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Information Exchange in Modern Airports The Foundation of Master Systems Integration

Understanding the Ownership, Quality and Lifecycle of Operational Information in Modern Airports

Brian Stanswood
Principal Consultant
Stanswood Consulting

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www.stanswoodconsulting.com

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Purpose and Audience

This technical paper examines the exchange of operational information as a core Master Systems Integration discipline within modern airport projects. It is written for Airport Owners, Airport Operators, programme directors, designers, contractors, system suppliers and operational stakeholders responsible for defining, delivering or maintaining airport systems and information interfaces.

The paper is intentionally practical. It explains where airport operational information originates, how authoritative sources are established, how information is published and consumed, and why information quality, open standards and lifecycle management must be considered from the earliest stages of airport planning and design.

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Executive Summary

Modern airport operations depend upon the continuous exchange of accurate, timely and reliable information between airlines, airport systems, operational stakeholders and external agencies.

Flight schedules, passenger status, baggage information, stand allocations, weather data, security events and operational decisions all originate from different sources. This information must be validated, distributed and acted upon by the systems and organisations responsible for operating the airport.

For this reason, Master Systems Integration is concerned with more than connecting systems together. Its purpose is to ensure that operational information reaches the correct people and systems, in the required format and at the time it is needed.

Airport information exchange begins outside the airport as well as within it. Airline host systems, airline and airport Departure Control Systems, Air Navigation Service Providers, meteorological services and industry messaging platforms may all provide information that is essential to airport operations. Within the airport environment, systems such as the Airport Operational Database, Resource Management System, Flight Information Display System, baggage systems, Airport Collaborative Decision Making and building, safety and security systems create, consume and exchange operational information.

The architecture used to support these exchanges will vary between airports. Different airports may use different systems, suppliers, integration platforms and information-routing arrangements. The objective of Master Systems Integration is therefore not to impose a single technical architecture, but to identify the operational information requirements, establish the authoritative source for each item of information and ensure that all required consumers receive consistent and dependable data.

This paper examines airport information exchange from an operational and Master Systems Integration perspective. It considers where airport information originates, how it enters the airport environment, how ownership and authoritative sources should be established, and how information quality, availability, security and governance influence airport operations.

Successful airport integration is not measured simply by the number of systems connected. It is measured by the confidence that accurate operational information is available to the people and systems that depend upon it throughout the operational life of the airport.

1. Introduction

Modern airports depend upon the continuous movement of operational information.

Aircraft movements, passenger processing, baggage handling, stand allocation, resource planning, security response and airport coordination all rely upon information being available to the correct people and systems at the correct time.

This information originates from many different sources. Some are located within the airport, while others are operated by airlines, Air Navigation Service Providers, meteorological services, government agencies and industry messaging platforms outside the airport environment.

The systems receiving this information may also have very different purposes.

An Airport Operational Database may consolidate and distribute flight information. A Resource Management System may use that information to allocate stands, gates and other airport resources. A Flight Information Display System may present selected information to passengers and staff. Baggage, security, building and operational systems may each create or consume information required to support their own activities.

The existence of technical connections between these systems does not, by itself, create effective information exchange.

The project must first establish:

- What information is required.
- Where that information originates.
- Which system or organisation is responsible for it.
- Which systems and stakeholders require it.
- When it must be available.

- What operational consequences may arise if it is delayed, incomplete or incorrect.

These questions are fundamental to Master Systems Integration.

Without a clear understanding of information ownership and operational use, systems may exchange data without supporting the intended airport process. Multiple systems may hold different versions of the same information, messages may be delivered to the wrong consumers, or critical updates may not reach operational stakeholders when required.

For this reason, airport information exchange must be considered as an operational discipline rather than simply a technical activity.

Technology provides the mechanisms through which information is transported, transformed, stored and presented. Master Systems Integration ensures that these mechanisms support the operational requirements of the Airport Owner and Airport Operator.

This paper examines the role of information exchange within modern airports and explains why the ownership, quality, distribution and governance of operational information form the foundation of successful Master Systems Integration.

2. The Airport Operational Information Exchange Environment

Every airport operates within a complex information environment where operational data is continuously created, updated, exchanged and consumed by numerous organisations and systems.

Unlike many conventional information systems, airports rarely operate as a single organisation. Airlines, Airport Operators, Ground Handling Agents, Air Navigation Service Providers, government agencies and numerous third-party service providers all contribute operational information that supports the safe and efficient operation of the airport.

Figure 1 illustrates a conceptual airport operational information exchange architecture. Rather than representing a specific airport or supplier solution, it provides a high-level view of the principal sources, processing systems and consumers of operational information typically found within a modern airport environment.

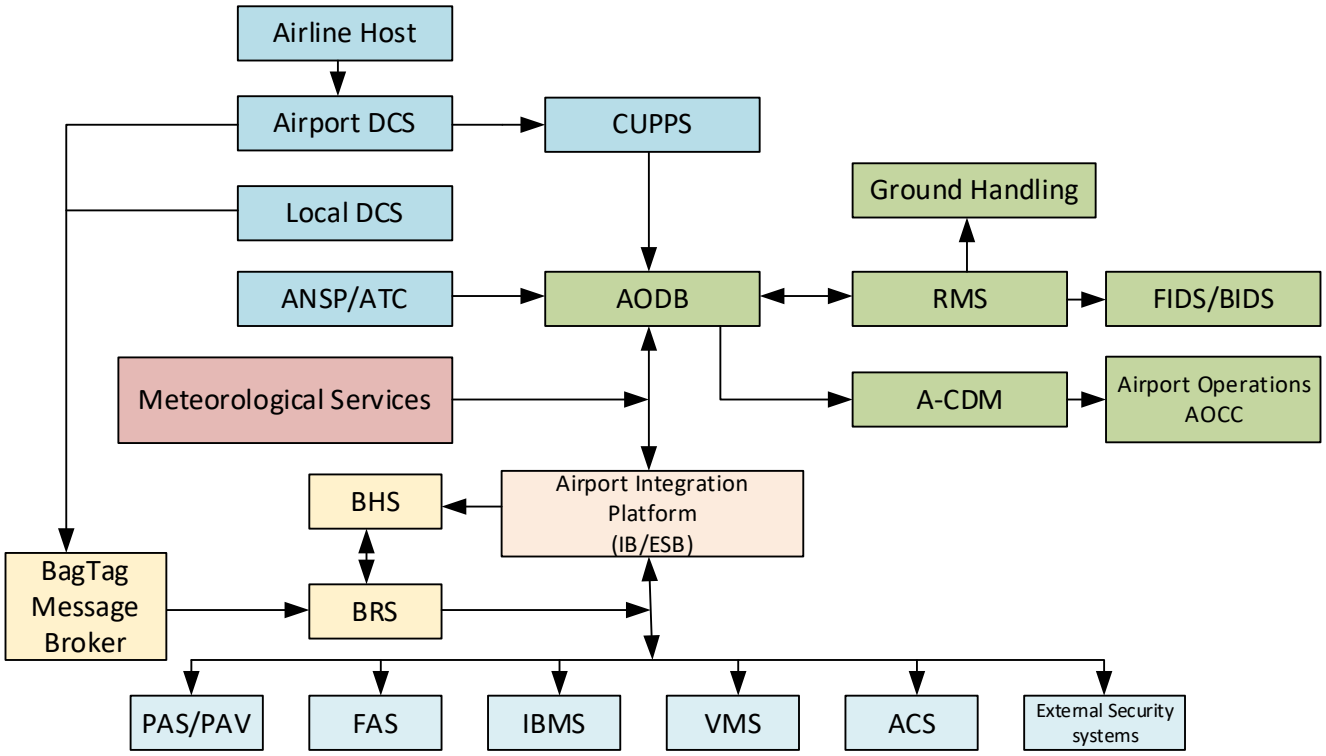

Figure 1 – Conceptual Airport Operational Information Exchange Architecture

The diagram demonstrates that operational information originates from multiple independent sources.

Airline Host Systems, Airline Departure Control Systems, Airport Departure Control Systems, Air Navigation Service Providers and Meteorological Services all generate information required to support airport operations. Much of this information originates outside the direct control of the Airport Operator, emphasising that successful airport integration extends beyond the airport boundary.

The Common Use Passenger Processing System provides the common-use environment through which authorised airline applications are accessed at the airport. The operational information itself remains generated and controlled by the airline or airport Departure Control System, rather than by the common-use platform.

This distinction is particularly important for baggage information. Bag tag information is generated by the applicable Departure Control System and may be distributed through an external industry baggage messaging platform. The Baggage Reconciliation System uses the baggage information to track and reconcile bags, while the Baggage Handling System consumes the relevant information to route and handle the physical baggage and may return handling or location events.

Within the airport, operational systems such as the Airport Operational Database, Resource Management System, Airport Collaborative Decision Making, Flight Information Display System, baggage systems and other airport applications process, exchange and consume information to support their respective operational functions.

The figure also illustrates the role of the Airport Integration Platform, commonly implemented using an Integration Broker or Enterprise Service Bus. Whilst the integration platform provides a controlled mechanism for exchanging information between participating systems, it should not be regarded as the owner of operational information. Information ownership remains with the originating operational system or organisation, whilst the integration platform provides the services necessary to transport, transform and distribute that information where required.

It is equally important to recognise that not all operational information is exchanged through the airport integration platform. Dedicated external messaging services, direct system interfaces and other approved mechanisms may be used where required by the operational architecture or the participating systems.

For this reason, Figure 1 should be regarded as a conceptual representation of airport operational information exchange rather than a detailed systems architecture. The precise information flows, integration mechanisms and participating systems will vary between airports according to operational requirements, regulatory obligations, supplier solutions and the overall scope of the project.

The objective of Master Systems Integration is not to ensure that every system communicates with every other system, but to ensure that the correct operational information is exchanged between the systems and organisations that require it to support airport operations.

3. Information Ownership and the Authoritative Source

Before operational information can be exchanged between airport systems, it is essential to establish which organisation or system owns that information and which system should be regarded as the authoritative source.

This is one of the most important principles of Master Systems Integration.

During the development of an airport, multiple systems may appear to contain identical information. Flight numbers may be displayed within the Airport Operational Database, Flight Information Display System, Resource Management System, Airport Collaborative Decision Making platform and airline systems. However, these systems do not necessarily own that information. In many cases they are consumers of information that has been created and maintained elsewhere.

The authoritative source is the recognised system or organisation responsible for creating, validating and maintaining a specific item of operational information. Other systems may receive, process or display that information, but they should not independently modify or redefine it unless this has been explicitly established within the airport operational concept.

Establishing authoritative sources prevents conflicting information from developing across the airport environment and ensures that operational decisions are based upon consistent and trusted data.

For example, flight schedules may originate from airline systems before being managed operationally within the Airport Operational Database. Stand allocations may be determined by the Resource Management System, whilst passenger check-in and boarding status remain under the control of the applicable Departure Control System. Bag tag information is generated by the Departure Control System, baggage reconciliation information is managed by the Baggage Reconciliation System, and the Baggage Handling System consumes the information required to support the physical movement of baggage.

The objective is not to duplicate operational information unnecessarily, but to ensure that each participating system receives the information required to perform its operational function whilst maintaining one recognised source of authority for each data element.

This principle also extends beyond airport-owned systems. Information provided by Air Navigation Service Providers, Meteorological Services, government agencies and airline host systems may remain under the ownership of those organisations even though it is consumed by airport systems to support operational decision making.

Identifying information ownership and establishing authoritative sources should therefore be undertaken during the concept and design stages. These decisions form the foundation upon which interface requirements, information exchanges and system responsibilities are subsequently developed.

Table 1 - Typical Information Ownership within an Airport Environment

Operational Information	Typical Authoritative Source	Typical Information Consumers
Flight schedule	Airline systems / AODB	RMS, FIDS, A-CDM and Airport Operations
Stand and gate allocation	RMS	AODB, FIDS, VDGS and Airport Operations
Passenger check-in status	Airport DCS / Local DCS	AODB, BRS and authorised operational consumers
Boarding status	Airport DCS / Local DCS	AODB, FIDS and Airport Operations
Bag tag information	Airport DCS / Local DCS	External baggage messaging service and BRS
Baggage reconciliation status	BRS	BHS, airlines, ground handlers and Airport Operations
Baggage handling and location events	BHS	BRS and authorised operational consumers
Aircraft movement information	ANSP / ATC and AODB	RMS, A-CDM, FIDS and Airport Operations
Meteorological information	Meteorological Service	AODB, A-CDM and Airport Operations
Fire alarm events	Fire Alarm System	Airport Operations, security and authorised integrated systems
Building services alarms	BMS / IBMS	Airport Operations, engineering and maintenance

Note: The authoritative source and information consumers will vary between airports depending upon the operational model, selected systems, agreed data ownership and project-specific requirements.

Multiple systems may contain the same information, but only one recognised source should be authoritative for each operational data element.

4. The Information Exchange Lifecycle

Operational information within an airport is continually created, validated, exchanged, updated and consumed throughout the operational day. Unlike static engineering data, airport operational information is dynamic, with many information elements changing in real time as aircraft, passengers, baggage and airport resources move through the airport environment.

Understanding this lifecycle is fundamental to successful Master Systems Integration because every interface exists to support one or more stages of the operational information lifecycle.

Although the implementation may differ between airports, most operational information follows a common sequence.

4.1 Information Creation

Every item of operational information originates from an authoritative source. Examples include an airline publishing a flight schedule, a Departure Control System recording passenger check-in, the Resource Management System assigning an aircraft stand, or the Fire Alarm System reporting an alarm condition. At this stage, the information has been created but has not yet been distributed to other systems.

4.2 Information Validation

Before operational information is exchanged, it may be validated to ensure that it is complete, accurate and suitable for operational use. Validation may be undertaken automatically by software applications or through operational procedures, depending upon the information and the operational process being supported. The objective is to prevent incorrect or incomplete information from being propagated throughout the airport environment.

4.3 Information Publication

Once validated, operational information is made available to other airport systems and stakeholders. Publication may occur through direct system interfaces, an Airport Integration Platform, dedicated industry messaging services or other approved communication mechanisms. Not every information exchange follows the same technical route; the selected method depends upon the operational architecture and participating systems.

4.4 Information Consumption

Airport systems consume operational information according to their functional responsibilities. The Flight Information Display System presents information to passengers and staff, the Resource Management System allocates resources, the Baggage Reconciliation System manages baggage status, while Airport Operations use information to support operational decision making. Many systems may consume the same information, but each uses it for a different operational purpose.

4.5 Information Update

Airport operations continually change. Flight delays, gate changes, stand reallocations, passenger status updates, baggage processing events and operational incidents all require information to be updated. When the authoritative source changes an information element, the update should be distributed to all relevant consumers in a controlled and timely manner. This stage is iterative: updated information may be revalidated, republished and consumed repeatedly throughout the operational process.

4.6 Information Archive

Once operational activities have been completed, information may be retained for operational reporting, regulatory compliance, performance analysis, incident investigation or historical reference. The retention period and archival method will depend upon operational, contractual and regulatory requirements.

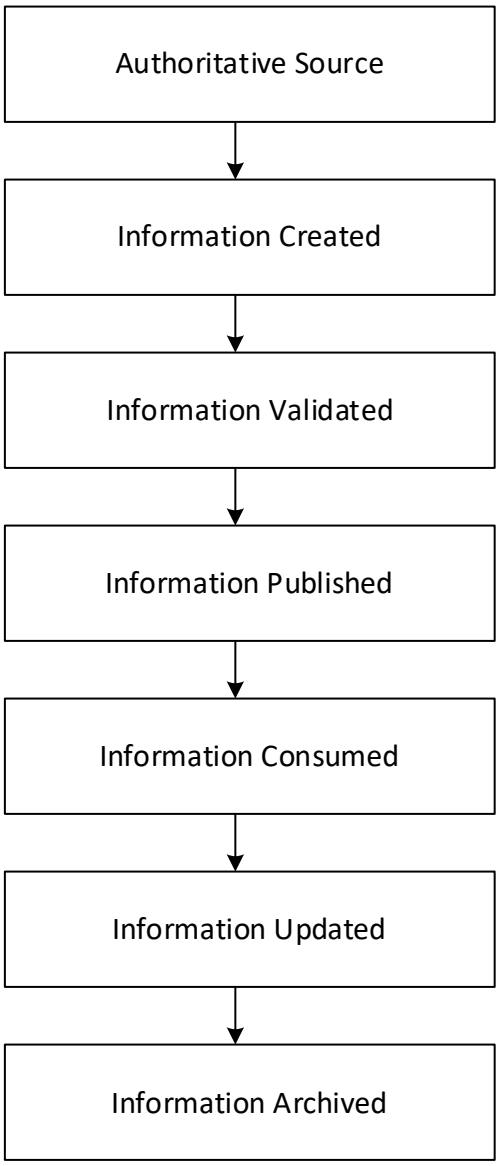

Figure 2 – Typical Airport Operational Information Lifecycle

Throughout this lifecycle, Master Systems Integration is responsible for ensuring that operational information remains consistent, traceable and available to authorised consumers. The objective is not simply to exchange information, but to ensure that the right information reaches the right system, in the correct format, at the appropriate time and with sufficient integrity to support safe and efficient airport operations.

Every operational information exchange identified during Master Systems Integration should support a defined operational requirement and one or more stages of the information lifecycle.

5. Information Exchange Models

There is no single method by which operational information is exchanged within a modern airport.

The architecture adopted for information exchange will depend upon the airport operational concept, selected systems, supplier capabilities, cybersecurity requirements, project scope and overall integration strategy.

For this reason, Master Systems Integration should not prescribe one information exchange model for every airport. The appropriate exchange mechanism should be selected to satisfy the operational, technical and business requirements of the project.

5.1 Direct System-to-System Exchange

The simplest information exchange is a direct interface between two systems. This approach may be appropriate where a limited number of systems require information exchange and the operational relationship is clearly defined. Direct interfaces can, however, become increasingly difficult to manage as more systems are introduced. A large number of point-to-point connections may increase engineering complexity, reduce flexibility and make future changes more difficult to implement.

5.2 Airport Integration Platform

Many modern airports use an Airport Integration Platform, typically implemented using an Integration Broker, Enterprise Service Bus or other middleware technology. Instead of creating numerous direct interfaces, participating applications exchange information through the platform. Depending upon the design, it may provide message routing, transformation, protocol conversion, validation, filtering, distribution, monitoring and logging. The integration platform is not normally the authoritative source of operational information; its role is to facilitate controlled exchange between participating systems.

5.3 External Industry Messaging Services

Not all airport information is exchanged through airport-owned infrastructure. Certain operational information may use external industry messaging platforms operating independently of the airport integration environment. Examples include baggage messaging, airline operational messaging and other services that support information exchange between airports, airlines and external organisations. Master Systems Integration must therefore consider both internal airport interfaces and external information dependencies.

5.4 Hybrid Information Exchange Architectures

Most airports employ a combination of information exchange models. Some systems communicate directly, others through the Airport Integration Platform, while specialist operational information may continue to use dedicated external messaging services. This hybrid approach enables each exchange to use the method most appropriate to its operational, technical, security and contractual requirements. The objective is not architectural uniformity, but reliable, secure and maintainable information exchange throughout the airport environment.

The selection of an information exchange model should therefore be based upon operational requirements rather than technological preference. Master Systems Integration is responsible for ensuring that the chosen architecture supports the Airport Owner's operational objectives whilst providing sufficient flexibility for future expansion, technology refresh and operational change.

6. Future-Proofing Airport Information Exchange

The design of airport information exchanges should consider the complete operational life of the airport rather than simply the initial implementation.

Airport systems are continually upgraded, replaced or expanded. Software versions change, cybersecurity requirements evolve, operational processes are refined and new technologies are introduced. Each change has the potential to affect existing information exchanges.

One of the most significant challenges encountered during airport modernisation is maintaining compatibility between legacy systems and newer technologies. Whilst a replacement system may support modern interface standards, an existing legacy application may be incapable of supporting the revised specification. Consequently, what appears to be a straightforward interface update may require extensive redevelopment of multiple interconnected systems or, in some cases, complete system replacement.

The consequence is that a relatively small change to one system may create significant technical, operational and commercial implications across the wider airport environment. Upgrade programmes may become constrained by the capability of the oldest connected system rather than by the requirements of the new solution.

For this reason, Master Systems Integration should encourage the use of open standards, published interface specifications and vendor-neutral integration mechanisms wherever practical. These approaches improve interoperability, reduce unnecessary supplier dependency and simplify future system replacement or expansion.

An Application Programming Interface is not automatically an open standard. The API may use open communication standards while its functions, data structures and versioning remain proprietary to the supplier. The long-term objective should therefore be to obtain clearly documented interface specifications and defined ownership, support and version-control arrangements rather than relying only upon the technology label applied to the interface.

The adoption of open standards does not guarantee future compatibility. Effective lifecycle management also requires:

- Robust and current interface documentation.
- Formal configuration management.
- Interface version control and compatibility policies.
- Impact assessments before system upgrades.
- Regression testing of affected interfaces.
- Coordinated change management across all affected stakeholders.

These activities help ensure that a modification to one system does not introduce unintended consequences elsewhere within the airport integration environment.

Successful airport integration is therefore measured not only by how effectively systems communicate when first commissioned, but also by how efficiently they can evolve throughout the operational life of the airport.

The true cost of an interface is not measured only when it is first implemented, but throughout the operational life of the airport. Decisions made during design can significantly influence the cost, complexity and flexibility of future upgrades.

7. Information Quality and Governance

The value of an airport information exchange is determined not by the quantity of information exchanged, but by the quality and integrity of that information.

Modern airport operations rely upon numerous decisions being made every minute. Stand allocations, baggage routing, passenger processing, aircraft turnaround activities, security responses and operational coordination all depend upon the timely availability of accurate and trusted information.

If operational information is inaccurate, incomplete or delayed, the consequences may extend beyond the system in which the error originated. Incorrect information may be propagated to multiple airport systems, resulting in inconsistent displays, operational inefficiencies and unnecessary disruption.

For this reason, Master Systems Integration must consider information quality as an integral part of the airport information architecture rather than solely as a software development issue.

Information exchanged between airport systems should, wherever practical, demonstrate the following characteristics:

- **Accuracy -** Information correctly represents the operational event or condition.
- **Timeliness -** Information is available when required to support operational decision making.
- **Completeness -** All information necessary to support the operational process is present.
- **Consistency -** Information remains consistent across authorised systems and stakeholders.
- **Availability -** Information is accessible whenever operationally required.
- **Security -** Information is protected against unauthorised access, modification or disclosure.
- **Traceability -** The origin, ownership, movement and changes to information can be identified throughout its lifecycle.

Information governance extends beyond the technical implementation of interfaces. It establishes the policies, responsibilities and controls necessary to ensure that operational information remains reliable throughout the operational life of the airport.

Typical governance activities include:

- Defining the authoritative source for each operational information element.
- Establishing ownership and responsibility for information maintenance.
- Managing interface and data definitions under formal configuration control.
- Assessing the operational impact of proposed system changes.
- Controlling interface version changes and compatibility.
- Monitoring information quality and resolving inconsistencies.
- Maintaining audit trails for operational and regulatory purposes.

As airport systems continue to evolve, effective information governance provides the framework necessary to manage change whilst preserving the integrity of operational information. Without this discipline, even technically successful interfaces may fail to deliver the operational outcomes expected by the Airport Owner.

Ultimately, successful airport operations depend upon confidence in the information being exchanged. Master Systems Integration provides the governance necessary to ensure that this confidence is maintained throughout design, implementation, operation and future development.

8. Information Exchange as a Master Systems Integration Discipline

Airport information exchange is one of the principal disciplines of Master Systems Integration.

Whilst software suppliers develop individual interfaces associated with their own systems, the responsibility of Master Systems Integration extends across the complete operational information environment. MSI

ensures that operational information is correctly identified, ownership is established, authoritative sources are defined and information is exchanged between the appropriate systems and stakeholders to support airport operations.

This responsibility begins during the concept stage by working with the Airport Owner and Airport Operator to understand how the airport is intended to function. From this operational understanding, the information required to support airport processes can be identified before interface solutions are developed.

Throughout design and implementation, Master Systems Integration coordinates stakeholders, develops the information exchange strategy, defines interface requirements and ensures that information ownership and governance are applied consistently across the airport environment.

During testing and operational readiness, MSI verifies that operational information is exchanged accurately, reliably and in accordance with the agreed operational concept. This process extends beyond technical connectivity to confirm that the information supports the operational activities for which it was intended.

The responsibilities of Master Systems Integration continue after airport opening. As airport systems are upgraded, replaced or expanded, MSI provides the engineering discipline necessary to assess the impact of change, maintain interface compatibility and preserve the integrity of airport operational information throughout its lifecycle.

As discussed in SC-TP-003, Interface Management provides the structured engineering framework through which information exchanges are identified, documented, implemented and verified. This paper extends that principle by focusing on the operational information carried through those interfaces.

Successful Master Systems Integration is therefore measured not simply by the number of interfaces implemented, but by the confidence that operational information remains accurate, consistent and available to support safe and efficient airport operations.

9. Conclusion

Modern airports rely upon the continuous exchange of operational information between numerous independent organisations, systems and stakeholders. Airlines, Airport Operators, Air Navigation Service Providers, government agencies and airport systems all contribute information that enables the airport to operate safely and efficiently.

Successful airport integration is therefore not achieved simply by connecting systems together. It depends upon understanding where operational information originates, establishing authoritative sources, maintaining information quality and ensuring that information is delivered to the systems and organisations that require it throughout the operational lifecycle of the airport.

As airports continue to evolve through technology refresh, operational expansion and changing regulatory requirements, the importance of well-designed information exchange architectures will continue to increase. The use of open standards, robust governance, effective lifecycle management and vendor-neutral integration strategies can improve the airport's ability to accommodate future change whilst reducing long-term operational and commercial risk.

Master Systems Integration provides the engineering discipline that brings these activities together. By focusing on operational information rather than technology alone, MSI ensures that airport systems support the operational objectives of the Airport Owner and Airport Operator both today and throughout the future life of the airport.

Ultimately, airports do not operate because systems are connected. They operate because accurate, timely and trusted information is exchanged between the people and systems responsible for delivering safe, efficient and resilient airport operations.

Further Reading

Readers wishing to explore the subjects discussed in this paper may find the following publications useful:

- ICAO, Airport Planning Manual, Part I - Master Planning (Doc 9184, Part 1), 3rd Edition, 2023.
- ACI and IATA, Airport Development Reference Manual (ADRM).
- IATA, Baggage Reference Manual, 7th Edition, 2026.
- IATA, Passenger Services Conference Resolution Manual, including Resolution 753 on baggage tracking and associated baggage messaging standards.
- ISO/IEC/IEEE 15288:2023, Systems and software engineering - System life cycle processes.
- ISO/IEC/IEEE 24748-2:2024, Systems and software engineering - Life cycle management - Part 2: Guidelines for the application of ISO/IEC/IEEE 15288.
- EUROCONTROL, Airport Collaborative Decision Making guidance and specifications.

About Stanswood Consulting

Stanswood Consulting provides independent consultancy services specialising in airport ICT, Special Airport Systems, Master Systems Integration, design assurance, airport data centres and digital infrastructure. The company supports Airport Owners, designers and contractors throughout the planning, design, implementation and operational phases of major airport developments.

Website: www.stanswoodconsulting.com

About the Author

Brian Stanswood is an independent airport systems consultant with more than 35 years of experience in the planning, design, integration, assurance and delivery of airport ICT, security and specialist airport systems. His project experience includes major international airport developments in Europe, the Middle East and Asia.