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Master Systems Integration in Modern Airports

Lessons Learned from More Than 30 Years of International Airport
Projects

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About this Technical Paper

The Stanswood Consulting Technical Paper Series has been developed to share practical engineering experience gained during more than thirty years working on international airport projects.

These papers are not intended to promote products, software or individual vendors. Their purpose is to encourage good engineering practice, stimulate professional discussion and assist airport owners, consultants, system designers and contractors in delivering airport systems that are easier to integrate, operate and maintain throughout their operational life.

The views expressed within these papers are based upon my professional experience and are intended to encourage discussion and the exchange of engineering knowledge across the airport industry.

Master Systems Integration in Modern Airports

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Introduction

When people hear the term **Master Systems Integration (MSI)**, they often think about software interfaces, testing or commissioning. In my experience, this is where many airport projects begin to go wrong.

Master Systems Integration does not begin during testing. It begins the moment the first operational requirements are defined. Every design decision made during a project influences how airport systems will exchange information, support operational processes and adapt to future operational and technological change.

Modern airports rely upon numerous operational, safety, security and business systems supplied by different manufacturers and software providers. Systems such as the Airport Operational Database (AODB), Flight Information Display System (FIDS), Baggage Handling System (BHS), Resource Management System (RMS), Passenger Processing Systems, Access Control, CCTV, Public Address, Building Management Systems and many others must work together as a single operational environment. The success of an airport depends not on how well each individual system performs, but on how effectively they work together.

Throughout more than thirty years working on international airport projects, I have repeatedly seen technically capable systems fail to integrate successfully. In almost every case, the technology itself was not the problem. The underlying causes were poor interface definition, unclear ownership, inconsistent operational requirements, fragmented responsibilities and the absence of a structured integration strategy established during the design phase.

One of the biggest misconceptions within our industry is that Master Systems Integration is primarily a commissioning activity. It is not. Testing simply confirms whether integration has been successfully designed. If the interfaces, operational workflows and integration requirements have not been properly defined during design, Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT) merely expose problems that should have been prevented much earlier in the project.

This paper shares some of the lessons I have learned during more than thirty years working on international airport projects. It is not intended to present academic theory or promote a particular methodology. Instead, it explains why Master Systems Integration should be regarded as a systems engineering discipline that begins during concept design and continues throughout the operational life of an airport.

What is Master Systems Integration?

Master Systems Integration is one of the most misunderstood disciplines in airport engineering. Over the years I have heard it described as software integration, interface management, middleware, testing, commissioning and simply "connecting systems together". Whilst each of these descriptions contains an element of truth, none of them fully explains what Master Systems Integration is intended to achieve.

Master Systems Integration is not about integrating technology for its own sake. Its purpose is to ensure that independently designed airport systems work together to support the safe, efficient and reliable operation of the airport.

This is an important distinction.

The objective of MSI is not to design individual systems. Those responsibilities remain with the individual system designers and specialist vendors. Likewise, MSI is not responsible for developing software applications or selecting proprietary technologies.

The responsibility of Master Systems Integration is to ensure that independently designed systems operate together as a single, coordinated operational environment.

To achieve this, MSI must consider far more than the technical interfaces between systems. It must understand how information flows throughout the airport, how operational processes depend upon multiple systems, how responsibilities are allocated and how future changes can be implemented without introducing unnecessary operational, technical or commercial risk.

Throughout my career I have found that successful Master Systems Integration is built upon five fundamental principles:

- Understanding the airport's operational requirements.
- Clearly defining the responsibilities of each system.
- Managing interfaces throughout the entire project lifecycle.
- Providing independent design assurance.
- Protecting the airport owner's long-term operational interests.

These principles extend well beyond technology. They require an understanding of airport operations, systems engineering, information management, operational workflows and the lifecycle of the airport itself.

One of the biggest misconceptions I continue to encounter is the belief that Master Systems Integration begins once systems have been procured and software development is complete. In reality, MSI should influence every stage of an airport project, beginning during concept design and continuing through detailed design, procurement, implementation, testing, commissioning and long-term operation.

By the time Factory Acceptance Testing (FAT) or Site Acceptance Testing (SAT) begins, the majority of the integration decisions have already been made. Testing should confirm that the integration strategy has been successfully implemented; it should never become the stage at which integration is first considered.

Common Misconceptions

Throughout my career I have encountered many different interpretations of Master Systems Integration. Whilst there is no single approach that suits every airport project, several misconceptions appear repeatedly and often contribute to avoidable technical, operational and commercial problems.

The following are some of the more common misconceptions that I continue to encounter.

Master Systems Integration begins during testing and commissioning

This is probably the most common misconception.

By the time Factory Acceptance Testing (FAT) or Site Acceptance Testing (SAT) begins, the majority of the important integration decisions have already been made. System architectures have been agreed, procurement contracts awarded, software developed and interfaces implemented.

Testing should confirm that the integration strategy has been successfully delivered. It should not become the stage at which the integration strategy is first developed.

When integration issues first appear during testing, they are often symptoms of design decisions made many months earlier.

Successful Master Systems Integration therefore begins during concept design and continues throughout the entire project lifecycle.

Master Systems Integration is simply about connecting systems together

Many people associate MSI with technical interfaces between systems.

Whilst interfaces are an important part of Master Systems Integration, they represent only one element of a much broader systems engineering discipline.

Successful integration requires an understanding of airport operations, passenger processes, aircraft turnaround, baggage handling, security operations and numerous other business processes that rely upon information being exchanged between independent systems.

The objective is not simply to exchange information, but to ensure that the correct information reaches the correct system, at the correct time, in a form that supports safe and efficient airport operations.

Technology is usually the cause of integration problems

One of the most valuable lessons I have learned is that technology is rarely the primary cause of integration failure.

Modern airport systems are generally mature products developed by experienced vendors.

Most integration problems arise because responsibilities have not been clearly defined, interfaces have been poorly specified, operational requirements have changed or design assumptions have not been fully understood by all parties.

In many cases the technology performs exactly as it was designed. The difficulty lies in how independently developed systems have been expected to work together.

Master Systems Integration is the responsibility of individual vendors

Individual vendors are responsible for delivering systems that comply with their contractual requirements.

Master Systems Integration is different.

It should represent the operational interests of the airport owner rather than the commercial interests of individual suppliers.

No single vendor has complete visibility of every operational process, interface or future expansion requirement across the airport.

For this reason, the overall integration strategy should remain independent of any individual system supplier.

The airport owner should define the operational objectives and integration requirements. Vendors should then deliver systems that comply with those requirements.

Master Systems Integration finishes when the airport opens

Airport systems continue to evolve throughout the operational life of the airport.

New airlines are introduced. Terminal facilities are expanded. Technology is upgraded. Cybersecurity requirements change. Operational procedures evolve.

Every change has the potential to affect existing integrations.

Master Systems Integration should therefore be regarded as a lifecycle engineering discipline rather than an activity that ends when construction is complete.

Lessons Learned

Looking back over more than thirty years of airport projects, several observations continue to prove true regardless of the size or complexity of the airport.

- Successful integration begins during concept design, not during testing.
- Clear operational requirements are more valuable than complex technical solutions.
- Clearly defined responsibilities reduce project risk.
- Independent design assurance identifies problems before they become expensive to correct.
- The airport owner should retain ownership of the overall integration strategy throughout the operational life of the airport.

None of these observations are particularly complex. However, consistently applying them throughout a project often makes the difference between a straightforward systems integration programme and one that

experiences unnecessary delays, additional costs and operational compromise.

Conclusion

Master Systems Integration has become one of the most important engineering disciplines in the successful delivery of modern airports. As airports continue to introduce new technologies and become increasingly dependent upon the exchange of operational information, the need for a structured and independent integration strategy becomes even more important.

In my experience, successful Master Systems Integration is not determined by the sophistication of the technology or the number of interfaces between systems. It is determined by how well the integration strategy supports the operational objectives of the airport from the earliest stages of design through to long-term operation.

Technology will continue to evolve. New systems, new communication methods and new operational requirements will emerge throughout the life of every airport.

The principles of good Master Systems Integration, however, remain remarkably consistent.

Understand the airport's operational requirements.

Clearly define responsibilities.

Develop a robust integration strategy during design.

Maintain independent engineering oversight.

Always remember that the objective is not simply to connect systems - it is to enable the airport to operate safely, efficiently and reliably throughout its operational life.

About the Author

Brian Stanswood is an independent Airport ICT and Special Airport Systems consultant with more than 30 years of international experience in the planning, design, integration and delivery of airport technology systems. His work includes Airport ICT, Special Airport Systems (SAS), Master Systems Integration (MSI), design assurance, data centres, systems engineering and technical advisory services across major airport projects in Europe, the Middle East, Asia and Africa.

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