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Justin Daugherty, Sr., Director of Aerospace Solutions for Maxa

“According to Gartner, 85% of data projects fail.”
Justin Daugherty, Senior Director, Aerospace Solutions for Maxa

Analysing/Comparing Data from Different MRO IT Systems and Sources

data from the documents and put it into the system. Most of the time, the documents remain in an unstructured format like PDF, which makes it difficult to run the analysis of the data within.”

This is just the thin edge of the wedge when it comes to integrating disparate data sources. In fact, “bringing this fragmented data back together across system boundaries can be a complex endeavour for several reasons,” Wagenmann said. “For instance, the keys for identifying the data sets can be different and thus complicate correct mapping. The data entities and their lifecycle may be incompatible, making data delimitation and normalisation a fuzzy process.”

“In the case of inconsistent or contradictory data, a decision must be made as to which data source is more trustworthy,” he added. Such decisions are usually well-informed and thoughtful, but still — it’s a bit of a coin toss.

When it comes to the trustworthiness of aircraft data, standards can vary widely from source to source. “Some systems like IFS are very rigid on data control and the business rules that allow you to enter data; plus aspects like

for Maxa, the ERP analysis software platform. As a result, “integrating multiple systems is crucial for more advanced analytics,” he said. “Instead of ‘reporting the news’ within a single M&E/MRO system, the real value comes from combining data across various sources (M&E/MRO, HR, Scheduling, Finance) to gain a deeper understanding of operational complexities. For example, gaining accurate labour costing insights requires data from M&E/MRO for task assignments, HR for labour costs, scheduling for time worked, and Finance for invoicing details.”

Unfortunately, this isn’t as easy as it sounds. The reason: “Most of the documents exchanged between airline customers and MROs are in PDF format, for example, the Input Workscope for Aircraft Check,” said Saravanan Rajarajan, Director of Aviation Solution Consulting with Ramco Systems, an enterprise aviation software provider. “It is quite likely that MROs receive the package of information one to two weeks before the aircraft’s arrival. Once the package arrives, MRO planning teams have to grapple with the formats in order to extract

Data is at the heart of modern aircraft maintenance. “You need it for compliance reasons, for documentation, and to unlock insights so that you can make the best decisions possible for your organisation,” said Robert Mather, Vice President of Aerospace and Defense Industries at IFS, a maker of enterprise software. In a perfect world, this data would be available in a consistent form from all sources, including different MRO IT systems. But we don’t live in a perfect world, which is why analysing and comparing data from multiple

sources is such a challenge for the aviation industry. **Why Discrepancies Exist** There’s a lot of maintenance data systems in use today. Some are computerised, while others are still paper-based. So why is this the case? “During the life cycle of an asset, be it an entire aeroplane or an assembly, its data is maintained in different systems,” replied Matthias Wagenmann, Chief Technology Officer at Swiss Aviation Software (Swiss-AS), provider of the M&E/MRO software AMOS. “One

reason for this may be that its owner uses several systems to manage it, which are not fully integrated. Another is that they are lent, sold, repaired, overhauled, or exchanged, thereby leaving the company’s boundaries and thus the domain of their IT systems. By that token, relevant data about the specific aircraft may be distributed among multiple systems.” In fact, most aviation organisations — even with well-structured system architectures — have multiple data sources. So says Justin Daugherty, Senior Director, Aerospace Solutions

MRO

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Engineering & Ops	Maintenance	Supply Chain	MRO & Part Sales	Flight Operations	Safety, Quality Control	Manufacturing	Employee Management	Finance & Accounting	
Configuration Management	Line Maintenance	Parts Administration	Supplier Management	Customer Management	Journey Log (ETD)	Compliance Reporting	Product Data Management	Employee Information	Enterprise Setup
Maintenance Program	Repair Management	Warehouse Management	Procurement Administration	Contract Management	Flight Charter Contracting	Quality Audit Management	Planning and Scheduling	General Accounting	Accounts Payable
Technical Records	Engine Maintenance	Material Planning	Repair & Exchange Mgt.	Customer Order Management	Flight Sheet Management	Occurrence Reporting	Manufacturing Execution	Accounts Receivable	Management Accounting
AD & SB Management	Shop Maintenance	Stock Management	Loan & Borrow	Quotations and Pricing	Crew Scheduling	Standard Reliability	Engineering Change	Financial Posting Engine	
Maintenance Planning	Tool & OSE Management	Physical Inventory & CC	RFI & Consignment	Part Tracking & Exchanges	EBI Central				
Task Card Management	Parts & Buckle Administration	Inventory Analysis	Claims & Warranty Mgt.	Part Sale Management	Flight Contract Invoice				
Library Management	Assignments & Time Tracking	Stores Management	Goods Receipt	MRO Warranty					
e-Publication	e-Signoff	Shipping	Part Kitting & Receiving						

Enterprise Add-ons

Hubs	Mobility	Platforms	In-memory Planning & Optimization (IPO)	Eco-System
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Shop - Quick Access Hub	Fixed Asset Hub	Mechanic Anywhere	Topology Optimization	SPRC 2000
Technical Records Hub	Inventory Hub	Manage Anywhere	Custom Pools	ODM Data Interface
Engineering Hub	Accounts Payable Hub	Ph. Anywhere (ERP)	Digital Task Card	
Engine Visit Hub	Financial Closure Hub	Line Anywhere (Garage)		
	Part Kitting Hub	Crew Anywhere		
	Fixed Overhaul Hub	Report Writer		
	Route Anywhere	E-Books		

Screenshot of Ramco Aviation Software. Credit: Ramco

configuration management that enforce rules through the data entry process, which ensures that you have really robust detailed and accurate information," said Mather. "But all systems are not created equal. As well, the data isn't always labelled the same across multiple sources. So there can be a translation activity to ensure that all of the data points are aligned, so that you know you're talking about the same thing."

Bringing Disparate Data Sources Together

Whatever the challenges of bringing disparate data sources together, the fact is that it has been done for the sake of aircraft owners/operators and the MROs who support them. It's not an easy task. "The basic prerequisite for analysing data from multiple sources is that it is available in a structured digital format," Wagenmann said. "If sub-processes are not adequately mapped in the IT system, the corresponding data is either not recorded at all or is recorded on paper/PDFs and is therefore only available for further processing in a roundabout way. Systems with sufficient production depth for the processes relevant to aircraft maintenance are therefore a mandatory requirement."

For different MRO data systems to interoperate with each, they need to have access to the right interfaces, he added. "This is why support for industry standards such as ATA-Spec simplify integration between different systems. A homogeneous system landscape also helps with integration: If the airline and MRO use the same M&E system, the data entities are defined equally and the integration effort is significantly lower, assuming the system has the appropriate interfaces."

According to Daugherty, bringing data together from disparate systems requires specialised skills in several areas. For instance, IT teams need to be able to manage data warehouses, govern that data, and ensure the selected tools are secure. "Then there's the complexity of understanding source system data structures, databases, and schemas that span across various platforms like M&E/MRO, HR, Finance, Flight Scheduling, and Payroll," he said. "This process often requires the expertise of Data Engineers and Architects to ensure proper data mapping, migration, and integration across these systems. Visualisation tools such as PowerBI, Tableau, or Streamlit are commonly used in the aviation sector, but these traditional

methods often struggle with handling complex data across systems, especially when calculations occur at the visualisation layer."

In those cases where data from disparate data sources are integrated the traditional way — by mapping data and creating warehouses through human operator entries — errors can creep into the mix. "They do this through a highly intensive manual process of going through hundreds of pages of documents, converting the unstructured data into structured data, and thereby interpreting and processing it," said Saravanan. "This is why Ramco Aviation Software ensures data integrity with its access controls and processes, when a customer is moving from legacy to new systems or upgrading our own system to a newer version. Automated bots conduct regular scans on data to identify any inconsistencies." [Note: like M&E/MRO, HR, Finance, Flight Scheduling, and Payroll, he said.]

Even when the impact of human manual entry errors are minimal, the process "can often lead to outdated analytics once the project is complete," Daugherty observed. "As well, source systems, data structures, and schemas are continually updated

Integrating multiple systems is crucial for more advanced analytics."

Justin Daugherty, Senior Director, Aerospace Solutions for Maxa.

or changed, which can cause many analytics solutions to fail or require costly updates over time. This is why Maxa addresses these challenges by automating data integration processes and providing ongoing support for evolving data structures."

Making Analysis Work

All told, integrating data from disparate MRO IT systems for useful analysis can be an incredibly

challenging task, and the risks of failure are real. This likely explains why "According to Gartner, 85% of data projects fail, often due to the complexities in standardising and unifying data from one or more data sources," said Daugherty. "While basic reporting may seem manageable, extracting valuable insights to drive profitability, efficiency, and safety in aviation requires leveraging data from all data sources. To succeed, MROs and airlines need advanced analytics that go beyond basic reporting."

"Near real-time data availability, consistent data quality and data depth are the cornerstones of modern data analysis," agreed Wagenmann. But this AI-driven analysis has its limits, because AI models can only be as good as the data they are trained with; optimization algorithms only work if the data used is consistent; and automation can only succeed

if the data used is reliable and comprehensive," he said.

In this less-than-perfect world, developing 'workarounds' that allow data sharing and analysis to function despite system shortfalls is often the best that airline and MRO IT experts can do. "A popular workaround to bridge the digital gap if IT systems cannot exchange data in a structured manner is to rely on unstructured data like PDFs," said Wagenmann. "Of course, this approach relies on the receiving system being able to build structured data from it. Unfortunately, this is rarely achieved reliably, promptly and without loss."

Another way to support effective analysis across multiple data sources is to ensure that your core data management system is completely digitised, robust, and governed by rules that ensure high data quality. This core system should also act as "the aggregator for an integrated ecosystem," Mather said. "That

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MRO



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Saravanan Rajarajan, Director of Aviation Solution Consulting with Ramco Systems. Credit: Ramco

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Saravanan Rajarajan, Director of Aviation Solution Consulting with Ramco Systems

means that if you do have solutions that are separate — for example, let's say you have electronic logbook that is different from your maintenance system — you have those interconnected and working together

so that all of the data from the logbook comes into the maintenance system, which then becomes the system of record that you can do all of your analysis on.”

Adopting standardised interfaces on multiple data sources can also aid analysis, by better enabling the sharing of data. “For example, Spec 2000 Chapter 18 [for Electronic Information Exchange between Operator Maintenance Systems and MRO Systems] will help streamline the data exchanges on work scope, work packages, work orders, related tasks, responses from the MRO on work accomplished, findings, new work orders raised, deferrals, and maintenance release,” said Saravanan. “Adoption of these standards by airlines and MROs will automatically lead to IT MRO software providers adopting and complying with the standards.”

Building for a Better Future

So far in this article, we have considered the challenges and solutions associated with multiple data sources in the aviation industry. Going forward, what steps should airlines and MROs be taking to minimise this problem, or to make it go away altogether?

Here's what the experts had to say: “MROs and airlines should prioritise data governance and

data-centric projects to improve margins and operational efficiency,” said Daugherty. “Documenting procedures, data protection practices, and data governance methods is essential as companies move towards creating Data Products for advanced analytics across multiple systems.”

“I think that, with the advent of modern technology over the past many years and the speed with which technology changes, it's imperative for organisations in the aviation maintenance realm to be on modern systems with a strategy for always keeping up to date on those modern systems,” Mather said. “It's cost-effective in a lot of cases to consolidate down onto a single system with a lot of inbuilt simplicity, but that isn't necessarily the solution for everyone. Still, you should have modern systems; a single platform where possible, but definitely integrated where the ecosystem demands it.”

According to Wagenmann, the best data analysis choices for airlines and MROs going forward include choosing comprehensive IT systems over specialised software offerings; making sure that their selected systems are designed to be open in terms of managing data flows and acting as data sources, and introducing clear data governance

MRO



Maxa brings the four key areas of data projects into a single solution. Credit: Maxa

into the overall IT structure. “For each data entity, it should be defined which system is in the lead (single source of truth),” he said. “Divergent data must be avoided.”

For his part, Saravanan believes that airlines and MROs should look at “a consolidation of platforms as a first step,” he said. “For instance, MRO software should be able to cover key functional modules of engineering, maintenance, SCM, finance, publications, and contracting. However, organisations may adopt the strategy of adopting the best of breed software, where the core M&E is managed by one software and functions like HR and finance are managed by other software. In this case, a clear process, workflow and integration are to be laid out to collect the right data and manage its integrity.” Whatever the case, “Data exchanges between Airlines and MROs need to be standardised, and IT MRO software providers must adopt these standards.”

Daugherty shares Saravanan's sense of judicious caution. “While

reducing the number of active systems can offer long-term value, and certainly is a recommended approach, such projects can be costly and time-consuming,” he said in conclusion. “Alternatively, customers should consider utilising modern data cloud platforms, with solutions like Maxa, that can automate the process of consolidating data from disparate systems into a single source of truth. Regardless of the approach, moving towards consolidation and integrating advanced analytics into daily operations can help companies stay profitable and competitive.” ■

By James Careless



Robert Mather, Vice President of Aerospace and Defense Industries at IFS. Credit: IFS