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Interface Management
More Than an Interface Register

A Practical Guide to Managing Operational, Functional and Technical Interfaces in Modern Airports

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Purpose and Audience

This technical paper examines Interface Management 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 interfaces.

The paper is intentionally practical. It explains why Interface Management begins with the airport operational concept, how interfaces are systematically derived, and how a single controlled Interface Register, supporting interface documentation and verification records are used throughout the project lifecycle.

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Executive Summary

Successful airport integration depends upon much more than documenting interfaces between systems. While the Interface Register is an essential project management tool, it represents only one element of a broader engineering process.

Effective Interface Management begins during the concept stage of an airport project, where the Airport Owner and Airport Operator define the operational philosophy, business objectives and functional requirements that will shape the future airport. These requirements determine which systems are required, how information must be exchanged and ultimately which interfaces must be developed.

This paper explains why Interface Management should be regarded as a core Master Systems Integration discipline rather than simply the production of an Interface Register. It demonstrates how interfaces are derived from operational requirements, identifies the principal categories of interfaces encountered within airport projects and explains why successful integration depends upon understanding airport operations before implementing technical solutions.

The paper also considers the role of a single controlled Interface Register, high-level interface schematics, Network and Infrastructure Interface Specifications, Software Interface Control Documents and the associated verification and acceptance documentation required to prove that interfaces operate correctly throughout the airport lifecycle.

Ultimately, the effectiveness of Interface Management is not measured by the number of interfaces recorded, but by the confidence that operational information is exchanged accurately, securely and reliably between airport systems, stakeholders and external agencies.

1. Introduction

Modern airports are among the most highly integrated operational environments in the world. Passenger processing, baggage handling, security, flight information, resource management, communications and numerous other airport systems must work together to support the safe, secure and efficient movement of aircraft, passengers and baggage.

As airports have become increasingly digital, the number of interfaces between systems has grown significantly. Information is exchanged continuously between operational systems, technical infrastructure and external organisations, making Interface Management one of the most important disciplines within Master Systems Integration.

Despite its importance, Interface Management is frequently misunderstood.

Many projects assume that developing an Interface Register is the primary objective of Interface Management. Whilst the Interface Register is undoubtedly an important project deliverable, it simply records interfaces that have already been identified. It does not explain why those interfaces exist, what operational purpose they support or whether the resulting information exchange will successfully support airport operations.

Successful Interface Management begins much earlier.

It starts by understanding how the Airport Owner intends the airport to operate, identifying the operational information required to support those activities and establishing how that information should flow between systems and stakeholders.

Only then can the required interfaces be identified, specified, implemented and verified.

This paper examines Interface Management from the perspective of Master Systems Integration, demonstrating why successful airport integration begins with understanding airport operations rather than simply documenting system interfaces.

2. Understanding the Airport Systems Landscape

Before interfaces can be identified, it is first necessary to understand the airport systems landscape.

Figure 1 illustrates a typical high-level airport systems integration concept that may be used during the early stages of an MSI workshop. Rather than concentrating on individual system-to-system interfaces, the diagram provides a structured overview of the operational domains, airport systems and external stakeholders that may participate in the exchange of operational information.

It is important to recognise that every airport is different.

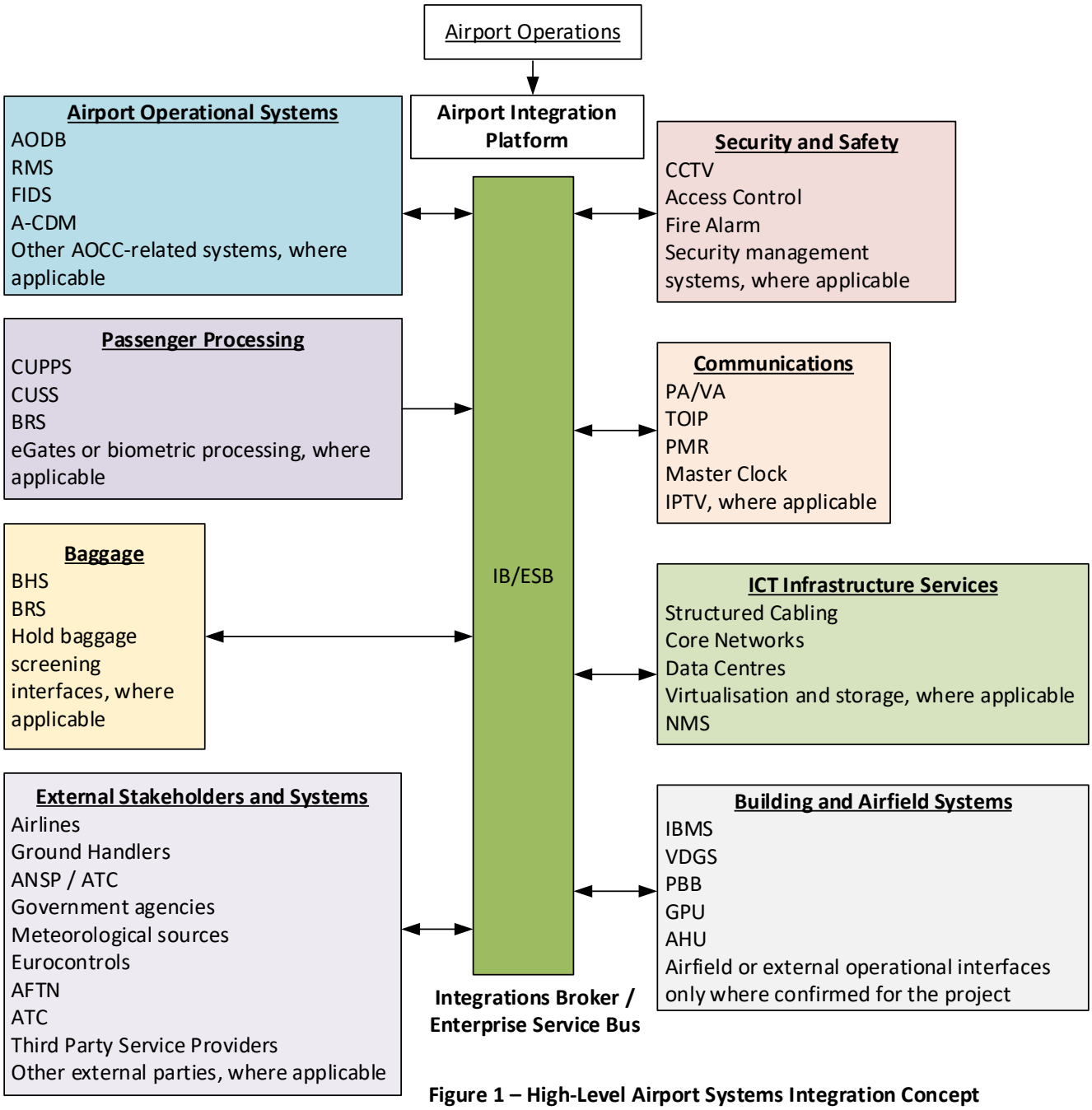

Figure 1 – High-Level Airport Systems Integration Concept

The systems illustrated within Figure 1 represent a typical airport environment and are intended to support discussion between the Airport Owner, Airport Operator, designers and other project stakeholders. Depending upon the airport's size, operational complexity, regulatory requirements and available budget, some airports may require only a subset of these systems, whilst others may include additional specialist applications.

The purpose of the diagram is therefore not to prescribe a standard airport architecture. Instead, it provides a structured framework from which the project team can identify the operational environment, confirm the systems required to support airport operations and establish the scope of future interface management activities.

This approach also enables the Airport Owner and Airport Operator to validate that the proposed systems architecture supports both current operational requirements and future business objectives before detailed design activities commence.

3. Interface Management Begins at the Concept Stage

One of the most common misconceptions within airport projects is that Interface Management begins once the system design has been completed.

In reality, successful Interface Management begins during the concept stage of the project.

At this stage, the Airport Owner and Airport Operator establish how the airport is expected to operate, the level of service to be provided, future operational aspirations and the long-term business objectives of the airport.

These decisions influence every subsequent stage of the project.

From the agreed operational concept, the project team can determine:

- Which airport systems are required.
- Which organisations will own or operate those systems.
- What operational information must be exchanged.
- Which interfaces are necessary.
- How those interfaces should be implemented.

For this reason, Master Systems Integration should be involved from the earliest stages of airport planning. Early engagement allows the MSI team to work alongside the Airport Owner, Airport Operator and design consultants to ensure that the proposed systems architecture supports the operational concept before detailed design and procurement activities begin.

Attempting to identify interfaces after individual systems have already been designed often results in unnecessary redesign, increased project risk and missed opportunities to improve operational efficiency.

Interface Management is therefore not simply a design coordination exercise. It is a structured engineering discipline that begins by understanding airport operations before determining how technology will support those operations.

The primary objective at concept stage is not to identify interfaces, but to confirm that the correct airport systems have been selected to support the Airport Owner's operational vision. Once this has been established, the required interfaces can be systematically derived.

4. What is an Interface?

The term interface is frequently associated with software, networks or communication protocols. Whilst these technical interfaces are essential, they represent only one aspect of a much broader integration environment.

From a Master Systems Integration perspective, an interface should be considered as the controlled exchange of information, services or responsibilities between two or more operational or technical entities in support of airport operations.

Every interface exists because an operational requirement demands that information, actions or responsibilities pass from one organisation, process or system to another.

Consider a simple example.

An aircraft is reassigned from one stand to another.

This is not a technical event; it is an operational decision.

Before determining how that information will be transmitted, the project team must first establish:

- Who owns the stand allocation?
- Which organisations require the updated information?
- What information must be exchanged?
- When must it be exchanged?
- What operational activities depend upon that information?
- What are the consequences if the information is delayed or incorrect?

Only after these questions have been answered should the technical implementation of the interface be defined.

Technology enables the exchange of information, but it does not determine why the information is required.

This distinction lies at the heart of successful Master Systems Integration. By concentrating first on operational requirements and information exchange, the MSI team ensures that technical interfaces support airport operations rather than becoming isolated system-to-system connections with little operational value.

5. Types of Interfaces

Successful Interface Management requires an understanding that not all interfaces are technical. Whilst software interfaces and network communications often receive the greatest attention, many of the most critical interfaces within an airport are operational, organisational or information-based.

For practical purposes, airport interfaces can be considered under five principal categories.

5.1 Operational Interfaces

Operational interfaces define how airport organisations, departments and operational procedures interact to deliver the day-to-day operation of the airport.

Examples include coordination between Airport Operations, Air Traffic Control, airlines, Ground Handling Agents, Security and Emergency Services. These interfaces may exist independently of technology and are primarily concerned with responsibilities, decision-making and operational workflows.

5.2 Information Interfaces

Information interfaces define the operational data that must be exchanged between systems and stakeholders.

Examples include flight information, baggage status, stand allocations, gate changes, security events and resource allocations. At this stage, the emphasis is not on how the information is exchanged, but on what information is required and who requires it.

5.3 System Interfaces

System interfaces describe how information is exchanged between individual airport systems.

These may include interfaces between the AODB, FIDS, Resource Management System, Baggage Handling System, passenger processing systems, security systems and numerous other airport applications. The purpose of the system interface is to ensure that operational information is exchanged accurately and consistently between participating systems.

5.4 Technical Interfaces

Technical interfaces define the engineering implementation of the information exchange.

These include communication protocols, APIs, web services, messaging formats, databases, network communications and other technical mechanisms required to implement the interface.

Technical interfaces answer the question: How will the information be exchanged? They do not determine why the information is required.

5.5 Stakeholder and External Agency Interfaces

Modern airports depend upon the cooperation of numerous organisations, many of which operate independently of the Airport Operator.

Examples include airlines, Air Navigation Service Providers, Ground Handling Agents, Customs, Immigration, Police, intelligence agencies, government departments and other regulatory authorities.

These organisations frequently operate their own applications, communications networks and security domains whilst still requiring the exchange of operational information with airport systems.

In some cases, specialist security systems, such as baggage screening equipment, explosive detection systems or government security applications, may operate on dedicated infrastructure or independently managed networks to satisfy national security or regulatory requirements. These systems may also impose substantial bandwidth, resilience, segregation and cybersecurity requirements.

Master Systems Integration must therefore consider not only the technical interface between systems, but also the operational responsibilities, ownership, security boundaries and governance arrangements associated with each stakeholder.

Successful integration requires cooperation between organisations as much as it requires communication between systems.

Although these interface categories appear distinct, they are closely related.

A change in airport operations may create new information requirements, which in turn require changes to system interfaces, technical implementations and operational procedures across multiple organisations.

For this reason, successful Interface Management cannot be undertaken in isolation. Every interface should be considered as part of an integrated operational environment where airport systems, external stakeholders and supporting technology work together to deliver a common operational objective.

Understanding these relationships provides the foundation for the systematic identification, specification and management of interfaces throughout the airport project lifecycle.

6. Developing the Interface Management Strategy

Having established the airport's operational concept, confirmed the systems architecture and identified the various categories of interfaces, the next step is to develop an Interface Management Strategy.

The purpose of the strategy is to provide a structured approach for identifying, defining, implementing and managing interfaces throughout the airport project lifecycle. It ensures that interface activities are coordinated across all project participants and that operational requirements remain the primary driver for integration decisions.

An effective Interface Management Strategy should be developed during the early stages of the project and should involve the Airport Owner, Airport Operator, designers, system suppliers and other key stakeholders. Early collaboration enables interface requirements to be identified before detailed system

designs become fixed, reducing the risk of redesign, programme delays and contractual disputes later in the project.

Rather than immediately developing an Interface Register, the MSI team should first establish a clear understanding of several fundamental questions.

- How will the airport operate?
- What operational services must be delivered?
- Which airport systems are required to support those services?
- Which organisations own or operate those systems?
- What operational information must be exchanged?
- Which systems publish that information?
- Which systems or stakeholders consume that information?
- What level of availability, resilience and performance is required?
- What operational consequences arise if an interface becomes unavailable?

The answers to these questions provide the foundation from which the project's interface requirements can be systematically derived.

Only after these activities have been completed should the project begin developing the Interface Register and the associated Interface Control Documentation. By following this approach, every recorded interface can be traced back to a clearly defined operational requirement, ensuring that the resulting integration supports the Airport Owner's operational objectives rather than simply connecting systems together.

Successful Interface Management is therefore a continuous engineering activity rather than a single project deliverable. As operational requirements evolve and system designs mature, interface requirements must be reviewed, validated and updated throughout the project lifecycle to ensure that the integrated airport continues to meet its operational objectives.

One of the most common mistakes on airport projects is to begin by asking, "Which systems need to interface?" A more effective question is, "What operational information must be exchanged to support the Airport Owner's operational concept?" Once this has been established, the required system interfaces can be derived in a structured and traceable manner.

7. The Interface Register

Having established the operational concept, identified the participating systems and stakeholders, and determined the information that must be exchanged, the next stage of the Interface Management process is the development of the Interface Register.

The Interface Register is one of the most important management documents produced during a Master Systems Integration project. It provides a structured record of the interfaces that have been identified and enables those interfaces to be monitored throughout the project lifecycle.

However, it is important to understand what the Interface Register is - and equally important to understand what it is not.

The Interface Register does not define the operational philosophy of the airport, determine system functionality or create new interfaces. Those activities should already have been completed during the concept development and systems definition stages of the project.

Instead, the Interface Register records the interfaces that have been derived from the operational requirements and provides a controlled mechanism for managing them throughout design, implementation, testing and commissioning.

A well-developed Interface Register typically records information such as:

- Interface identification number.
- Source system or organisation.
- Destination system or organisation.
- Description of the information or service being exchanged.
- Interface owner.
- Responsible organisations.
- Interface status.
- Related Interface Control Documentation.
- Verification and testing status.
- Comments, assumptions and outstanding actions.

The level of detail contained within the Interface Register will vary depending upon the size and complexity of the airport project. Some projects may manage only a few dozen interfaces, whilst major international airports may require the management of several hundred or thousands of individual interfaces across numerous contracts and stakeholders.

The MSI should maintain one controlled airport-wide Interface Register. Dividing the register by individual discipline or contract can obscure interfaces that cross package boundaries, create duplication and make airport-wide coordination more difficult. A single register provides a common source of truth across the complete integration environment.

One of the challenges associated with a large Interface Register is that it may not be the most effective means of communicating the overall integration concept to airport stakeholders. For this reason, high-level interface schematics are developed to provide a visual representation of the airport systems landscape and the principal information exchanges between systems and organisations.

The schematic and the Interface Register should therefore be regarded as complementary engineering tools. The schematic provides a conceptual understanding of the integration environment, whilst the Interface Register provides the detailed management and traceability required throughout the project lifecycle.

Figure 1 is an example of such a high-level schematic. On larger and operationally complex airports, additional interface architecture diagrams or information-flow schematics may also be developed to illustrate the movement and traffic flow of operational information between systems. These models provide a valuable engineering reference during design reviews, interface verification and troubleshooting.

The Interface Register should be regarded as a live management document rather than a static design deliverable. As system designs evolve, operational requirements change and new stakeholders become involved, the register must be maintained under formal configuration control to ensure that all project participants are working from the latest approved information.

Used correctly, the Interface Register provides visibility of the project's integration activities, supports coordination between stakeholders and assists the planning of interface testing. It is therefore an essential management tool within any airport MSI project.

It should never, however, be mistaken for the Interface Management process itself.

Successful Interface Management begins long before the first entry is added to the register and continues long after the final interface has been tested and commissioned.

8. Interface Control Documentation

Whilst the Interface Register identifies the interfaces that exist within the project, it does not contain sufficient engineering detail to enable those interfaces to be designed, implemented, tested and commissioned.

This is achieved through a suite of Interface Control Documents and associated engineering documentation.

Rather than relying upon a single document, successful airport projects develop a series of complementary interface documents, each addressing a specific aspect of the interface lifecycle.

8.1 Network and Infrastructure Interface Specification

The Network and Infrastructure Interface Specification confirms that the physical and logical communications path exists between the participating systems.

This may include:

- Structured cabling and fibre-optic connectivity.
- Network topology and connection points.
- VLAN allocation and IP addressing.
- Routing and firewall requirements.
- Cybersecurity zones and security boundaries.
- Bandwidth and performance requirements.
- Network resilience and redundancy.
- Monitoring and logging requirements.

Before application software can exchange operational information, the complete communications path must be identified, implemented and verified, including any firewalls and security controls through which the data must pass.

8.2 Software Interface Control Document

Once the communications infrastructure has been established, the Software Interface Control Document defines how operational information will be exchanged between the participating systems.

This documentation may specify:

- Data ownership and authoritative data sources.
- Information and services to be exchanged.
- Communication protocols and connection methods.
- Message structures and data formats.
- APIs, web services or other integration mechanisms.
- Data mapping and transformation rules.
- Transaction, sequencing and synchronisation requirements.
- Error handling, retry and recovery procedures.
- Performance and availability requirements.
- Cybersecurity and access-control requirements.

The Software Interface Control Document should describe the interface in sufficient detail to support independent development and verification without requiring interpretation by individual suppliers.

8.3 Interface Verification and Acceptance Documentation

Successful interface implementation cannot be assumed. Each interface should therefore be supported by appropriate verification, testing and acceptance documentation.

This may include:

- Interface Test Specifications and procedures.
- Factory Acceptance Test records.
- Site Acceptance Test records.
- System Integration Test records.
- Operational Acceptance Test records, where applicable.
- Test reports and evidence.
- Non-conformance records and corrective actions.
- Final acceptance and closure records.

These documents provide objective evidence that the infrastructure path, software exchange and operational behaviour of the interface comply with the agreed requirements.

Collectively, the Network and Infrastructure Interface Specification, Software Interface Control Document and verification documentation form the engineering baseline for the interface throughout its lifecycle.

The exact number and format of the documents will vary between projects. However, each interface should be supported by sufficient engineering documentation to allow independent design, implementation, verification and long-term maintenance without ambiguity.

The Interface Register provides project-wide traceability, whilst the supporting Interface Control Documentation provides the engineering detail required to successfully deliver and maintain each interface.

9. Verification, Validation and Lifecycle Management

The successful implementation of an interface cannot be confirmed solely through the completion of design documentation. Whilst the Interface Register and supporting Interface Control Documentation establish the engineering requirements, they do not provide evidence that the interface performs correctly within the operational airport environment.

Every interface should therefore be subject to a structured programme of verification and validation throughout the project lifecycle.

Verification confirms that the interface has been designed and implemented in accordance with the approved engineering documentation.

Validation confirms that the completed interface supports the operational requirements for which it was originally developed.

These activities should not be regarded as a single testing phase undertaken immediately before airport opening. Instead, interface verification should form a continuous process that progresses alongside the development of the airport systems.

Typical verification activities may include:

- Design reviews.
- Network and infrastructure verification.
- Software interface verification.
- Factory Acceptance Testing.
- Site Acceptance Testing.
- System Integration Testing.
- Operational Readiness and airport trials.
- Operational Acceptance Testing, where applicable.

As interfaces are progressively verified, the results should be recorded within the project's Interface Register and supported by the associated test records and acceptance documentation. This provides complete traceability from the original operational requirement through to the final verified interface.

Successful Interface Management does not end when an airport becomes operational.

Airports continually evolve. New airlines are introduced, passenger numbers increase, regulations change and airport systems are upgraded or replaced. Each of these changes may create new interface requirements or modify existing information exchanges.

For this reason, Interface Management should continue throughout the operational life of the airport. Maintaining the Interface Register, Interface Control Documentation and associated verification records ensures that future changes can be implemented in a controlled manner whilst minimising operational risk.

The true measure of successful Interface Management is not the number of interfaces documented, but the confidence that operational information continues to be exchanged accurately, securely and reliably throughout the life of the airport.

10. Conclusion

Interface Management is frequently associated with Interface Registers, technical specifications and software integration. Whilst these documents and activities are essential, they represent only part of a much broader engineering discipline.

Successful Interface Management begins during the concept stage of the project by working with the Airport Owner and Airport Operator to understand how the airport is intended to operate. From this understanding, the required airport systems can be identified, the operational information exchanges established and the necessary interfaces systematically derived.

The Interface Register, Interface Control Documentation and associated verification activities provide the structured engineering framework that enables those interfaces to be implemented, tested and maintained throughout the airport project lifecycle.

Ultimately, Master Systems Integration is not concerned simply with connecting systems together. Its purpose is to ensure that people, processes, technology and operational information work together to deliver a safe, efficient and resilient airport.

Successful airport integration is therefore achieved not through documentation alone, but through a disciplined engineering process that begins with operational understanding and continues throughout the life of the airport.

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).
- INCOSE, Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities, 5th Edition, 2023.
- ISO/IEC/IEEE 15288:2023, Systems and software engineering - System life cycle processes.
- ISO/IEC/IEEE 29148:2018, Systems and software engineering - Life cycle processes - Requirements engineering.

- EUROCONTROL, Specification for Airport Collaborative Decision Making (A-CDM), Edition 1.0, 2025.

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.

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