Mitigate Aviation Operating Risk and Reduce Cost with IFS ERP and Aircraft Maintenance and Engineering Software

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Commercial airlines operating passenger and cargo fleets face multiple challenges in the market including:

- Scaling their operations as projected demand for air travel is being adjusted upward, according to Bain, from 120 percent growth of pre-pandemic levels by 2030 to about 140 percent given baseline CO2 costs

- Dealing with mergers and acquisitions which will then require operational consolidation including standardized maintenance and airframe management systems across a combined group

- Startup and emerging airlines formalizing their operational structures to enhance competitiveness and regulatory compliance

- Managing and extending the lifecycle of aging fleets with lifecycle extensions, refits and maintenance, repair and overhaul (MRO) programs

- Protecting margin by managing operating cost even as the price of fuel has risen 25 percent over prices five years ago while the Teamsters Union has negotiated a pay increase for mechanics that will put their salary at about $145,000 per year

- According to Bain, airlines are having to wait longer for repairs on aircraft, with mean time to repair skewing 150 percent higher than before the pandemic for newer engines and 35 percent higher for legacy engines

According to Airlines for America, United States-based airlines earned a 2.7 percent pre-tax profit margin in the first half of 2024. With this razor-thin margin they must not only sustain current operations and prepare for growth, but chip away at debts left after the $175 billion in pandemic losses.

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In our work with passenger airlines and air cargo carriers, Tsunami Tsolutions is leveraging Maintenance and Engineering (M&E) software from IFS and our own domain-specific consulting capabilities to lower and control operating costs while preventing disruption in the business in several ways.

Hangar Equipment Tracking and Tool Management

While an aircraft fleet is likely the single largest fixed asset an airline operates, keeping track of other equipment assets is important. Reducing shrinkage of this equipment is one easy cost reduction strategy for aircraft fleet operators. Tsunami Tsolutions has extended IFS ERP software with internet of things (IoT) tracking devices to manage expensive assets used to maintain aircraft.

Using our own whitelableled line of hardware products and systems integration skills, Tsunami Tsolutions has helped our customers monitor the location of equipment including jet engine stands that may leave their facility and not return, or simply be misplaced. Tsunami Tsolutions has been able to configure a solution to communicate over a cell connection, low power wi-fi or a secure private network and into the correct tables in IFS ERP. These sensors are appropriate for unpowered assets that cannot provide their own battery power. They feature magnetic attachment so sensors can be moved from one asset to another.

In other situations, Tsunami Tsolutions has configured sensors on operating equipment to capture vibration data. Attached to an electric motor, for instance, it may sense anomalous vibrations that suggest the bearings or other components are about to fail. Tsunami relies on standard libraries of vibration signatures and can, with a well-defined scope of work, enable software to trigger inspection or maintenance on a broad spectrum of equipment using data from our own sensors or those that come standard on operating equipment.

Expediting Repairs

Tsunami Tsolutions experts have been behind significant early IoT use cases in aviation, including use enabling aircraft to transmit condition-based maintenance data to ground crews so they can have appropriate parts, consumables and technicians available on landing to shorten mean time to repair.

More recently, Tsunami Tsolutions has leveraged the IFS Planning and Scheduling Optimization (PSO) artificial intelligence (AI) tool to create a streamlined, optimal workflow for repair technicians and spares and repairs inventory management. This has the effect also of reducing turn time while making the most of the technician workforce. By integrating IFS PSO, IFS ERP, a custom mobile work order tool and the Novacura Flow low-code interface, an airline can manage work across multiple hangar sites in a unified and transparent fashion.

IFS PSO offers the flexibility of a business rules engine, so mechanics can be sent from one location to another based on priorities that can be configured to meet an airline or fleet operator's requirements and changing priorities. Lowest cost qualified mechanic, mechanic with access to the right tools and parts, closest

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mechanic, routing to reduce travel time or fuel consumption—the airline management and asset management teams have full control. The simplified process flow has also streamlined training and onboarding new management and mechanics, making better use of increasingly expensive human capital.

Tsunami Tsolutions has also extended IFS software for warehouse management, enabling our aircraft operations customers to identify multiple locations for inventory—in a central warehouse, in bins in one or more hangars across multiple cities or countries, or in vehicles as mechanics travel between sites to complete work.

Using Nova Cura Flow, Tsunami Tsolutions has created an integrated process for inventory management between IFS's airframe maintenance software, IFS Maintenix, and their ERP products which would be the data master for inventory.

Digitizing Configuration Management

Tracking the current condition of aircraft, with a full roster of parts installed and their age, serial, lot or batch number and usage history, is currently an exercise in frustration that, due to legacy paper-based processes, creates risk for fleet operators.

Regulation requires aircraft operators be able to document they are following a conformity inspection process for aircraft to ensure parts used to service and maintain aircraft are approved for use on that specific aircraft. Operators are required to prove that component suppliers have secured FAA Parts Manufacturer Approval or a Supplemental Type Certificate for spares, repairs and replacement components used if they differ from original equipment.

This is a challenging task because while most modern airframe maintenance and MRO software can easily track the as-delivered and as-maintained state of the aircraft in a robust and auditable fashion, information on the original configuration and allowable replacement parts and modifications come in a flat PDF or even in print form rather than a nested table like an XML file or other digitally useful format. The image below illustrates the processes to build a digital view of an operator's aircraft configuration.
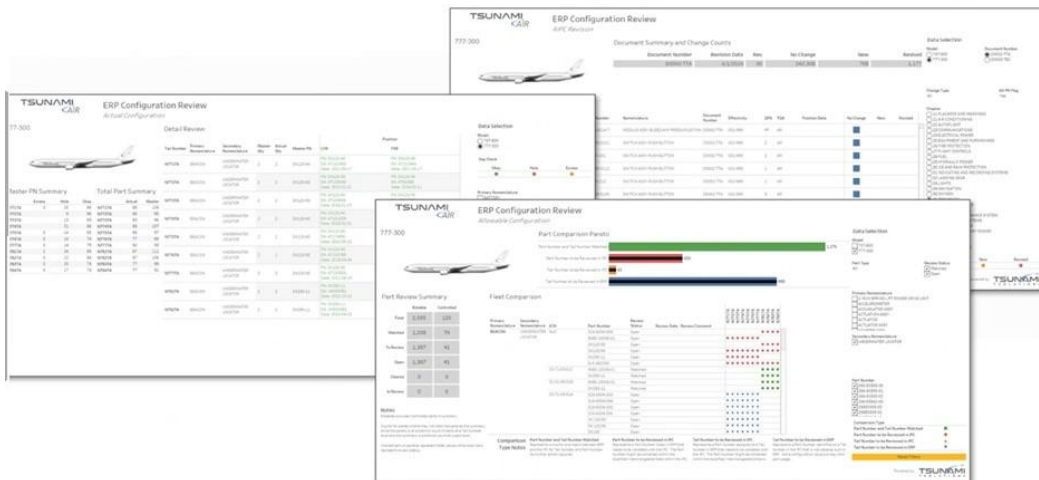
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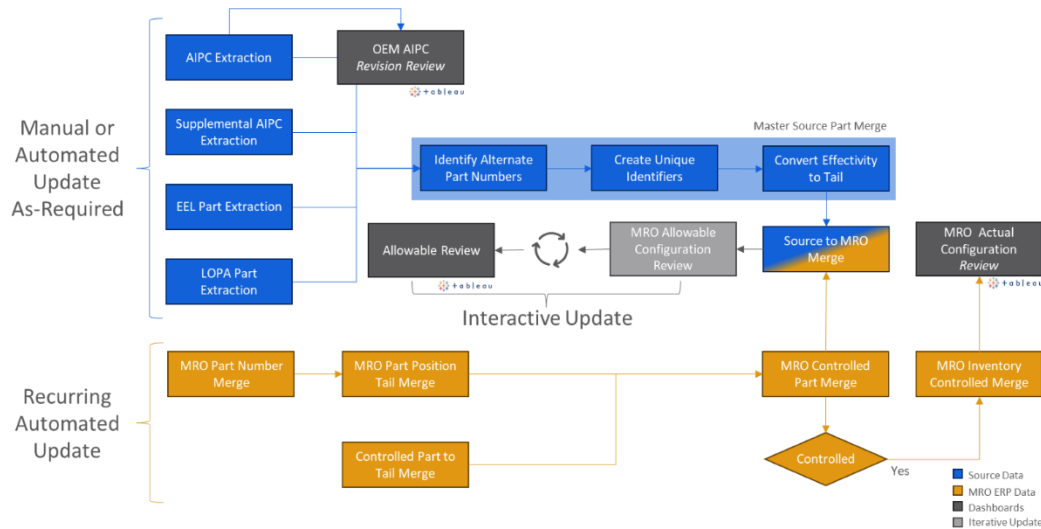
Tsunami Tsolutions offers professional services that ensure aviation operators have complete and current configuration data in their airframe maintenance, ERP or MRO software system of record.

Periodic revisions of the allowable parts list come to the operator in a PDF as well which means a mechanic performing a conformity inspection is in a poor position to ensure an aircraft's current condition is in keeping with either the original or current guidance. What operators have lacked is an intuitive way to link the OEM part and alternate parts down to the tail number level in the context of the MRO software or maintenance and engineering management software used to manage a fleet of aircraft.

Tsunami Tsolutions is currently helping multiple aircraft fleet operators satisfy conformance requirements not only with its proprietary tooling for aircraft data migration into MRO software, but by leveraging airline-specific domain expertise to periodically update enterprise software with current data from sources including:

- Aircraft Illustrate Parts Catalogs (AIPC)

- Component Maintenance Manuals (CMM)

- Engine Illustrated Parts Catalogs (EIPC)

- Allowable configurations

- Service bulletins

Using proprietary tooling capabilities and extensive in-house expertise, Tsunami Tsolutions is delivering conformance updates quarterly or with other specified periodicity to ensure customers can demonstrate compliance and avoid unsafe or unapproved aircraft operation.

Tsunami Tsolutions standardizes data from various sources and provides intuitive visual guides for conformance inspections and review.
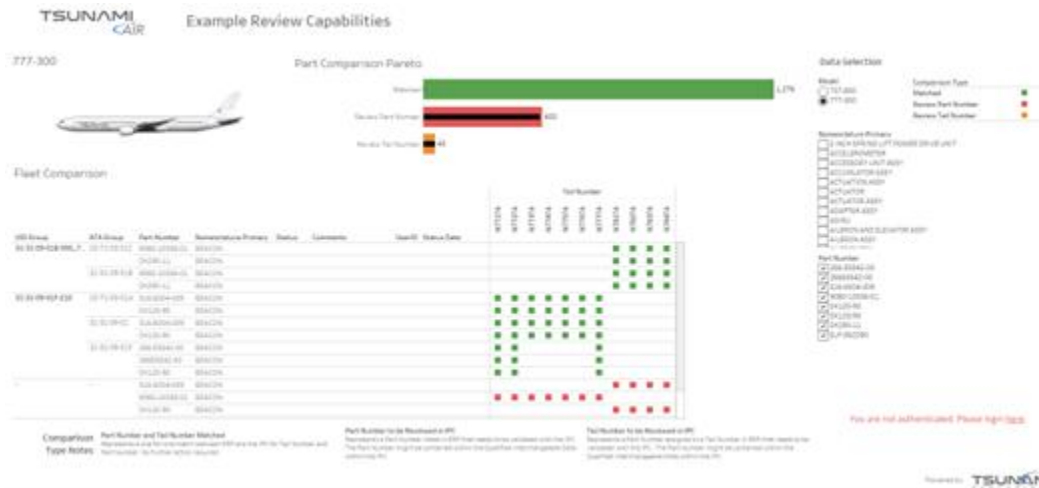
Tsunami Tsolutions enables customers to visualize data to quickly help configuration engineers separate the critical few from the irrelevant many.

With this improved visibility of the aircraft's as-maintained condition, Tsunami customers realize benefits including:

- Improved MRO software part master accuracy

- More rapid IPC review and impact analysis for engineering and materials teams

- Compressed timelines for aircraft induction into the MRO software system

- Access to advanced analytics against the merged data set to identify optimization or cost savings opportunities

- Reduced troubleshooting time and increased first time fix rates

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Mechanics and configuration engineers meanwhile get the information they actually need to confidently document the current state of aircraft and perform conformance inspections. Senior executives gain confidence in the airworthiness of their fleet and worry less about nonconformances that impact safety, creating liability and exposing the airline to fines and other penalties.

De-Risking Data Migration

The tooling and processes Tsunami Tsolutions uses for configuration management are also key success factors in its software implementation and data migration work.

Tsunami Tsolutions has developed the WAVES Data Management Toolset. WAVES is short for:

- Wash: Extract customer data and initial storage for downstream processes

- Analyze: Subject matter experts transform, cleanse and analyze the data

- Verify: Create rules to ensure data integrity, verified by subject matter experts

- Enhance: Data enrichment to meet unique needs

- Store: Creation of a living and evolving ontology around the dataset

Despite the fact that much of this data originates from flat representations like PDF files, and tabular formats that exist do not conform to a consistent standard, Tsunami Tsolutions can with the WAVES methodology ingest:

Configuration Data
- Aircraft Illustrated Parts Catalogs (AIPC)
- Supplemental Illustrated Parts Catalogs (SIPC)
- Component Maintenance Manual Parts Lists (CMMIPL)
- Engine Illustrated Parts Catalogs (EIPC)
- Engine Parts Configuration Management Sections (EPCM)
- Power Plant Build-up Manual Illustrated Parts Lists (PPBMIPL)
- Tool and Equipment Manuals (TEM)
- Wiring Manuals (WM)
- Aircraft Readiness Logs (ARL)

Maintenance Data
- Maintenance Planning Documents (MPD)
- Maintenance Review Board Reports (MRBR)
- Maintenance Steering Group Documents (MSG-3)
- Aircraft Maintenance Manuals (AMM)
- Aircraft Recovery Manuals (ARM)
- Component Maintenance Manuals (CMM)
- Consumable Products Manuals (CPM)
- Engine Cleaning Inspection and Repair Manuals (CIR)
- Engine (Shop) Manuals (EM)

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- Fault Reporting and Fault Isolation Manuals (FRM/FIM)
- Power Plant Build-Up Manuals (PPBM)
- Service Bulletins (SB)
- Airworthiness Directives (AD)
- Structural Repair Manuals (SRM)
- Weight & Balance Manuals (WBM)

Database Sources

- Engine Data
- Maintenance Accomplishment Data
- Flight Data and Utilization
- Component Usage, Removals, Installs, Days/Hours/Cycles On-wing, TSO/TSR
- Shop Visit Data (partial, not migrated)
- Forecasts (PDF)
- Flatirons data from the popular aerospace workflow management tool

Manual Sources

- Engineering Orders (Aircraft, Component, Engine)
- Definition of tracked, serialized, and batched parts
- Parts Tags
- Gear Build-Ups
- Measurements

Excel Files

- Software Matrices
- Aircraft Readiness Logs
- Forecasts in CSV format

Other data sources the WAVES Data Management Toolset has successfully worked with include component actuals, configuration data from illustrated parts catalogs and promotion to tracked parts and block data manually manipulated prior to ingestion.

Apart from the ability to quickly digitize multiple data sets into formats consistent with the requirements of maintenance and engineering, ERP and MRO software, Tsunami Tsolutions brings value to software implementation and data migration processes with the domain specific knowledge on what data must be migrated.

Software implementation consultants normally involved with finance and operations data in other sectors may have a default setting of migrating a current financial period of data and archiving the remainder. Aviation operators have much more nuanced requirements. Records of repairs performed on an aircraft and accumulated usage will need to be migrated further into the past than flight issues or closed out airworthiness directives. These deep insights are one more way Tsunami Tsolutions' deep focus on and relationship with the aviation industry benefits customers.

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The contribution of subject matter experts is critical because a software vendor's professional service team or partners may not understand aviation data retention requirements, and oftentimes their customer does not understand what data to retain or where it should go in the tables that underpin a software solution. Because of this, Tsunami Tsolutions tends to remain involved in the later stages of customer implementations. In contrast, some ERP and other software vendors will typically have the customer handle data migration due to the consultant's lack of detailed working knowledge of the data set and its' meaning. This, however, results in longer implementation timelines, false starts and due to the complexity of the data set and regulations, and failed implementation due to corrupted data.

Small Airline Software Delivery

Tsunami Tsolutions has also leveraged the WAVES methodology and a unique templated approach to IFS aviation maintenance and engineering software to make sophisticated operations software accessible to smaller airlines with smaller fleets. With this streamlined approach, operators with fleets as small as 20 aircraft, with as few as 100 employees can access IFS Maintenix software on a not-to-exceed fixed-price project.

While this pricing is based on a standardized feature set and implementation, these smaller customers can still augment their solution under a separate project if need be. The templated, standard solution can run in the IFS Microsoft Azure cloud, in another private or public cloud or on-premise. Tsunami Tsolutions can also host the solution, providing a negotiated service level agreement (SLA) for uptime and performance.

 Smaller airlines will also lack the engineering staff on a master configuration management team to keep up with changes to the allowable parts list and current configuration of each tail number in their fleet. Tsunami Tsolutions Configuration Management services can close this gap, providing full and reliable visibility of required data sets over the years they own each aircraft.

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