPORTUNITY EVALUATION
DESCRIPTION & BENEFITS/MEASUREMENT CRITERIA

Opportunity Description		
Benefits and Measurement Criteria		
Category	**Benefit**	**Value**
Financial		
Operational		
Stakeholders		
Staff		

TEMPLATE 3 – BUSINESS CASE DEVELOPMENT GUIDE
PART B2 – OPPORTUNITY EVALUATION
COST FUNDING PLAN

Cost and Funding Plan			
Category	**Cost Item**	**Value**	**Budgeted (Yes/No)**
People			
Physical			
Marketing			
Stakeholders			
Organization			
Funding Source	**Amount**	**Notes**	

TEMPLATE 3 – BUSINESS CASE DEVELOPMENT GUIDE

PART B3 – OPPORTUNITY EVALUATION

FEASIBILITY / RISKS / ISSUES

Feasibility		
Component	**Rating (1-10)**	**Method Used to Determine Feasibility**

Risks			
Description	**Likelihood**	**Impact**	**Mitigating Actions**

Issues		
Description	**Priority**	**Resolution Actions**

Assumptions

TEMPLATE 3 – BUSINESS CASE DEVELOPMENT GUIDE
PART B4 – OPPORTUNITY EVALUATION
STAKEHOLDER IMPACT

Stakeholder Impacts
Commercial Impacts
Planning Impacts
Facility Impacts
Legal Impacts
Financial Impacts

Stakeholder Impacts
Risk Impacts
Operations Impacts
Regulatory Impacts
Security Impacts
Technology Impacts

APPENDIX F

Useful Resources

This appendix provides a top-level list of resources that may be useful for further evaluation. Each of these resources provides a depth of information useful to gain a deeper understanding of the material presented in this Guidance.

Name	Website Address	Description
ACRP: Airport Cooperative Research Program	http://www.trb.org/ACRP/ACRP.aspx	Research program focused on wide range of airport-related issues
ACI-NA, BIT: Airport Council International – North America, Business Information Technology Committee	http://aci-na.org/committee/business-information-technology	Airport industry committee focused on airport IT issues
AAAE: American Association of Airport Executives	http://aaae.org/	Airport industry association focused on wide range of airport-related issues
IATA: International Air Transport Association	http://www.iata.org/Pages/default.aspx	Airline trade association providing recommended practices affecting airport IT systems
ISO: International Organization for Standardization	http://www.iso.org/iso/home.html	Organization focused on defining standards across many industries
COSO: Committee of Sponsoring Organizations of the Treadway Commission	http://coso.org/	Committee focused on organizational governance, business ethics, internal control, enterprise risk management, fraud, and financial reporting
COBIT: Control Objectives for Information and Related Technology	http://www.isaca.org/cobit/pages/default.aspx	Framework for information technology and management and governance
ITIL: Information Technology Infrastructure Library	http://www.itil-officialsite.com/	IT service management practices focused on aligning with business needs
TOGAF: The Open Group Architecture Framework	http://www.opengroup.org/togaf/	Comprehensive framework for enterprise information architecture
PMBOK: A Guide to the Project Management Body of Knowledge	http://www.pmi.org/PMBOK-Guide-and-Standards.aspx	Comprehensive methodology for project management
PRINCE2: Projects in Controlled Environments	http://www.prince-officialsite.com/	Project management methodology addressing high-level management, control, and organization of projects
BABOK: A Guide to the Business Analysis Body of Knowledge	http://www.iiba.org/BABOK-Guide.aspx	Comprehensive methodology for business analysis

Abbreviations and acronyms used without definitions in TRB publications:

A4A	Airlines for America
AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
MAP-21	Moving Ahead for Progress in the 21st Century Act (2012)
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation