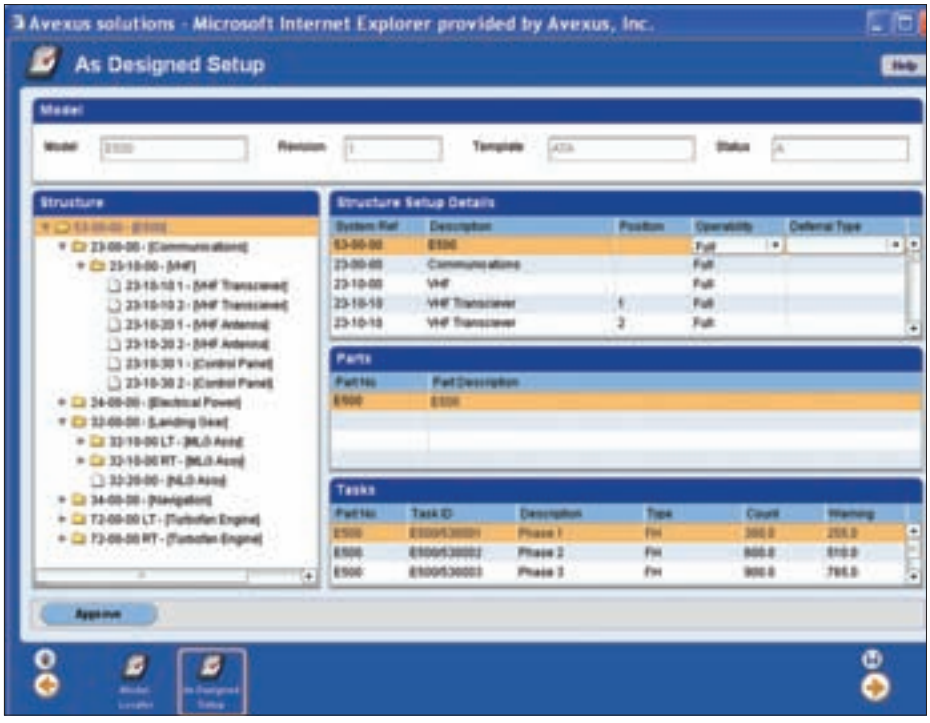
Configuration Management

Software vendors say the complexities of aircraft MRO can be tamed by using the configuration as the basis for managing maintenance and ensuring compliance with airworthiness requirements. *Bernard Fitzsimons* investigates.



The configuration of an aircraft displayed in the Avexus application.

Aircraft maintenance, as described by Mxi, requires the coordination of thousands of maintenance requirements imposed by manufacturers, regulators, maintenance review boards, vendors and internal engineering. All configuration changes, faults, and maintenance actions must be recorded to ensure and prove regulatory compliance. And the actions required are executed by thousands of workers at multiple, geographically dispersed locations.

Making sure that all the necessary work is done, but only the necessary work, is not a trivial task. Moreover, Mxi maintains, accurate and timely tracking of in-service configuration and historical records of aviation assets is a business imperative as well as a regulatory requirement.

Component-centric approach

Configuration management is a fundamental element of the Mxi Maintenix suite, according to the vice president of marketing and alliances Matt Tobin. "Component-centric design makes a lot of downstream problems easier to solve," he says. "Maintenix was built in late the 1990s so it was a 'green field' development. We could build it any way we chose, and when we started analysing the market we came up with the component-centric approach."

Other software systems, particularly those with origins in other industries, may adopt a work-centric approach that is concerned primarily with how to get work done or how to deploy people, so that the asset itself is an afterthought. "We turned that on its head and said let's make what is being worked on central," Tobin recalls.

That approach works in aviation because of the issue of parts interchangeability combined with the need for cradle to grave traceability, he says, making it much easier to track serialised parts. The capability is doubly important when tracking work in and out of an organisation, he adds: "When an engine or component goes out, it needs to take the associated records with it.

The component centric approach means maintenance information is managed at the component level. That information combines relatively static elements, such as part and serial numbers, maintenance programme and compatibilities, with highly dynamic attributes such as maintenance history, usage, effectivity and faults. And just as an aircraft is the sum of a large number of components which can be subdivided into systems or assemblies, a maintenance programme is the sum of all the maintenance programmes of all the components that make up that aircraft at a given instant.

Maintenix's programme management features, which are part of the maintenance engineering module, manage both the logical component configuration — the hierarchy of components that make up the aircraft, including compatibility rules — and the maintenance programme definitions. The maintenance programmes contain definitions and baselines of all maintenance tasks, including the latest revised tasks. They also incorporate all the maintenance

requirements and tasks required to keep the aircraft airworthy; the associated maintenance procedures, non-routine documentation such as the minimum equipment list (MEL), structural repair manual (SRM), and corrective actions in the aircraft maintenance manual (AMM); and traceability from external requirements to internal job cards.

Maintenix also allows for new maintenance requirements to be added to the maintenance programme as needed. maintenance engineers can build airworthiness directives (ADs), service bulletins (SBs), modifications and other engineering orders in Maintenix, incorporate them into the maintenance programme and issue them to the fleet using effectivity and applicability rules to update the appropriate maintenance plans and schedules for the affected components.

Intelligent slots

The fundamental issue to be addressed, says Richard Wallis, vice president sales — Europe with Ultramain Systems, is trying to maintain the aircraft in a safe and approved configuration: "You have a series of events on the flight line where parts are changed. You need to be able to recognise the correct part to be fitted, and you need to update all the records associated both with the part being removed and the part being fitted." The process, with components continually moving on and off the aircraft, is reminiscent of a merry-go-round, "and you have to make sure all the time that the aircraft is still within a safe configuration."

Ultramain's approach is to use a basic tree structure within which are what it terms intelligent slots, Wallis says: "That enables us to define what can be fitted, what can't be fitted and what can be fitted with conditions. It also means we can recognise that if a part is removed it may remove a modification, and modifications removed may require additional checks to be instituted." The recognition provides an automatic alert to users.

The process, Wallis says, is essentially an intellectual exercise required to ensure the safety of an aircraft. The slot represents a link to parts, maintenance requirements, modifications and SBs so that all the features that impact on the slot are related to it, and the impact of any change is apparent. As a part is ordered for a particular location the system checks that the part is approved and advises of any constraint, so users are made aware whether what they are doing is within the permitted configuration.

"It won't stop people fitting a part if they believe they have more up-to-date information", Wallis says. "There will always be a time lag between a part being approved and getting it into the configuration, and if somebody has the authority to fit a part the system will allow it. So we have built in a mechanism to alert the maintenance controller and advise him what has occurred so the position can be regularised and he can close off the quality process."

The Ultramain system has been developed over 30 years, and while it always provided configuration management, the intelligent slot is a recent addition. "We set out with the idea that this was a more demanding area so we were looking for particularly fast ways of doing it within the database," Wallis comments.

One challenge facing all maintenance providers as an airframe moves among suppliers, leasing companies and different operators is to be able to exchange the detailed configuration quickly, he adds. "What we really need is for everyone to start maintaining and exchanging the data electronically. At the moment you get a truck full of paper records that need to be entered manually." The result is that there is an overlap between electronic and paper records: "The reconciliation of the two is a significant problem for airlines as they move aircraft about, one that imposes both a cost and time penalty."

Part-level tracking

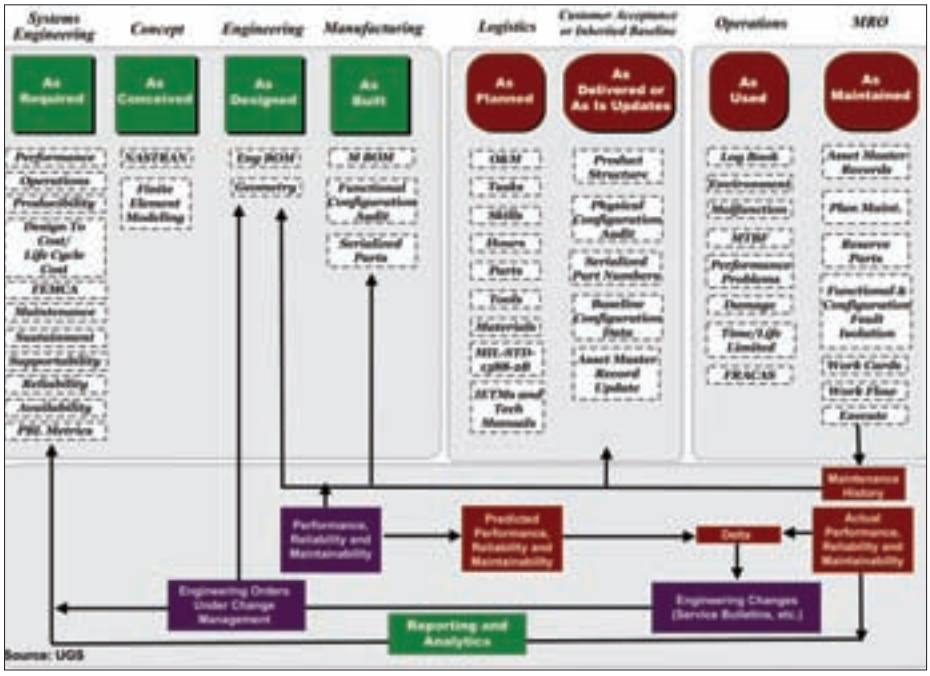
The crux of the Avexus approach to asset management according to Ari Master, vice president business consulting, is the ability to track an asset down to the level of each serialised part and the information associated with it: "That includes what is currently installed or configured, what are the allowable parts for each position on a particular asset, and then what are the maintenance programmes or the rules on who has to maintain that asset, when and where. Tracking an asset down to the serialised part level, managing all the maintenance rules down at that level — I would see that as one of the first requirements for configuration management."

The next is being able to incorporate operational information about the asset — what are the current flight hours, cycles, landings — on a near-real time basis: "It doesn't have to be as soon as the plane lands that the system gets updated, but certainly within each day you want that information to be updated down at that serialised part level, because that's the information that that triggers the maintenance programme."

The final requirement is to incorporate all the regulatory directives and service bulletins against each serialised part: "If you get an SB against a particular section of an engine, you want to able to take that and apply it against all the engines you're currently managing that have that section.

The benefits of this approach are significant, Master considers: "You're able to understand what the downstream supply chain requirements are going to be. If you're only tracking an asset at system level or higher you're really not able to get visibility as to what maintenance activities need to be performed at a particular point in time." It can also improve task yield, he says: "Being able to better manage when tasks are being done, being able to package and plan tasks that maybe don't need to be done at a given point in time but can be packaged with another piece of work that does, improves performance as it relates to task yield."

When the operational information for a given tail number is updated,



UGS model of the configuration driven lifecycle.

the flight hours and landing cycles propagate down through the entire configuration or bill of materials of that asset, Master explains. The updates can be done automatically through a direct link to the flight operations system, or manually. And if a component is removed from one aircraft and installed on another, the application enables it to be moved to the new asset, taking its associated operational information with it.

To automate the entry of remove and install information, Avexus is pushing the use of mobile technology at the point of work, Master says: "Right now we have one for the inspection process of an asset, and we're continuing to build out point of work applications. We're also working on business work flows that can be used for a specific business process. A remove and install would be an example of a particular work flow, so we're working to make the application easy to use for the pieces that do need to be manual."

The Avexus solution is 100 per cent web-based, Master says, accessible using a regular browser through a secure network. "A deployment methodology that is really taking hold is where we host an application for a client, so they're able to get up on line with servers that are actually hosting the application. We incorporate their data and they access the application through the internet. That can be a lot quicker than the traditional applications where you do an on-site deployment, so we've really been working on shrinking what that overall timeframe is."

Avexus also offers a standard enterprise setup for airlines with an existing IT infrastructure. But the focus really is on web-enabled technology, Master adds, along with ease of use and rapid deployment.

Configuration-driven MRO

Last year Plano, Texas-based product lifecycle management (PLM) specialist UGS launched Teamcenter for MRO, which is designed to provide what the vendor terms configuration-driven MRO.

"Configuration management is a religion for us," says Steve O'Lear, marketing director MRO. "From the original idea through the conceptual configuration to the actual configuration, understanding the configuration of what you have on the ground and in the air drives spares provision, maintenance planning and operations."

All assets are one-offs, O'Lear elaborates. "They may fall into a class, such as a Boeing 737, but each one is different from the one built before it and the one that comes next. In Teamcenter, configuration management enables you to track it throughout its life, and it drives everything from repair and maintenance requirements to inspection reports."

MRO group business development director Chris Schrand distinguishes between the neutral representation of an asset — "what it should be" — and what is a valid configuration. "A valid configuration for airworthiness evolves over time through airworthiness directives and service bulletins, so a part may have been valid 10 years ago but not any more."

With Teamcenter the definition carries over from the OEM through the operator to third party MRO providers, O'Lear says: "It's an integrated lifecycle, they can manage it from the build side through the operational side and benefit from rapid, accurate information at every stage. So instead of grabbing the technical manual for the airframe or the engine, they can grab all the information for a specific tail number or engine serial number because everything is tagged to that configuration. Configuration-driven MRO means everything can be accessed in the context of a configuration."

One benefit, Schrand says, is the ability to schedule only maintenance tasks that are actually required: "Traditionally when you received an engine, for example, you would have a whole slate of things to do covering every variant of that engine, so they might or might not be applicable. Once you understand the configuration you can eliminate the tasks that do not apply without having to go through the whole list and evaluate which ones you need to perform."

The application is web-based, so any MRO can access the same knowledge base. An engine sent for overhaul may be torn down and distributed across five locations, Schrand points out: "With Teamcenter you have a single database that can support all five locations."