

There are four main categories of IT systems airlines can acquire to manage maintenance. There are M&E pureplay, ERP, and CMS/DMS systems; and point solutions. The vendors and their systems are documented in this bi-annual survey.

# MRO IT vendors survey 2013

The basic structure of an airline's maintenance and engineering (M&E) IT system is a core system, often referred to as a best-of-breed or pureplay M&E system. These systems are interfaced with other solutions, that can include: a content management system (CMS) or document management system (DMS) for managing technical publications and documents; specialist point solutions for a variety of specialist maintenance functions; and an airline's main management system that has staff management, and financial and accounting functionality. The alternative to a core M&E system interfaced with a main management system is an enterprise resource planning (ERP) system. The aircraft original equipment manufacturers (OEMs) also offer document management, job and task card production, and other specialist services.

This is a bi-annual survey of the solutions with M&E functionality available on the market.

These IT solutions to manage M&E functions have replaced the legacy systems, often home-built, that have been used by airlines, in some cases for decades, but are gradually being replaced.

OEMs and independent maintenance repair and overhaul (MRO) providers can choose from more than 15 M&E systems, and more than 10 ERP systems for airline M&E (see table, page 44).

The specialist point solutions provide functionality for: maintenance check progress monitoring; engine engineering management and maintenance cost planning optimisation; rotatable inventory management and optimisation; and technical and maintenance records.

The main airframe OEMs offer document, technical manual management, and job and task card production services (see table, page 44).

There are also five independent

CMS/DMS systems (see table, page 44).

The information provided for each vendor in the survey includes: main contact details; main product name; production technology; the different ways of paying for the system; the different situations in which the system is used; the different types and levels of the product's functionality; and the number, size and type of customers. A further issue for the pureplay M&E and ERP systems is which CMS/DMS and specialist point solutions they are interfaced with.

The information for each vendor has been sourced through a questionnaire. Those vendors that have not responded, have been omitted from the survey.

The survey lists vendors in the four main categories of: pureplay M&E system vendors; ERP vendors; CMS/DMS suppliers; and specialist point solution providers. Vendors in each category are listed and described in alphabetical order.

## Pureplay solutions

Pureplay, or best-of-breed, M&E solutions are those with a broad range of functionalities that allows them to manage many M&E tasks.

This includes all engineering management functions: managing maintenance programmes; monitoring aircraft configuration; tracking aircraft utilisation data; monitoring and managing airworthiness directives (ADs) and service bulletins (SBs); monitoring an aircraft's maintenance status; monitoring the due date of all maintenance tasks and checks; creating and defining a minimum equipment list (MEL) and tracking each aircraft's outstanding defects; monitoring the lives of rotatable components and life limited parts (LLPs); monitoring aircraft reliability; performing quality control; and maintaining regulatory compliance. M&E systems also have several

categories of maintenance functionality, some of which can be regarded as engineering functions, rather than maintenance. These include inventory management, job and task card production, warranty management, and maintenance package planning.

These overlap with on-going maintenance activities. Maintenance functionality can also include: keeping aircraft technical logs; analysing defects and managing their rectification; and line maintenance production, in terms of creating job cards to rectify defects.

For larger maintenance checks and worksopes, a system's maintenance functionality will also include monitoring the progress of checks and overall production management, and keeping and maintaining technical records.

Other functions include managing human resources (HR), finances relating to M&E, and invoicing. However, M&E systems do not carry out all HR functions needed by an airline or an entire company, so they have to be interfaced with specialist HR and finance systems.

## AD Software

AD Software is headquartered in Cluses and Lyons in France, and offers its AIRPACK suite as a pureplay M&E system, based on .NET production technology. The system comprises several modules: AIRTIME, for maintenance and airworthiness; AIRSTOCK, for inventory control and purchase orders; AIRUSER, for access control; AIRDOC, for electronic documentation management; AIRSTAT, for monitoring fleet and equipment performance indicators and reliability management; and AIRWORK, for job card production and time tracking. The system can work with manuals and documents in PDF, SGML and XML formats.

In line with recently introduced methods for customers to pay for software solutions, the AIRPACK suite is available in the cloud. It can also be paid for and licensed by number of concurrent users, or by the user's fleet size.

AIRPACK is one of the most popular M&E systems, with 48 live airline clients at the end of 2012. It has won 13 new customers since the last edition of this survey was published two years ago.

AD Software has a total of 110 users worldwide, including helicopter operators. Its largest customer is French helicopter operator and maintenance provider Heli Union. All of AD Software's customers are in civil aviation.

AIRPACK is used by airlines with and without a significant amount of maintenance facilities, by independent MRO providers, and by independent engine repair and overhaul shops.

The suite has extensive M&E

functionality, but lacks the ability to take data from an ETL.

AD Software's main contact person is Fred Ulrich (*see table, page 44*).

### Aerosoft Systems Inc

Aerosoft Systems Inc from Toronto, Canada markets three systems: DigiMAINT and WebPMI, two pureplay M&E systems; and DigiDOC, a CMS. DigiREPORTS, DigiPLAN and AeroBUY are specialist integration modules for DigiMAINT, WebPMI and DigiDOC. DigiDOC's predecessor, Life\*Web, was acquired from Corena in 2008.

Aerosoft's main contact person is president and CEO Thanos Kaponeridis (*see table, page 44*). Kaponeridis explains that WebPMI is marketed primarily to PMI customers. The full airline financial accounting capability of PMI is no longer sold, since most airlines integrate with

modern ERP-financial systems.

WebPMI is used by airlines like Amerijet, Tampa Cargo, Mesa Airlines, Mesaba, KLM UK and Air Wisconsin. DigiMAINT is Java-based technology, and WebPMI is based on an object-oriented language.

All of Aerosoft's customers are airlines and civil aviation companies, which include independent MROs. At the end of 2012 Aerosoft had 23 live airlines using its applications. New customers added over the past two years are Icelandair Technical Services, Aerocontractors of Nigeria, and Polish airport services provider GTL-LOT.

Aerosoft makes its systems available on a pay-as-you-go basis and in the cloud. The applications can be paid for based on the number of concurrent users, or by the user's fleet size.

WebPMI and DigiMAINT are used by airlines with both limited and extensive maintenance facilities, independent MROs, the engine shops operated by International Aero Engines and Pratt & Whitney (PW), and several of the OEMs' component repair shops.

WebPMI and DigiMAINT have extensive functionality (*see table, page 44*). Both systems operate with some document capability and manuals in PDF. DigiDOC is the recommended solution for SGML and XML formats.

With DigiDOC as Aerosoft's CMS system, it can be interfaced with WebPMI and DigiMAINT. This option has not been implemented by any WebPMI or DigiMAINT users, however. DigiDOC can be implemented with any third party M&E system. Both systems have logistics planning functionality with DigiPLAN, and are also capable of interfacing with an ETL.

### Applied Database Technology

Applied Database Technology (ADT) is a Turkey- and US-based provider of its Wings system; the system is based on Java, Ajax and J2EE technology.

ADT is headquartered in Istanbul, Turkey; Tampa, Florida; and Bellevue, Washington. Main contact is Ilhan Yagiz (*see table, page 44*).

Wings is used 100% in civil aviation, and despite being a relative newcomer to the market, the system was in use with 21 live passenger and cargo airlines at the end of 2012, as well as 15 independent MROs.

It has gained 11 new customers over the past two years. Its largest customer is Turkish carrier SunExpress, which operates 50 aircraft, a number that will have increased to 65 by the end of 2013.

ADT will make Wings available in the cloud by the end of 2013. For now, the system can be paid for on the basis of named users, or the user's fleet size.

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MRO & FLIGHT OPERATIONS SOFTWARE VENDOR COMPANY DETAILS													
Company	Website	Contact person	Contact details	Current product	Production technology	No of airlines in 2012	ASP/ pay-as-you-go offered?	Used by airlines with limited maintenance facilities?	Used by airlines with maintenance facilities?	Used by third party MROs?	Used by engine shops?	Used by component repair shops?	Tech logs defect manage & reliability?
<b>PURE-PLAY MRO SOLUTIONS</b>													
<b>ADSOFTWARE</b>	www.adsoftware.fr	Fred Ulrich	f.ulrich@adsoftware.fr	AIRPACK	.NET	48	Yes	Yes	Yes	Yes	Yes	No	Yes
<b>Aerosoft</b>	www.aerosoftsys.com/ www.aerosoft.aero	Thanos Kaponeridis	thanos@aerosoftsys.com +1 905 678 9564	DigiMAINT WebPMI	Java	23	Yes	Yes	Yes	Yes	OEM	OEM	Yes
<b>Applied Database Technology</b>	www.adbtech.com	Alan Yagiz	sales@adbtech.com +90 541 421 6646/ +1 646 213 4343	Wings	Java, J2EE	36	Yes	Yes	Yes	Yes	No	Yes	Yes
<b>Aviation InterTec Services</b>	www.aviationintertec.com	Eric Hansen	ehansen@aviationintertec.com	RAAS, RAAS Express	.NET	34	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>CALM Systems</b>	www.calm-systems.com	Errol Friedman	errol@calm-systems.com +1 847 480 9750	CALM	Visual FoxPro	N/A	No	Yes	Yes	Yes	Yes	Yes	Yes
<b>Commsoft</b>	www.commsoft.aero	Nick Godwin	nsg@commsoft.co.uk	OASES	Java & Oracle database	35 direct 15 indirect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>EmpowerMX</b>	www.empowermx.com	Phil Bathurst	phil.bathurst@empowermx.com 1 426 238 0081	FleetCycle	Java	8	Yes	Yes	Yes	Yes	No	No	Yes
<b>IBM</b>	www-01.ibm.com/ software/tivoli/ products/maximo- asset-config-mgr	Vito DeMalteris	vwdemalt@us.ibm.com +1 770 344 9253	Maximo Asset Management plus Maximo Asset Configuration Manager	Java	18 plus military fleets	In cloud	Yes	Yes	Yes	Yes	Yes	Yes
<b>IFRSKEYES</b>	www.ifrskeyes.com	Philippe Lakhdar	philippe.lakhdar@ifrskeyes.com +335 6274 7500/+336 8469 0915	AMASIS	Cobol & Java	45	Yes	Yes	Yes	Yes	No	No	Yes
<b>Infospectrum</b>	www.infotraksolutions.com	Bob Bush	rbush@info-spectrum.com +1 818 874 9226 xtn 25	infoTRAK™	Java, Oracle	N/A	N/A	No	No	Yes	Yes	Yes	No
<b>Lufthansa Technik</b>	www.manage-m.com	Erik Abels	erik.abels@lht.dlh.de +4969 696 60040	manage/m	Java, Web 2.0	N/A	No	Yes	Yes	Yes	Yes	Yes	Yes
<b>Mxi Technologies</b>	www.mxi.com	Steve Morris	info@mxi.com +1 613 747 4698	Maintenix Maintenix CE	Java	22 + OEM	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Rusada</b>	www.rusada.com	David Chisnall	david.chisnall@rusada.com +44 7841 870 735	Envision Lite	.Net/SQL Server	11	No	Yes	Yes	Yes	No	Yes	Yes
<b>SaSIMS</b>	www.sasims.com	Anders Cassel	anders.cassel@sasims.com	SaSIMS	Embarcadero InterBase	24 + MROs	Yes	No	Yes	Yes	No	No	Yes
<b>Swiss AviationSoftware</b>	www.swiss-as.com	Swiss-AS Marketing Department	marketing@swiss-as.com +41 61 582 7294	AMOS	Java	114	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Tracware</b>	www.tracware.co.uk	Patrick Waker	patrick_waker@tracware.co.uk	AeroTrac™	MSSQL, .NET	1 + MROs	No	Yes	No	Yes	Yes	Yes	Yes
<b>Trax</b>	www.trax.aero	Chris Reed	sales@trax.aero +1 305 662 7400	Trax	Java & .NET	118	Yes	Yes	Yes	Yes	No	Yes	Yes
<b>Ultramain</b>	www.ultramain.com	David Abbott Marcelle Vittitow	dabbott@ultramain.com mvittitow@ultramain.com +1 505 828 9000	Ultramain	Java	N/A	Yes	Yes	Yes	Yes	No	Yes	Yes
<b>Volartec</b>	www.volartec.aero	John Barry	jbarry@volartec.aero +353 61 740 010	Alkym	.NET	36	Lease option	Yes	Yes	Yes	No	No	Yes
<b>ERP SOLUTIONS</b>													
<b>2MORO</b>	www.2moro.com	David Ferrier	david.ferrier@2moro.com +336 1419 6092	Aero One Aero-Webb	.Net Java	2 + OEMs	No	Yes	Yes	Yes	Yes	Yes	Yes
<b>BA Engineering</b>	www.ba-mro.com	Rajan Bindra	rajan.bindra@ba.com +44 7500 767 685	Swift MRO	SAP A&D ECC 6	1	Hosted	No	Yes	No	No	No	Yes
<b>Component Control</b>	www.componentcontrol.com/quantum/	Andrew Valley	avalley@componentcontrol.com +1 619 696 5446	Quantum Control	Oracle PL/SQL, Java	Large number	Yes	No	Yes	Yes	Yes	Yes	No
<b>IBASEt</b>	www.solumina.com	Conrad Leiva	cleiva@ibaset.com +1 949 598 5200	Solumina	Java, Oracle, SQL	OEMs	No	No	OEM & MRO	Yes	Yes	Yes	Yes
<b>IBS Technics</b>	www.ibsplc.com	David Spellman	david.spellman@ibsplc.com	iFlight MRO	.NET	12	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>IFS</b>	www.ifsworld.com/ifsdefence	Jeff Pike	jeff.pike@ifsdefence.com	IFS Applications™	.NET	20	Yes	No	Yes	Yes	Yes	Yes	Yes
<b>Oracle</b>	www.oracle.com/us/products/applications/ebusiness	Hannes Sandemeir	hannes.sandemeir@oracle.com	cMRO	Java/.NET	5+	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Pentagon 2000 Software Inc</b>	www.pentagon2000.com	Kirk Baugher	kirk.baugher@pentagon2000.com	Pentagon 2000SQL	.NET	2 Part 121 + FBOs	Yes	No	Yes	Yes	Yes	Yes	Yes
<b>PSIPENTA</b>	www.psipenta.de	Oliver Schmidt	sales@psipenta.de	PSIpenta maintenance PSIntegration PSipenta ERP	Java	0 Several MROs	No	No	No	Yes	No	No	No
<b>Ramco</b>	www.ramco.com/aviation	Agata Gogolewska	agatag@ramco.com +1 305 773 3254	Ramco Aviation Suite	.Net, SQL, Java, Oracle	50	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Rusada</b>	www.rusada.com	David Chisnall	david.chisnall@rusada.com	Envision	.Net/SQL Server	11	No	Yes	Yes	Yes	No	No	Yes
<b>SAP</b>	www.sap.com	Jens Schoeneberg	jens.schoeneberg@sap.com	SAP's solution for MRO based on SAP for aerospace, plus iMRO from HCL-Axon	SAP Netweaver, Java ABAP	18, total 93 customers	No	Yes	Yes	Yes	Yes	Yes	Yes
<b>Sheorey Digital Systems</b>	www.sds.co.in	Prashant Kavi	prashant.kavi@sds.co.in	ARMS + sub systems	.NET	8	Yes	Yes	Yes	Yes	No	Yes	Yes

## MRO &amp; FLIGHT OPERATIONS SOFTWARE VENDOR COMPANY DETAILS

Tech records manage?	Workscope planning?	Production manage?	Inventory manage?	Engineering manage functions?	Commercial manage?	Warranty manage?	Quality manage?	Line maintenance control centre?	Document manage?	HR & manpower planning?	Native finance & accounting?	Electronic tech log?	Document format capability	Company
<b>PURE-PLAY MRO SOLUTIONS</b>														
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	PDF, SGML, XML	AD Software
Yes	Yes	DigiMAINT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PDF, SGML, XML	Aerosoft
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Partial	Coming	PDF	Applied Database Technology
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	PDF, SGML, XML	Aviation InterTec Services
Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	PDF	CALM Systems
Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	PDF, XML	Commsoft
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes, No	Yes	PDF, XML	EmpowerMX
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PDF, SGML, XML	IBM
Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Links to external	No	No	No	PDF, SGML, XML	IFRSKEYES
No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	No	N/A	Infospectrum
Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	PDF, SGML, XML	Lufthansa Technik
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PDF, SGML, XML	Mxi Technologies
Yes	Yes	Yes	Yes	Yes	In 2013	Yes	Yes	Yes	With CMS/DMS	Coming	Interfaces with finance packages	Yes	PDF, SGML, XML	Rusada
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Some	No	PDF, SGML, XML	SaSIMS
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PDF, SGML, XML	Swiss AviationSoftware
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PDF, XML	Tracware
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	PDF, SGML, XML	Trax
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PDF, SGML, XML	Ultramain
Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes: in-built module	Yes	Yes	Yes	PDF & SGML	Volartec
<b>ERP SOLUTIONS</b>														
Yes	Yes	Yes	Yes	Yes	Yes	Yes	On-going	Yes	Yes	In SAP	In SAP	Interface	PDF, SGML, XML	zMORO
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PDF, SGML, XML	BA Engineering
No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	N/A	Component Control
Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Mechanic licensing	No	Yes	PDF, SGML, XML	iBASEt
Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	PDF, SGML, XML	IBS Technics
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	PDF, SGML, XML	IFS
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PDF, SGML, XML	Oracle
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PDF, SGML, XML	Pentagon 2000 Software Inc
No	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	No	PDF, SGML, XML	PSIPENTA
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PDF, SGML, XML	Ramco
Yes	Yes	Yes	Yes	Yes	In 2013	Yes	Yes	Yes	With CMS/DMS	Coming	No	Yes	PDF, SGML, XML	Rusada
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PDF, SGML, XML	SAP
Yes	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Yes	Yes	No	Yes	PDF, SGML, XML	Sheorey Digital Systems

Wings is used by airlines with limited or extensive maintenance facilities, independent MRO providers, as well as by independent aircraft component repair and overhaul shops.

Wings has evolved over the past 14 years from a project implemented at a US-based independent MRO.

Wings has the following functionalities: technical log and defect management; technical records management; maintenance package and workscope planning; production management; standard M&E system inventory management; engineering management; commercial and warranty management; quality control, and line maintenance and control.

An advanced production planning schedule, supported by operations research optimisation techniques, together with an advanced graphical user interface, is being developed for MRO production planning departments. This will be offered as a standalone module for non-Wings clients from the end of 2013. Yagiz expects this new module to revolutionise the way in which MROs optimise their labour, parts, tooling, and hangar space resources. The module should also shorten check turnaround times.

Wings also has a basic document management system, which can handle documents and manuals in PDF. It has so far not been interfaced with a CMS/DMS.

Istanbul-based MNG Technic uses this capability for job and task card creation.

Wings also has maintenance-related HR and manpower planning, and partial native finance capability. It has robust billing and contract modules, developed as a result of its initial implementation at a US independent MRO. Functionality to operate with an ETL is currently being developed and implemented.

### Aviation InterTec Services

Aviation InterTec Services (AIS) is based in Thunder Bay, Ontario, Canada. It also has offices in Amman, Jordan; and Calcutta, India. It offers a pureplay M&E system RAAS and RAAS Express based on .NET technology (see table, page 44).

Main contact Eric Hansen explains that the system is used purely by airlines and other civil aviation companies. The systems are mainly aimed at start-up and legacy airlines, and continuing airworthiness management organisations (CAMOs). The system is also used by independent airframe, engine and component repair and overhaul shops.

Its largest customer is Toronto-based Q400 operator Porter Airlines. AIS had a total of 34 live airline customers at the end of 2012. Three of these were gained during 2011, and five during 2012, illustrating AIS's rate of development.

RAAS and RAAS Express are available on a software-as-a-service

(SaaS) basis and in the cloud. The systems can be paid for by number of concurrent users, by named users, and by fleet size.

RAAS and RAAS Express have extensive M&E functionality, can interface with an ETL and have a document repository. They can handle documents in PDF, SGML and XML, and in Word and Excel formats.

### CALM systems

C.A.L.M. Systems of Northbrook Illinois, USA offers its computerised Aircraft Log Manager (C.A.L.M.) pureplay M&E system that is wholly used in airlines and civil aviation. Production technology is Visual FixPro.

C.A.L.M.'s main contact person is Errol Friedman (see table, page 44). C.A.L.M. is not yet available in the cloud, or on a SaaS basis. It is paid for purely on the basis of the user's fleet size. Its largest user has a fleet of 70 aircraft.

C.A.L.M. is used by airlines that perform limited or extensive in-house maintenance, by independent MRO operators, by independent engine shops, and independent component repair and overhaul shops. The system has most M&E functionalities, with the exception of production management (see table, page 44).

Although C.A.L.M. has a document management module, and can handle documents and manuals in PDF format,

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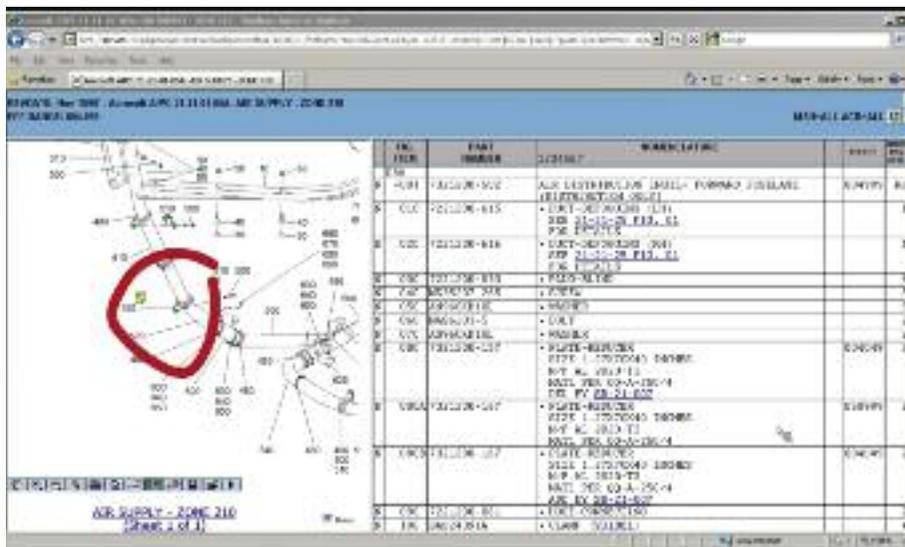
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as well as interface with an ETL, it does not have any HR or finance and accounting capability.

## Commsoft

Commsoft, based in Tiptree, Essex in the UK, provides its OASES pureplay system, which is based on Java and Oracle database technology.

OASES can now be paid for on a pay-as-you-go, as well as on a SaaS basis, by number of concurrent users, or by the user's fleet size. OASES users are 85% airlines and other civil aviation companies. OASES is mainly used by small- and medium-sized airlines. It has 35 full airline users and a further 15 CAMO users. Its largest airline customer is UK carrier Jet2.com, which has 50 aircraft.

Its customer base has recently grown considerably, with 16 new airline customers, including SkyExpress, Smartlynx, JetTime and NextJet. Airline users include those that carry out limited or extensive in-house maintenance. The system is also used by several independent MROs, engine shops, and aircraft component repair and overhaul shops.

OASES has most M&E functionalities, but the system has no quality control function.

It also has its own limited-capability document management module, although it is able to handle PDF and XML formats. It has not been required to handle SGML format to date, and has so far not been interfaced with a CMS/DMS by any of its users.

OASES is interfaced with the Air Vault CMS system produced by Critical Technologies (see table, page 44). OASES is interfaced with AirVault at Scottish carrier Loganair and NextJet. Other airlines are evaluating the combination of the two systems.

OASES has partial capability for HR and manpower planning, and finance and

accounting. It is interfaced with several flight operations systems, and HR systems to achieve the full functionality required. OASES is also interfaced with AerData's EFPAC system, which carries out engineering management functions and optimises engine maintenance management and costs at Jet2.com.

A more recent development has been to increase the system's capability to interface with an ETL.

## EmpowerMX

EmpowerMX, based in Frisco, Texas, offers a suite of applications called FleetCycle. Phil Bathurst, executive vice president of sales and consulting, explains that these now constitute a full M&E system, having evolved from a point solution that focused on maintenance check planning, execution and monitoring.

FleetCycle is based on several suites: Execution, for maintenance execution monitoring; Data Extraction; and Electronic Logbook, Material Manager, Maintenance Program Manager, Planning Manager, and Maintenance Intelligence, all modules that are centred around maintenance planning and execution.

The applications are based on Java technology, and they are used 100% by airlines and other civil aviation users.

At the end of 2012, FleetCycle's main users included American Airlines, American Eagle, Southwest Airlines (for maintenance execution), United Airlines (for maintenance execution), Delta Airlines (used as a MRO ERP system in the cloud), California Pacific Airlines, US Airways, Aviation & Defense Inc, and North State Aviation. American Airlines and United Airlines are the largest users. FleetCycle is used by airlines and independent airframe maintenance providers.

EmpowerMX makes FleetCycle available on a SaaS basis, and also through the Amazon cloud. It can be paid

Aerosoft is the only system vendor to both offer a pureplay M&E system and a CMS/DMS solution. The two are designed to interface.

for on the basis of number of concurrent users, named users or fleet size.

FleetCycle has extensive M&E functionality, partial document management capability, HR and manpower planning capability, native finance (but no accounting), and can receive data from an ETL.

FleetCycle can handle documents in PDF and XML formats, and will be interfaced with InfoTrust's TechSight/X suite of CMS products at Delta TechOps by the summer of 2013. Bathurst explains that the plan calls for having routine job cards available on tablet devices or kiosks. Non-routine cards are already paperless, and available through tablets or kiosks.

## IBM

IBM offers its Maximo Asset Management product, previously marketed as MRO Software prior to being acquired by IBM.

Maximo Enterprise Asset Management (EAM) is joined by an add-on product called Maximo Asset Configuration Manager (ACM) for aircraft maintenance.

EAM is the core M&E system, while ACM adds 38 applications designed for the aerospace sector. The latest release of ACM included an electronic Flight Log Book (eFLB) and Progressive Inspection Planning (PIP) capability.

These two systems are based on 100% Java web architecture, and are installed as a seamless solution via an intuitive user interface.

The EAM product is marketed from Armonk, New York, USA. Main contact is Vito De Malteris, although Rob Powell in the UK is IBM's European contact.

About 70% of the two IBM Maximo systems' clients are in civil aviation. At the end of 2012 the system had 18 live airline users, including airlines that carry out limited or extensive maintenance.

Its largest airline user is Compass, with a fleet of 42 aircraft. It has also gained 10 new civil aviation customers over the past two years. It is also used by aerospace companies, independent MROs, engine shops, component repair and overhaul shops, OEMs and government users, including the US Customs and Border Protection agency, with a fleet of 280 aircraft. The system also has several large military users, including the US Air Force, which uses it to manage its fleet of 417 KC-135s.

In recent years IBM has made it possible for Maximo Asset Configuration Manager to be available in the cloud, although De Malteris comments that he is not aware of systems that have been implemented this way. The system can be paid for in several ways, including by number of concurrent users, by named users, and by the user's fleet size.

Maximo Asset Configuration Manager has full M&E functionality, but De Malteris concedes that its commercial management capability is only partial.

The system can handle manuals and documents in PDF, SGML and XML, but only as attachments, so that it can view documents in these formats, but it cannot extract information or edit them.

Maximo Asset Configuration Manager also has HR and manpower planning, and finance and accounting capability. It has also recently expanded its functionality to work with an ETL.

## IFRSKEYES

IFRSKEYES, previously named IFR, is based in Toulouse, France and markets its AMASIS pureplay M&E solution. The company also has support offices in Moscow, Singapore and Bolivia.

AMASIS is based on Cobol and Java technology, and has among the largest number of airline users, with 45 live airlines at the end of 2012 (see table, page

44). Its largest airline customer is Aeroflot, which operates 123 aircraft.

Over the past two years AMASIS has been selected by several airlines, including TAME, Vladivostok Air, and Syphax. It is also used by a number of OEMs, including: SAE in Singapore; Airbus Flight Hour Service (FHS), which supplies rotatable components on a fixed rate per hour basis; and Airbus Military. AMASIS is also used by independent airframe maintenance providers, component repair and overhaul shops.

One of IFRSKEYES' largest contracts for AMASIS is the French Ministry of Defence, which manages 1,200 aircraft.

IFRSKEYES aims to make AMASIS available via SaaS on a power-by-the-hour (PBH) basis. A hosted solution is also available, which only requires an internet connection. The system is paid by number of concurrent users.

AMASIS has full M&E functionality, but no commercial management capability (see table, page 44). It can handle documents in all types of formats, but it is unable to modify them. Aeroflot has interfaced AMASIS with Airbus's document management system and job card publisher ADOC.

## Infospectrum

Infospectrum of Agoura Hills, California, USA markets its infoTRAK

pureplay M&E system, which is based on Java and Oracle database technology. Main marketing contact is Bob Bush (see table, page 44).

InfoTRAK is not used by airlines, but is used by independent MRO facilities, engine shops, as well as by aircraft component repair and overhaul shops.

The system specialises in managing airframe checks and work orders, so it has functionality for: engineering management; maintenance package and workscope planning; production management; inventory management; commercial management; quality control; and native finance and accounting (see table, page 44).

It does not, however, have capability for HR and manpower planning, keeping aircraft technical logs, line maintenance, MEL, and maintenance control.

## Lufthansa Technik

Lufthansa Technik offers its manage/m Technical Operational webSuite, which has most of the functionality of a pureplay M&E system. The system comprises 15 modules, and is based on Java and Web 2.0 technology.

Lufthansa Technik's main base is Frankfurt, Germany. Main contact is Erik Abels (see table, page 44). The system's main and largest user is Lufthansa, but it is also used by airlines with limited

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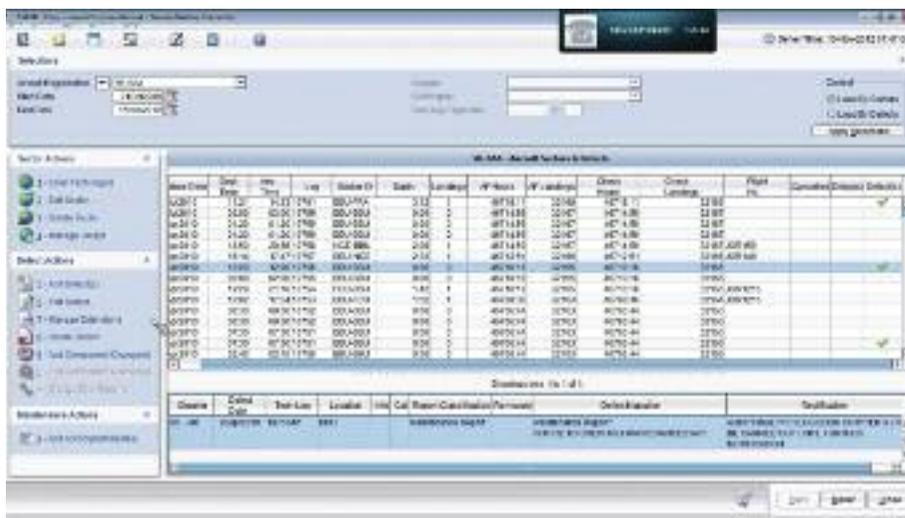
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maintenance facilities, and independent airframe, engine and component overhaul and repair shops.

The system is mainly used as part of Lufthansa Technik's maintenance contracts, so it is not available on an application services provision (ASP) basis. In fact it is automatically included free for Lufthansa Technik customers.

Manage/m's first four main modules are: m/airborne, which records aircraft utilisation data; m/techlog, which records and keeps track of a fleet's outstanding technical defects; m/condition, which records AHM and EHM data; and m/program, which manages fleet maintenance and schedules.

The main modules for planning and managing maintenance are: m/event and m/control, for planning maintenance events; m/job card, for generating routine and non-routine job cards; m/modification, for planning and organising supplementary maintenance relating to modifications; m/progress, for monitoring the progress of maintenance checks; and m/process, an on-line portal to view the progress of maintenance and repair of aircraft and components.

Other modules address engineering functions, such as maintenance records, regulatory compliance, managing rotatable inventories, and tracking reliability.

Manage/m has a document management system, and can handle documents in PDF, SGML and XML. It interfaces with Lufthansa Technik's own techlog system, but not with other ETLs.

## Mxi Technologies

Mxi Technologies of Ottawa, Canada offers two variants of its Maintenix pureplay M&E system: Maintenance and Maintenix CE. Maintenix is a web-based application that is based in Java.

Maintenix can handle documents and manuals in PDF, SGML and XML. It is interfaced with several CMS/DMS applications at several of its users. One example is Icelandair Technical Services,

where Maintenix is being interfaced with Aerosoft's DigiDOC CMS application.

The system is used in civil aviation and by military operators. While it has a moderate number of airline users, with 22 at the end of 2012, some of these are large carriers. Its largest airline user is Netjets, which has a fleet of more than 700 aircraft. Airline customers also include Lan Chile, Qantas as well as Icelandair.

Maintenix has 12 defence and 10 OEM users, including Boeing, which uses it to manage its 787 Goldcare program.

Other users include independent MRO facilities, engine repair shops, and component repair and overhaul shops.

Mxi Technologies has been offering Maintenix on an ASP basis. While Mxi does not disclose the exact terms that users can pay for Maintenix, it does offer a wide range of ways to pay for it.

Maintenix has full functionalities in both M&E (see table, page 44), including document management, HR and manpower planning, native finance and accounting, and interface with an ETL.

Maintenix has programming interfaces (APIs) that allow integrated connectivity to all possible specialist point solutions in aircraft maintenance, including HR, finance, flight operations, shipping, diagnostics and many others.

## Rusada

Rusada, based in Oxford in the UK, offers a pureplay M&E system, Envision Lite, and an ERP system, Envision. It also has support offices in Dubai, Singapore, and Chennai, India. David Chisnall, head of sales at Rusada, explains that Envision Lite does not have the same management functionality or scalability as Envision.

Both systems are based on .NET/SQL server technology.

80% of the systems' users are civil aviation companies, while the remainder are parapublic and military. It also has OEM users, like Beechcraft in the US and Europe.

Commssoft's pureplay OASES system can handle PDF and XML document formats, and is used mainly by small- and medium-sized operators.

At the end of 2012 it had 11 live airline customers. New customers gained over the past two years include Belgian helicopter operator NHV, RAK Airways of Dubai, and Beechcraft Global Customer Support, which will be Rusada's largest customer to date. It will support it at seven sites in the US and Europe, accounting for some 3,000-4,000 annual aircraft maintenance checks.

Envision and Envision Lite are not yet available on an ASP basis. The systems can be paid for by number of concurrent users, by named users, or by fleet size.

The range of airline users includes those with limited or extensive maintenance facilities; a CAMO provider; and independent airframe MRO providers in the US and Europe. Envision Lite is also used by an independent component repair and overhaul shop.

Envision Lite has almost full M&E functionality, with commercial management being added in 2013.

The system can work with documents in SGML and XML formats, and can integrate with CMS/DMS applications. One example is where it is interfaced with Enigma's InService MRO CMS and technical documents system.

Envision Lite now has functionality to accept data from ETLs, and store and display it. It is developing new functionality for HR and manpower planning. It is also designed to interface with over 30 native finance packages, including MSDynamics, Sage and SAP.

## SaSiMS

SaSiMS's main base is Shannon, Ireland, and main contact is Anders Cassel. It provides a pureplay M&E system based on Embarcadero InterBase technology.

The system is used purely by airlines and civil aviation companies. At the end of 2012 it had 24 airline operators with extensive maintenance facilities and independent airframe MROs. Its largest customer has a fleet of 50 aircraft.

The system is available on an ASP basis, and it can be paid for based on number of concurrent users or fleet size.

SaSiMS has extensive functionality (see table, page 44), which includes internal document management, HR and some accounting capability. It can handle documents in PDF, SGML and XML formats.



## Swiss Aviation Software

Swiss Aviation Software (Swiss-AS), based in Basel, Switzerland, offers its AMOS pureplay M&E system. Based on Java technology, AMOS is one of the most successful M&E systems in terms of attracting airline customers. It is wholly used by civil aviation clients.

At the end of 2012 AMOS had 114 live airlines. The largest is Ryanair, with a fleet of 305 aircraft. Many of AMOS's customers have been recently added, including Finnair, South African Airways Technical, Brussels Airlines, Transaero Airlines, Flybe, Thomas Cook Group, Pegasus Airlines, AvianaTACA Group and SAS Scandinavian Airlines. Swiss-AS's main contact point is its marketing department in Basel, but it also has support offices in Miami, USA and Singapore.

Besides being available through a regular licence model, Swiss-AS offers a rental approach as a hosted version for providing AMOS. It can be paid for by named users or on the basis of fleet size.

Airline users with limited maintenance facilities include IndiGo Airlines, Global Supply Systems, Privat Air, and easyJet. Those with extensive maintenance facilities include Austrian Airlines, Czech Airlines and Monarch.

Some of its airline users utilise AMOS in their engine repair and overhaul shops, and component repair shops. AMOS is also used by independent MROs that include Lufthansa Technik Maintenance International, Enhance Aero, AMAC Aerospace and Braathens Technical.

AMOS has extensive functionality in the main areas of M&E. It can manage documents and technical manuals, and is able to handle documents in PDF, SGML, XML, HTML, Excel and Plaintext

formats. It is therefore not interfaced with any CMS/DMS.

AMOS also has HR and manpower planning capability, and offers a native finance management and billing module that includes contract management and financial reports. This does not, however, replace a complete accounting system.

It has recently added an interface to receive data from an ETL.

## Tracware

Tracware in Dorset, UK offers its pureplay M&E system AeroTrac, although sales director Patrick Waker admits the system offers elements of a M&E system. The system is based on MSSQL database technology, but it is currently being re-written into .NET.

Tracware's original intention was to provide a product for small independent MROs. The software was therefore intended to cover all of a MRO's business processes, including technical, commercial, logistical and financial functions. Aero-Trac can integrate with other software systems to achieve the desired functionality.

Main customers include engine and component overhaul and repair shops; and overall users can be classified as Part M, Part 145 and Part 21 modification services. These include Cobham Aviation Services, NetJets Technical Services, Sloane Helicopters, London Helicopters and the UK Police Aviation Services. It also has customers in Australia, Belgium, China, Italy and Singapore.

The system is not available in the cloud, but is installed locally. It can be available by remote connection, like TS or Citrix, and in a Virtual Server environment.

AeroTrac has extensive M&E

Swiss Aviation software's AMOS system is used by one of the largest number of airlines of any M&E system.

functionality, limited document management, HR and financial capability, and a web interface that allows aircraft hours and a forecast and view of current aircraft maintenance status.

Document formats used with AeroTrac are mainly XLS and PDF, although integration with XML is now also common. Tracware now markets a web application that allows data transfer from one system to another.

## Trax

Trax offers its Trax pureplay M&E system, which had 118 live airline users at the end of 2012. The system is based on Java and .NET technology. It has a CMS module and can handle documents in PDF, SGML and XML formats.

Air Canada interfaces Trax with Airbus's ADOC to perform CMS/DMS functions for all of its fleet. Trax can also be interfaced with Boeing's Maintenance Performance Toolbox (MPT).

Trax's main headquarters are in Miami, Florida, USA. Its largest customer is United Airlines, which has a mainline fleet of more than 700 aircraft since acquiring Continental Airlines.

Trax is 100% used in civil aviation. It has gained 19 airline customers over the past two years, including the US's largest low-cost carrier (LCC) Southwest, as well as Turkish Airlines.

Trax is now offered on an ASP basis, available on pay-as-you go and in the cloud. Payment can be made on the basis of named users.

Trax is used by airlines with limited or extensive maintenance facilities. It is also used by independent MROs and component repair and overhaul shops.

Trax has all main M&E functionalities, and a HR and manpower planning module. It does not, however, have a native finance and accounting module, or the capability to receive data and information from an ETL.

## Ultramain

Ultramain, based in Albuquerque, New Mexico, USA, offers its Java-based Ultramain pureplay M&E system. The latest version is Ultramain v9. It contains standalone point solutions that can be implemented separately. Collectively they comprise a full M&E system.

Ultramain's main contacts are David

Abbott and Marcelle Vittitow.

Most users are in civil aviation, and the rest are military. Airlines are those with limited or full maintenance facilities. It is also used by independent MROs, and component repair and overhaul shops.

Ultramain is now available on an ASP basis, and is paid for on the basis of the user's fleet size.

Ultramain has full functionality in the main categories of M&E. It also has a document management module, and can handle documents in PDF, SGML and XML. The system is also interfaced with several CMS applications at some users. Cathay Pacific, for example, has selected InfoTrust's TechSight/X suite of products. Cathay Pacific, Virgin Atlantic and Emirates all interface Ultramain with Airbus's ADOC for AMM management and task card content.

Ultramain also has HR and manpower planning, native finance and accounting capability, as well as the ability to interface with an ETL. It provides its own electronic flight bag (EFB) and ETL software and systems.

## Volartec

Volartec is based in Cordoba, Argentina, and offers its Alkym pureplay M&E system. It also has a European office in Shannon, Ireland, where

Volartec's main point of contact, John Barry, is based (*see table, page 44*).

Alkym is based on .NET technology, and is used mainly by airlines and independent MRO facilities. All clients and users are in civil aviation.

At the end of 2012 Alkym had 36 live airline users, including: Enter Air, Poland; Avion Express, Lithuania; Sky Airlines, Chile; Vivaerobus, Mexico; Air Panama, Panama; Conviasa, Venezuela; and Africa Charter Airlines. Conviasa is the largest carrier, with a fleet of 28 aircraft.

Alkym has gained 11 new customers over the past two years.

Barry explains that users currently have the option to acquire Alkym on lease, but that it will also be available in the cloud in late 2013. Payment is on the basis of number of concurrent users.

Airlines with limited or extensive maintenance facilities use Alkym as well as independent MRO airframe facilities.

Alkym has functionality in most M&E capabilities, but not commercial management (*see table, page 44*). It has its own in-built DMS system, and can handle documents in PDF and SGML. Barry explains that it plans to add XML capability when a user requests it.

Alkym also has HR and manpower planning, and native finance and accounting capability. It can now interface with an external ETL.

## ERP systems

ERP systems were originally developed as core business systems for all types of industries. The main difference between pureplay M&E systems and ERP systems is with functionality and philosophy of development. Pureplay systems have been developed from the core M&E functionality outwards. ERP systems with M&E capability have been developed inwards from core business systems. There are also differences in M&E functionalities.

The first generation of ERP systems for airline M&E had aircraft M&E functionality developed from the original ERP systems.

British Airways and SR Technics have versions of SAP customised for maintenance. Another example is Oracle's ERP system, which developed cMRO for aircraft maintenance. This is used by Korean Air, American Eagle, Mexicana, and Abu Dhabi Technologies.

The second level of ERP systems was developed purely for airlines and MRO providers. One example is the iMRO system developed by SAP and HCL-Axon. This specialist ERP system for MRO can be interfaced with the main ERP system that performs core business functions. These second-level ERP systems should be easier to implement

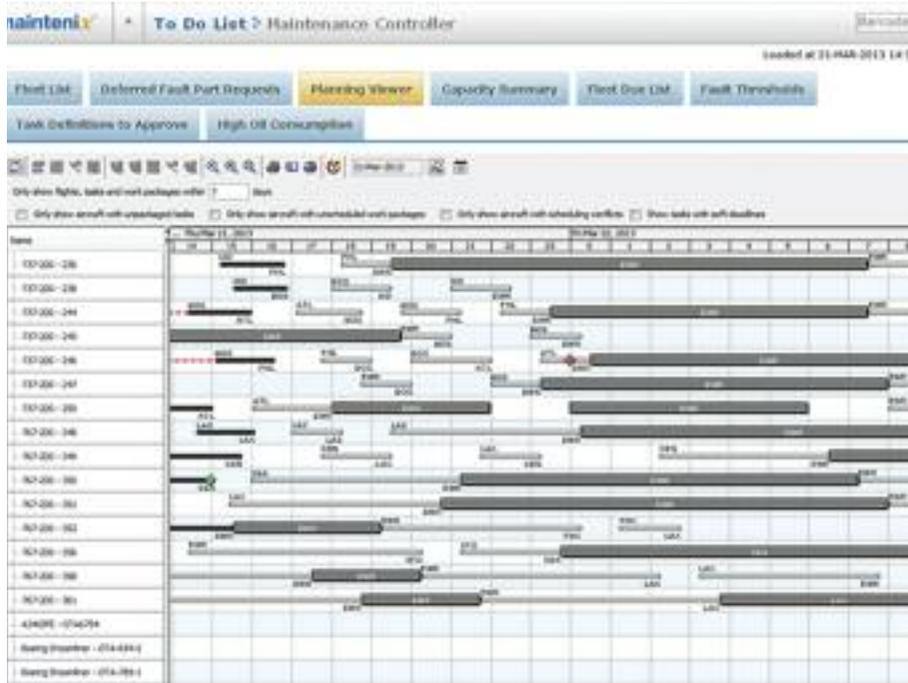
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Mxi's maintainix check planning system is one of its many functionalities, and like most designs this function uses a gantt chart.

than a complete ERP system.

Like a specialist ERP system for an MRO, a pureplay M&E system will have to be interfaced with the user's core ERP system that performs core functions. It is claimed that there can be 700-800 interfaces between a pureplay M&E system and the user's core ERP system.

A third level is an aviation-specific ERP system developed with an autonomous core business and specialist M&E system: Ramco's Ramco Aviation Suite, which only needs integration with specialist maintenance point solutions.

Component Control's Quantum Control falls into this category.

## 2MoRO Solutions

Based in Biarritz, France, 2MoRO Solutions provides Aero One and Aero-Webb ERP solutions. Contact David Ferrier says that Aero One is suitable for small- and medium-sized companies, while Aero-Webb is for larger ones.

Aero One is based on .NET, SDK and SAP Business One production technologies, while Aero-Webb is based on Java and NetWeaver technologies.

The company has support offices in Montreal, Canada and supplies the two ERP systems to civil aviation and military users, with civil aviation companies accounting for 80% of its client base.

Aero One and Aero-Webb are used primarily by OEMs. They have two live airline customers and another Peruvian airline that operates CRJs where the system is being implemented.

2MoRO's OEM clients are Safran Snecma, Safran Turbomeca, Zodiac Aero and Thales. MTR, which is a joint venture between MTU, Rolls-Royce and Turbomeca, is also a user.

There is also a client that is an

independent MRO airframe maintenance provider. Another MRO is having the system implemented.

New clients that 2MoRO has gained over the past two years include Peruvian Airlines, CMR, OEM Defense Services, Canadian airline Enerjet, and ATI.

Safran Turbomeca is 2MoRO's largest customer, using Aero-Webb to manage 20,000 helicopter engines, operated by 400 operators in 14 countries.

Neither of the ERP systems is yet available on an ASP basis or in the cloud. The system is paid for on the basis of named users.

The applications have the most M&E capabilities and functionalities (see table, page 44). They can perform warranty management, but only by connecting with SAP. 2MoRO is currently developing quality control capability.

Ferrier explains that the applications can read and edit all documents and manuals issued by OEMs in SGML, XML and other formats. Some document management is done in Aero-Webb, and so far none of its users have interfaced it with a CMS/DMS. All documents and manuals are managed within Aero-Webb.

The HR and manpower planning, and native finance and accounting functions are performed in SAP, which is interfaced with Aero One and Aero-Webb. The applications can also interface with an ETL.

## BA Engineering

British Airways (BA) Engineering and Tata Consultancy Services (TCS) offer an ERP M&E System called Swift MRO (see table, page 44). Swift MRO is based on SAP, and utilises Netweaver technology.

Swift MRO is marketed from BA Engineering's HQ at London Heathrow

airport. Main contact is Rajan Bindra. Implementation and support services are provided by TCS from Mumbai.

Swift MRO's main customer is BA Engineering, which uses the system to manage its fleet of 250 aircraft. It has also recently gained a flag carrier as a new customer. The main target customers are airlines and cargo operators with significant in-house M&E activities on a similar scale to BA.

Swift MRO can be hosted by the user, or from TCS. BA Engineering and TCS offer flexible payment models, and these can be tailored to a customer's needs.

Swift MRO has extensive M&E functionality (see table, page 44), and document management, HR and manpower planning, native finance and accounting, and ETL capability. The document management repository function can hold documents and manuals in PDF, SGML and XML formats.

## Component control

Component Control is based in San Diego, California, USA. It has other US offices, as well as locations in the UK and Switzerland. Main point of contact is Andrew Valley.

Its Quantum Control ERP application has been built using several languages and technologies that include OraclePL/SQL organised on Oracle packages.

Quantum Control can be installed on a client's network, or is available through the cloud. It is paid for on the basis of number of concurrent users and the modules required.

Quantum Control is used by a large number of component repair shops. Its speciality is managing the repair and overhaul process of components. Its main areas of functionality include: maintenance workscope planning; production management; inventory management; warranty management; and quality control. It also has the ability to manage customer invoicing, other financial processes and human resource functions. It is not a full M&E system, however, since it cannot perform the engineering functions for an airline's fleet.

## iBASEt

California-based iBASEt offers its Solumina software suite for Supplier Quality Management and MRO

Operations. Main contact Conrad Leiva explains that Solumina technology is also being sold as part of the Costpoint ERP system that is sold by Deltek. This is an ERP solution for MROs targeted at the defence market.

Solumina has Windows and web browser clients, and uses Java, Oracle or SQL Server databases.

The application has two main groups of functionality. The Supplier Quality Assurance includes receiving inspection, source inspection, supplier audits, corrective actions, supplier ratings, and supplier communications portal.

MRO management includes: services planning; configuration management; visit planning; production control; inspection findings; parts removal tracking; mechanic certification and validation; tool calibration; on-line maintenance execution; and service records reports.

Solumina is used by major component and OEM maintenance facilities. These include PW's 20 MRO facilities around the world, and Sikorsky aircraft sites.

Solumina is available on lease terms but not yet on a SaaS basis or in the cloud. The system can be paid for on the basis of named users or on fleet size.

Solumina has most M&E function capabilities. It does not, however, perform

inventory management, but interfaces with ERP systems for this. It also does not have commercial management and warranty management capabilities.

The system can handle documents in PDF, SGML and XML when integrated with the appropriate viewer. It also has document management capabilities.

Solumina can track mechanics' certification requirements, but does not do manpower scheduling. It lacks native finance and accounting capability.

A recent development has been the ability to interface with an ETL.

## IBS Technics

IBS Technics provides its iFlight MRO ERP system as its MRO solution. IBS has HQ in Andover, Massachusetts, USA, and main marketing contact is David Spellman. IBS also has a secondary office in Kerala, India, and HQ in Trivandrum, India. It also has consulting centres in the US, UK and Australia.

iFlight MRO is a web-based and mobile-enabled ERP system suited to the needs of airline CAMO and third-party MRO businesses. It uses state-of-the-art user experience for airlines and MRO shops. It also provides mobile solutions deployed on handheld devices to allow maintenance-on-demand functionality,

and document management capability. The system is based on a .NET platform.

iFlight MRO is used mainly with airlines and in civil aviation. It had 12 live airline users at the end of 2012. Its largest customer is China Southern Airlines, with a fleet of 400 aircraft.

New customers over the past two years include Merpati Airlines, Merpati Maintenance Facility and Viva Colombia.

In addition to being used by airlines with limited or extensive maintenance facilities, Solumina is also used by independent MRO airframe facilities, engine shops, and component repair and overhaul shops.

It is available in the cloud and on an ASP basis. It is paid for through flexible schemes that take into account a customer's situation.

iFlight MRO has most M&E functionalities. The exception is quality control management.

The application can handle manuals and documents in PDF, SGML, XML. Solumina is integrated with Microsoft SharePoint technology, which Spellman claims brings benefits to customers in job card production and also in OEM document management.

iFlight has an application programming interface (API) for airframe check scheduling and manpower

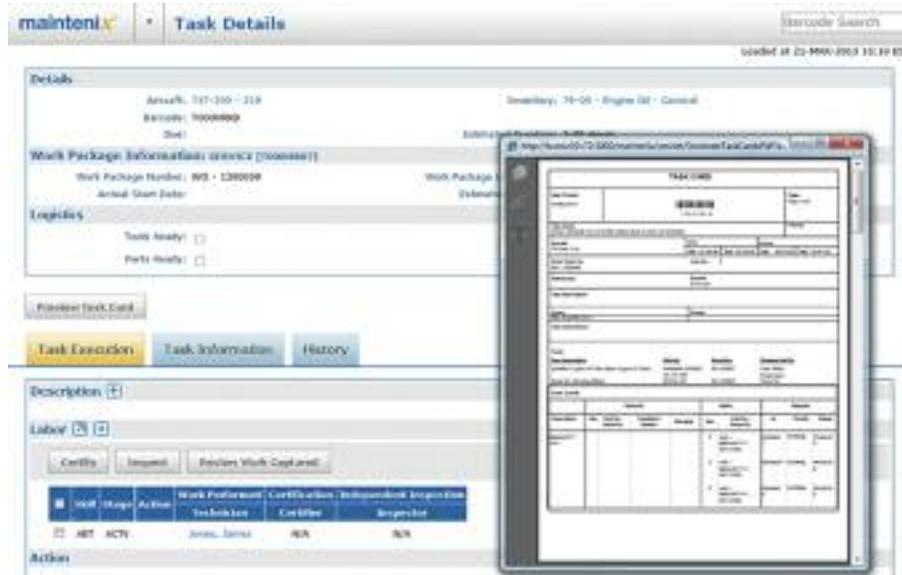
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Maintenix generates task cards. These can be rendered in PDF and sent to devices such as kiosks and tablet computers. The cards can accept fully-electronic signatures.

planning. It also has native finance and accounting, and APIs to Oracle and SAP.

iFlight MRO is also integrated with IBS's iFlight Lite for ETL.

## IFS

IFS of Linköping Sweden offers its IFS Applications of ERP systems. It also has support offices in the UK, and main contact point is Jeff Pike (*see table, page 44*). The IFS Applications are: IFS Enterprise Explorer, an ERP system with functionalities for all industries, including aerospace and defense; and IFS Mobile, with touch applications for use on smartphones for point functionality. One example is a flightlog that allows faults raised by an aircraft crew to be reported.

IFS is used mainly by military clients, with only 10% of customers involved in civil aviation. It had 20 live airline and civil aviation customers at the end of 2012. Over the past two years it has gained the following new customers: AMS, Italy; Norwegian Aviation Authorities; the Federal Aviation Administration; TAE Gas Turbines; and GKN Aerospace, Sweden. Its largest customer, however, is Saab Aircraft, with more than 200 external customers.

IFS is used by airlines with limited maintenance facilities, as well as by major carriers like Finnair. Third-party MRO users include GE Aviation and Saab. Independent engine shop Hawker Pacific in California, and component repair agency Gables Engineering are users.

IFS is available either as an Infrastructure-as-a-Service (IaaS) or as a Platform-as-a-Service (PaaS) model. These can be available through the cloud. The application is available to the UK public sector through the UK government's G-cloud initiative. This is a strategy that IFS is expanding globally.

The system can be paid for by number of concurrent users, by named users, and by the user's fleet size.

IFS has extensive M&E, HR, and finance and accounting capability. It does not yet have an interface with an ETL or technical log functionality, but IFS intends to enhance this. IFS has document management and document viewer modules, and can handle PDF, SGML and XML formats.

## Oracle

Oracle is a first generation ERP supplier, based on Redwood Shores, near Los Angeles, California. It offers its cMRO application as part of its eBusiness Suite as a complete ERP and M&E system. cMRO has been designed specifically for airline maintenance and MRO.

Its main contact point, Hannes Sandemeier, claims that cMRO has functionality to cover every M&E process, and is fully integrated into supply chain management, financials, procurement, and human capital management. cMRO also provides an out-of-the-box integration with Enigma's InService MRO system that performs technical documentation and content management. Korean Air, one of its largest customers, utilizes this configuration.

cMRO is used mainly by airlines and civil aviation MROs, but also by aerospace companies and OEMs. It only had five live airline users at the end of 2012, but customers include the US Air Force, the US Coast Guard, Evergreen Aviation Technology and Advanced Military Maintenance Repair and Overhaul Centre in the UAE.

cMRO is available as an on-demand hosted solution in the cloud and is licensed by named users only.

cMRO has full M&E, finance and accounting as well as HR functionality. It handles documents in PDF, SGML and XML formats, and has its own internal document management capability.

## Pentagon 2000 Software

Pentagon 2000 Software Inc is based in New York City, USA. Its Pentagon 2000SQL application is a MRO and ERP product. Main contact Kirk Baugher explains the system is based on .NET technology, and that 70% of its users are aircraft and civil aviation companies. Most users are Part 121 and fixed base operators. Japan Airlines and All Nippon Airways use the software system for sourcing materials. Dynamic Aviation, which operates a fleet of 80 corporate and regional aircraft for governments, is the largest user of Pentagon 2000SQL.

New customers gained over the past two years include Bombardier, Airbus Military and Talatus.

Pentagon 2000SQL is also used by independent airframe facilities, engine shops, and component repair and overhaul shops.

The system is available either on a software licensing model, or in the cloud via rackspace.com. The system is paid for by the number of concurrent users.

Pentagon 2000SQL can handle documents in PDF, SGML and XML. It has a built-in module for document management, and a link to web-based document management providers. It has full M&E, HR, finance and accounting, as well as ETL functionality.

## PSI Penta

PSI Penta from Berlin, Germany offers its PSI Penta range of applications: PSIPenta maintenance; PSIPintegration; and PSIPenta ERP. These products constitute an ERP application for MRO, and are based on Java technology.

PSIPenta Maintenance manages the maintenance process. PSIPenta Integration assists the integration and implementation of various applications together with the SAP-certified PSIPintegration interface. PSIPenta ERP's impressive range of functions includes value-added production and logistics processes. The entire planning process is covered, from project management to detail planning, and the complete supply chain process is supported.

The PSI Penta suite of applications is used by SR Technics and military and government customers. Its main areas of functionality are maintenance package

and workslope planning, production management, and inventory management. It can handle documents in PDF, SGML and XML. It has a document management module, and HR, and finance and accounting capability. It is not yet available on an ASP basis, and is paid for by named users.

## Ramco

Indian IT vendor Ramco has developed an aviation-specific ERP application together with an autonomous core business and specialist M&E system.

Ramco Aviation Suite comprises several products: Ramco Maintenance and Engineering Solution; Ramco MRO Solution; Ramco Aviation Analytics; Ramco Aviation Financials; and Ramco Human Capital Management. All are available in the cloud.

Ramco Aviation Suite also includes: Ramco ePublications; Ramco Electronic Flight Bag; Ramco Off-line Field Maintenance Solution; and Ramco Reliability Management Solution. These are not available in the cloud.

In addition to Ramco Aviation Suite, Ramco Aviation is offered on the cloud for small operators, CAMO providers and independent maintenance facilities.

Ramco can be paid for by number of

concurrent users, named users, and fleet size.

Ramco Aviation Suite not only provides ERP and M&E functionality, but it can read documents in PDF, SGML and XML formats and has its own CMS system, and a point solution for reliability management and off-line field maintenance. The standard technology for the applications is Microsoft .NET and MS-SQL. It can also be offered, however, in multiple platforms such as Microsoft/Oracle and Java/Oracle, depending on customer needs.

Almost all its customers are airlines or in civil aviation, but 5% are military. At the end of 2012 Ramco had 50 live airline users. Over the past two years it has gained several new airline customers, including: Emirates, Go Air, Air Tahiti and Hevi Lift. It has also gained several aerospace manufacturers. Ramco's largest customer is US-based corporate and air medical service company Air Methods Corporation, with a fleet of 420 aircraft.

Users are LCCs with limited maintenance facilities, airlines with full facilities, and independent airframe, engine and component repair shops.

Ramco Aviation Suite has all levels of M&E, HR and manpower planning, finance and accounting, and ETL functionality.

## Rusada

Rusada offers Envision Lite as a pureplay M&E system, and Envision as an ERP solution. Envision has full M&E functionality (see table, page 44). It can read documents in SGML and XML, and can integrate with Enigma via XML documents. Envision can interface with more than 300 native finance packages that include MSDynamics, Sage and SAP. It can also accept data from ETLs.

## SAP

SAP provided a first generation ERP system, but other ERP applications based on SAP have since been developed.

Main contact point Jens Schoenberg at SAP's HQ in Walldorf, Germany explains that the basic SAP was developed 10 years ago as a solution called SAP MRO for aerospace, with maintenance functionality for airlines and MROs. Early customers included BA, Japan Airlines, All Nippon Airways and Lufthansa. Schoenberg says that early customers looked for additional features, which were developed by HCL-Axon. Five years ago SAP partnered with HCL-Axon to develop a solution called iMRO to address all M&E functionalities. This is marketed by SAP and HCL-Axon.

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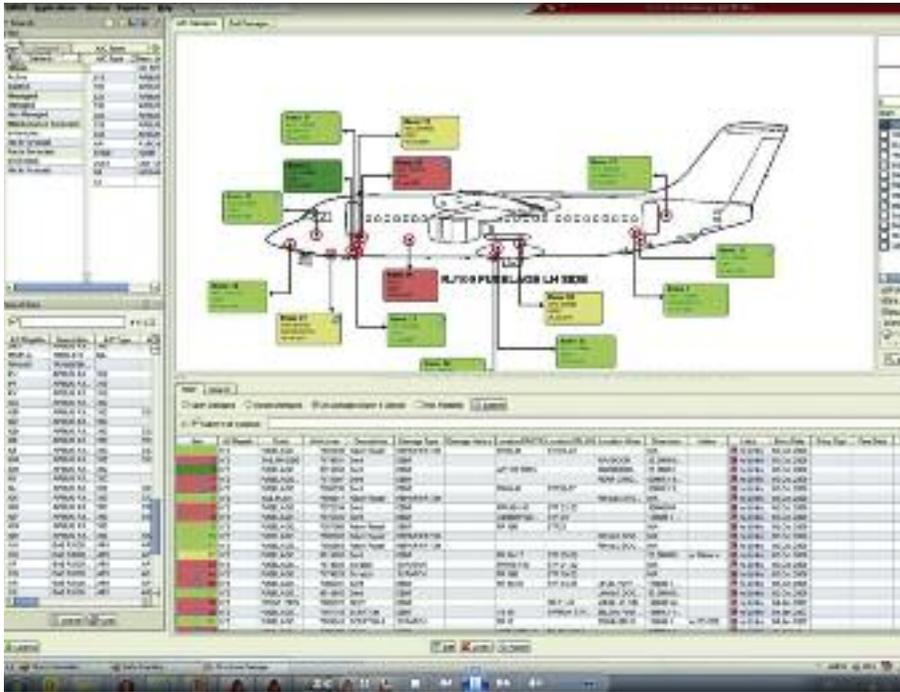
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The basis of SAP MRO was to provide functionality for engineering, planning, maintenance execution, supply chain management, finance, commercial contracts, and warranty management. The functionality gaps in SAP MRO were filled by iMRO. These included graphics and workbenches for monitoring the progress of airframe checks.

Another variant of SAP was the system developed for Lufthansa Systems that was based on the standard SAP system. This was implemented by three or four airlines, and used as a template to develop other versions.

The applications are based on NETweaver, Java and ABAP technology, and can operate with documents in PDF, SGML and XML. They do not have a sophisticated in-built CMS/DMS system, so they have to be integrated with SAP's DOC management, which then provides standard connectivity to an independent CMS/DMS that is offered by Enigma, IDMR, InfoTrust or Lufthansa Systems.

The systems are used mainly by airlines, independent airframe MRO providers and OEM aftermarket services, and by a small number of defence maintenance providers. At the end of 2012 SAP ERP systems had 93 users, including 18 airlines. It is used to support engineering, airframe maintenance, engine overhaul, component repair and overhaul, inventory management, and commercial and warranty management. It has extensive functionality in these areas. Workscope planning, for example, includes scheduling of all resources.

SAP ERP systems are not yet available in the cloud. They have full M&E functionality (see table, page 44), as well as HR, and native finance and accounting capability, and bi-directional connectivity to OEM and aftermarket ETL solutions.

## SDS

Sheorey Digital Systems (SDS) has its HQ in Mumbai, India. It offers its ARMs V2 Engineering Management sub-system, ARMS V2 Logistics & Inventory Management sub-system, and InfoPrompt Integrated Document Management System. The combined systems handle documents in PDF, SGML and XML.

These constitute an ERP system and a CMS/DMS system that integrates with its M&E system. These systems are based on .NET production technology.

The ARMS V2 and InfoPrompt systems are used by airlines and civil aviation, and they had eight live users at the end of 2012. The largest customers include Gulf Helicopters of Qatar, and Airphil Express of the Philippines. They are offered on an ASP basis, which includes SaaS. Its new applications for EFB and ETL are available in the cloud. It can also be purchased outright, or licensed by number of concurrent users, named users and the user's fleet size.

The two main systems combined have full M&E functionality, although its capability for warranty management is only partial (see table, page 44).

It also has full document management capability that would otherwise be required by a CMS/DMS system, so none of its customers have yet needed it to be interfaced with a CMS/DMS.

The systems have HR and manpower planning, and ETL capability, but no native finance and accounting capability.

## OEM services

The main OEM services are solutions for content and document management, task and job card production, and for managing technical defects.

Swiss Aviation's AMOS keeps a record of all structural repairs made on an aircraft for future reference.

## Airbus

Airbus is based in Blagnac, Toulouse, France. It offers a suite of solutions based around the AirN@v suite and ADOC, a system to manage documents and manuals. ADOC is a CMS/DMS service that can be used for all aircraft, not just Airbus types.

ADOC is based on JAVA webstart technology. It is used by 39 airlines, the largest of which is Air France with a fleet of 409 aircraft. The system is charged on a price-per-aircraft basis. It is also available to independent airframe MROs.

The product comprises content management, job card publishing, and consultation. Content management services allow users to update documents as revisions are issued. Users are able to create, update and revise all documents. Documents can also be authored.

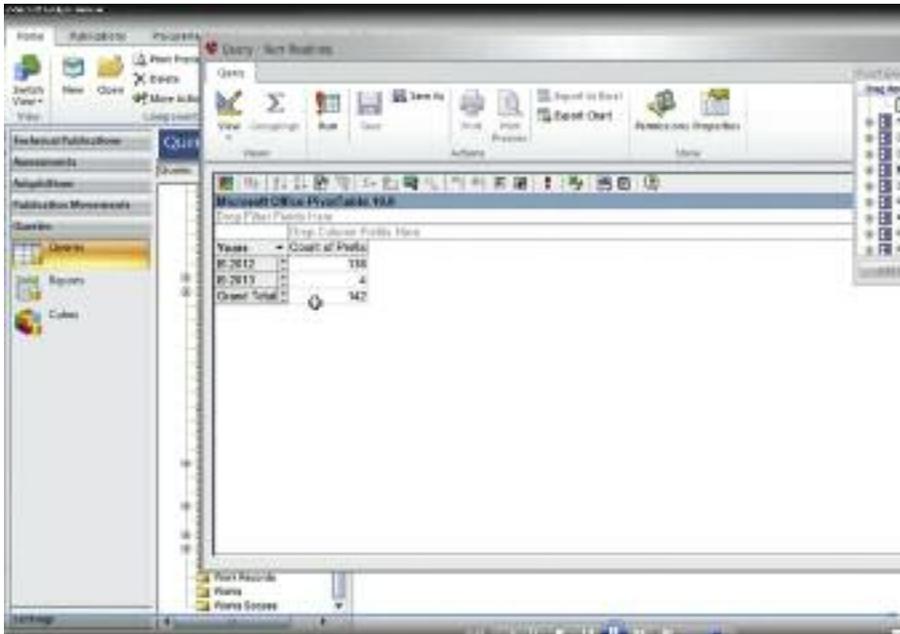
Job card publisher is a facility to automatically produce job and task cards for maintenance. The solution is interfaced with an operator's M&E system. Users can customise job and task cards at standards that are familiar with its mechanics. The system works for Airbus and non-Airbus aircraft in iSpec 2200 standards in SGML documentation. The finalised cards can be printed in PDF.

In addition to ADOC, the four main products offered are: Repair Manager, AirPl@n, AIRMAN-web, and AirN@v Suite.

Repair Manager allows a user to log and store all its approved structural repairs.

AirPl@N is used for maintenance programme development and maintenance check preparation. Its two main areas of functionality are maintenance package and workscope planning, and engineering management functions. It can handle documents in PDF, STML, XLS and XML formats. AirPl@N is based on HTML, XML and STML technology. It is used by 60 airlines, and can be acquired as a standalone product or on-line via AirbusWorld. It is paid for on the basis of the user's fleet size, although it is also used by independent MROs.

AIRMAN-web is a system based on JAVA technology, and makes aircraft health monitoring (AHM) data available on-line. It also takes live data from an aircraft's ETL via ACARS transmissions.



The system can be used to plan repair actions according to the type of defect.

AIRMAN is used by 106 customers; the largest, US Airways, has 258 aircraft. AIRMAN-web has been in service since late 2010, and most of its customers migrated from AIRMAN Classic.

AirN@v Suite manages ADOC functionality.

Airbus is developing ETL software for all aircraft, not just Airbus types. This will be directly linked to AIRMAN-web.

## Boeing Edge Fleet Services

Boeing Edge Fleet Services is based in Seattle, USA. It provides its Maintenance Performance Toolbox (MPT), which has five main modules. The Toolbox is built with Java and runs in a J2EE environment, and the database is Oracle.

The suites together provide a CMS/DMS, which can be used for aircraft from manufacturers other than Boeing. Outside of 787 operators, MPT is used by 103 airlines. Its largest customer is Southwest Airlines, which operates more than 400 aircraft.

MPT is being transitioned to the cloud, and payment for the service is partially based on the user's fleet size. It is also used by independent MROs.

The first MPT module is the Library, which allows a user to store its customised documents and manuals. This is the core of the toolbox product.

The second module is Systems, which provides functionality for airline mechanics to perform troubleshooting actions. The system provides visuals on the screen, with mechanics being able to access appropriate manuals, such as the TSM and AMM. "The system allows the user to click on a specific line replaceable unit (LRU) that might be causing a problem. The user can then drill down to get detailed information on that LRU,"

explains Darlene Dobson, marketing manager at Boeing Commercial Aviation Services. "The system also has 3-D graphics to illustrate how the system runs through the aircraft."

The remaining three modules manage content. The Authoring module is a XML-based system. It allows the user to author and edit various documents and manuals, such as the AMM and IPC. The manuals from a third party following a STC or EO can be incorporated, as can hyperlinks between the relevant manuals.

The Task module is for creating job and task cards. The process starts with the MPD. The airline can add its own maintenance tasks, which can be located in the user's M&E system. The system is XML-based. "Changes made in the AMM are automatically upgraded in the task cards because of hyperlinks, which means revisions and customisations are all done automatically," explains Dobson. "The task cards can then be sent back to the M&E system."

The fifth module is Structures, a repository for all structural repairs made by the user. A 3-D image of the aircraft and location of all the repairs stored in the system can be viewed, and detailed information gained by drilling down.

## CMS/DMS providers

There are seven independent providers of CMS/DMS systems. These provide document and content management, and job and task card production services, and are mainly interfaced with M&E and ERP systems.

## Aerosoft

In addition to its WebPMI and DigiMAINT pureplay M&E systems, Aerosoft offers its DigiDOC CMS. The system was originally developed by

Volartec's Alkym has its own built-in DMS system that can handle documents in PDF and SGML format.

Corena, and Aerosoft acquired it in 2008. It has since been transformed.

DigiDOC is used by International Aero Engines (IAE) and PW, and is being interfaced with Mxi's Maintenix M&E system at Icelandair, and with Swiss AMOS, IFS, SAP and Trax.

Its main areas of functionality include technical records management, engineering management, and full content and document management. It can handle documents in PDF, SGML and XML formats.

## AviIT

AviIT is based in Dunfermline, Scotland, UK. Its eMan solution provides a centralised technical, application and website library management and document distribution solution that is an alternative to the CMS/DMS systems.

The system is based on .Net, Internet Information Service, and ZenApp technology. It is used only by airlines and civil aviation companies. Main contact point is Kevin Clark (*see table, page 61*).

eMan electronically performs the library management functions of all documents and manuals. The two main functions are to keep all documents up-to-date and to distribute them to all relevant users. The system also informs relevant users, such as mechanics, of changes to documents they use. The users can then acknowledge receipt of the updated documents. The system therefore has an in-built audit capability.

eMan does not, however, open documents and does not have an authoring and editing capability. An airline's own authorings and editing are done in their own M&E systems. So if edits and changes are required, the documents are transferred from eMan to the M&E system. Once the changes are made they are transferred back to eMan.

eMan's largest customer is Airberlin Technik. Other users include BMI Regional, Virgin Atlantic and Greenwich Aerogroup. It is also used by independent MROs and helicopter operators.

eMan can be acquired on a classic software licence model, or on a SaaS basis. AviIT can host the system, or work with the client's hosting organisation. When AviIT hosts the system it can also offer a fully managed service.

## MRO &amp; FLIGHT OPERATIONS SOFTWARE VENDOR COMPANY DETAILS

Company	Website	Contact person	Contact details	Current product	Production technology	No of airlines in 2012	ASP/ pay-as-you-go offered?	Used by airlines with limited maintenance facilities?	Used by airlines with maintenance facilities?	Used by third party MROs?	Used by engine shops?	Used by component repair shops?
<b>OEM SERVICES</b>												
Airbus	www.airbus.com	Sebastien Godfroy	sebastien.godfroy@airbus.com +336 6193 2050	ADOC	JAVA webstart	39	No	Yes	Yes	Yes	No	No
	www.airbus.com	David Marem	david.marem@airbus.com	AirPI@n	HTML, XML, STML	60	N/A	Yes	Yes	Yes	No	No
	www.airbus.com	David Marem	david.marem@airbus.com	AIRMAN	JAVA	106	Yes	Yes	Yes	Yes	Yes	Yes
Boeing Edge	www.boeing.com/ boeingedge/ fleetservices	Darlene Dobson	darlene.m.dobson@boeing.com	Maintenance Performance Toolbox	JAVA, Oracle	103	Transition to the cloud	Yes	Yes	Yes	No	No
<b>CMS/DMS SOLUTIONS</b>												
Aerosoft	www.aerosoftsys.com/ www.aerosoft.aero	Thanos Kaponeridis	thanos@aerosoftsys.com +1 905 678 9564	DigiDOC	Java	23	Yes	Yes	Yes	Yes	OEM	OEM
AviIT	www.aviit.com	Kevin Clark	kclark@aviit.com +44 1383 620 927	eMan	.NET, Internet Information Service	4 + MROs & others	Yes	Yes	Yes	Yes	No	No
Comply365	www.comply365.com	Troy Salwei	tsalwei@comply365.com +1 608 313 1518	Suite of CMS/ DMS solutions	.NET	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Enigma	www.enigma.com	Asher Gabbay	asberg@enigma.com	InService MRO	Java	10	Yes	No	Yes	Yes	Yes	No
IDMR	www.idmr-solutions.com	Israel Revivo	irevivo@idmr-solutions.com +1 888 675 4527	InForm	.NET	11	Yes	Yes	Yes	Yes	Yes	Yes
InfoTrust Group	www.infotrustgroup.com	Julie Fouque	jfouque@infotrustgroup.com +1 303 627 6536	TechSight/X	J2EE	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Terra XML	www.terraxml.com	Helmuth Naumer	hnaumer@terraxml.com +1 720 224 4175	TerraView™, TerraMRO™	Java	None, helicopter operators	Yes	No	Yes	Yes	No	Yes
<b>POINT SOLUTIONS</b>												
AerData	www.aerdata.com	Godfrey Ryan	godfrey.ryan@aerdata.com	STREAM, EFPAC, CMS & AtlasData	ASP, .NET	22	Yes	Yes	Yes	Yes	Yes	Yes
ARMAC	www.armacsystems.com	Michael Armstrong	michaelarmstrong@armacsystems.com +353 41 987 7480	RIOSys	Java J2EE	N/A	Yes	No	Yes	Yes	No	Yes
Conduce	www.conduce.net	Paul Saunders	paulsaunders@conduce.net +44 888 4066	Bespoke COTS solutions	.NET, Apple xCode	N/A	Contact for details	Unknown	Yes	Unknown	Unknown	Unknown
Hexaware	www.hexaware.com	Ashley Peterson	ashleyp@hexaware.com +1 609 409 2328	HMRO Analytics Framework	Hosted all platforms	8	Yes	Yes	Yes	Yes	Yes	Yes
Holocentric	www.holocentric.com	Geoff Zuber	geoff.zuber@holocentric.com +612 8705 3308/ +61 409 773 840	Modelpedia, Modeler	.NET	2	Yes	No	Yes	No	No	No

## Comply 365

Comply365 is based in Beloit, Wisconsin, USA. Main contact is Troy Salwei (see table, this page).

Comply365 offers a suite of solutions that provide a CMS and technical documents management system. These are based on .NET technology. It is available in the cloud, and can be paid for on the basis of number of concurrent users and named users.

The system is used by airlines, as well as a variety of independent airframe, component and engine overhaul shops.

The suite of products offered by Comply365 include a document & communications manager (DCM); and modules called LMS learning manager, AQP learning manager, IQP learning manager, Workflow365, Forms365, Schedule365, and Tablet Rollout Services.

## Enigma

Enigma is based in Boston, Massachusetts, and provides its InService MRO CMS/DMS application. The system is based on Java technology. Main contact is Asher Gabbay (see table, this page).

InService MRO is used by civil and military clients, and it had 10 live airline users at the end of 2012. Its largest user is FedEx, which it shares with InfoTrust, and has a fleet of about 700 aircraft. Other airline customers include American Eagle and Atitech. One particular user is Korean Air, which interfaces InService MRO with Oracle's cMRO ERP system.

InService MRO is also used by independent airframe, engine and component repair and aircraft overhaul providers.

InService MRO is available on a SaaS basis, and in the cloud. It can be paid for on by named users or the user's fleet size.

The system can handle documents in PDF, SGML and XML formats. It is also capable of handling S1000D standard, is used by the 787, A350 and C-Series.

## IDMR

IDMR is based in New York, USA and Tel Aviv, Israel. It provides its InForm product as a full suite of document management solutions. The system is based on .NET technology. Its specialist functions include task card production, engineering functions and integrating with most M&E systems. It can handle

eight document formats.

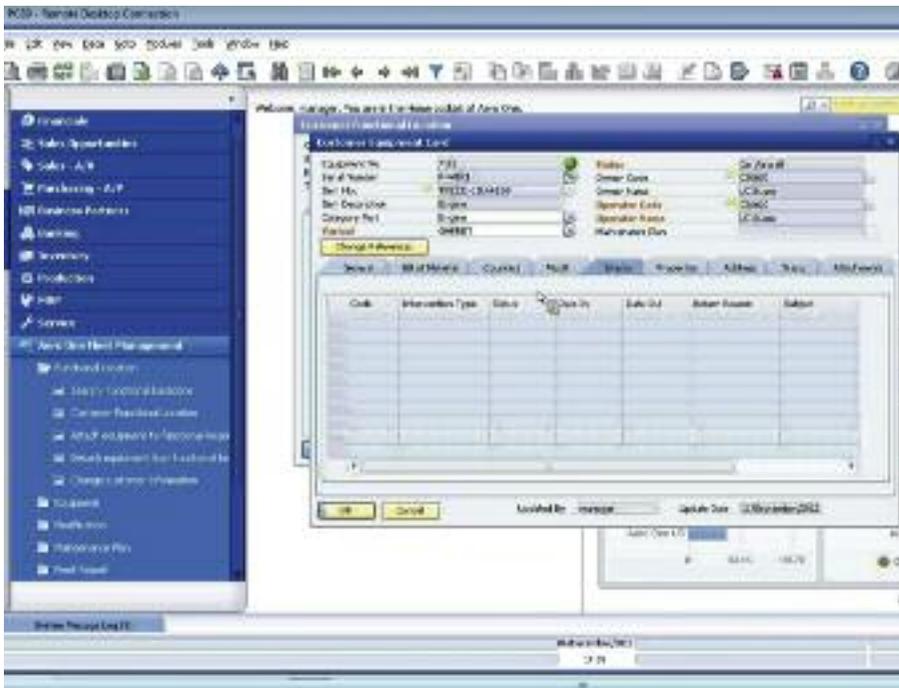
The majority of InForm's users are airlines and civil aviation organisations. InForm had 11 active airline users at the end of 2012. Its largest customer is Air India, which operates about 130 aircraft. A new customer gained over the past two years is North American Airlines.

InForm is also used by independent airframe, engine and aircraft component repair and overhaul providers.

The system is available both on an ASP basis and as a licensed solution. It is paid for either on the basis of named users or by the user's fleet size.

Main contact Israel Revivo explains that InForm is a complete CMS/DMS. InForm is interfaced with several M&E systems, including Trax at Atlas Air and Polar Air Cargo; Ramco at Air India and Columbia Helicopters; and at Ultramain, with World Airways and with North American Airlines.

InForm has a full electronic task card system for generating routine and non-routine task and job cards. "These can be displayed in tablets through a Windows operating system. Our first user is Columbia Helicopters," says Revivo. "We are also working to allow the job and task cards to be displayed on iPads".



## InfoTrust

The InfoTrust Group is based in several cities in the US, as well as having a software development office in Shanghai, China. Main contact is Julie Fouque (see table, page 61).

It offers its TechSight/X solutions. The suite embraces XML technologies. The main modules are: TechSight/X Aircraft Maintenance Edition, TechSight/X TechOps and Engineering Edition, TechSight/X Flight Operations and Company Manuals Edition, and iPad and Android EFB and ETL.

TechSight/X suite is designed to address the complete life-cycle of maintenance information in an aircraft. It functions on the basis of converting all documents and manuals to XML format.

Functionality starts with content creation and management, and delivery of content into several channels that include PDF, Interactive Electronic Technical Publication (IETP), portals, iPhones and Android tablets. The suite of applications can handle documents in PDF, SGML and XML formats.

TechSight/X is available on an ASP basis, and can be paid for by number of concurrent users or specific named users.

InfoTrust's largest users of the TechSight/X suite of products include: Delta Airlines, United Airlines, American Airlines, US Airways, FedEx, and UPS, all of which use old legacy M&E systems, such as Sceptre and Maxi Merlin.

The main functionalities of the TechSight/X product suite are: authoring and editing content; styling content for HTML viewing on tablets and computer screens; publishing content in formats that include PDF for printing or through an IETP viewer; ordering parts when mechanics have viewed manuals such as

the AMM and IPC; and generating routine and non-routine electronic task cards.

## Terra XML

Terra XML is based in Lafayette, Colorado, USA. It offers its TerraView™ and TerraMRO™ CMS/DMS products, which are based on Java technology. Main contact is Helmuth Naumer (see table, page 61).

The company has so far sold its solutions to mainly military customers, but is increasing its presence in civil aviation. Its largest users include the Bristow Group, Weatherford, Kohler, Goodrich and Bell. The Bristow Group operates mainly helicopters, and has a fleet of 350 aircraft. The system is available on an ASP basis, and is paid for by licence fee.

Terra View supports content in PDF, SGML and XML formats, and any graphics that are supported by a web browser, operating system or a third-party viewing tool. Data standards include ATA Spec 2200 and S1000D, as well as proprietary data models used by Airbus and Boeing, and other custom types created by TerraXML or those supplied by customers.

TerraView integrates with the main M&E systems that include AMOS, Maintenix and Trax. It is a specialised document delivery and management system that understands popular aviation document types, and is also customised to incorporate operator-specific content.

TerraMRO is an extension of TerraView that is aimed at aviation operators and MRO providers. It functions include M&E, minimum equipment list (MEL) management, job card production and MPD management.

2MoRO Solutions provides Aero One and Aero-Webb ERP solutions. The systems are used primarily by OEMs, including Safran Snecma.

## Point solutions

Despite the many levels of functionality, M&E and ERP systems do not have everything required by an airline. More detailed functionalities require specialist point solutions.

One particular specialist function is the optimisation and management of rotatable inventories. M&E and ERP systems generally lack the capability to provide detailed analysis of the stock of rotatable inventory held at each main base and outstation for each aircraft type. This capability, which results in optimised inventories of rotables being held, and therefore large savings for airline users, requires a specialist point solution.

Other types of specialist point solutions include: managing and keeping technical records; performing engine management and engineering functions; monitoring check and workpackage performance and progress; and analysing maintenance inputs and performance.

## AerData

AerData is based in Amsterdam, the Netherlands; London Gatwick, UK; Dublin, Ireland; and Washington DC, US. Main contact is Godfrey Ryan (see table, page 61).

It supplies several point solutions that include EFPAC, STREAM, and AtlasData (see table, page 61). The solutions are based on ASP.NET, and are used exclusively by airlines and civil aviation companies. At the end of 2012 AerData had 22 live airline customers, 16 of these gained over the past two years. Its biggest customer for EFPAC is American Airlines, which operates 600 aircraft.

The systems are available on an ASP basis, in the form of SaaS. They are paid for based on fleet size.

STREAM is an aircraft records scanning, archiving and search solution. It uses optical character recognition (OCR) technology to search through scanned records.

EFPAC is an engine M&E management solution that was purchased by Total Engine Support (TES). EFPAC takes engine health monitoring (EHM) data and uses other data such as LLP lives, engine utilisation data, ADs and SBs to optimise the removal timing and shop visit workscope of each engine to achieve the overall lowest maintenance cost per

Many airlines are considering implementing systems to send fully-electronic task and job cards to tablet devices and computer kiosks for full electronic signature. This system is already in place with a number of airlines.

engine flight hour (EFH) for the engine fleet. It requires data inputs relating to engine shop visit workscopes and related costs, as well as practical issues of shop visit turnaround times and spare engine availability.

## ARMAC

ARMAC Systems is based in Drogheda, County Louth in Ireland. It provides RIOsys, a specialist application for optimising rotatable component inventories. Main contact is chief executive officer Michael Armstrong.

The system is based on Java J2EE technology. RIOsys can be provided to users on an ASP basis, or can be installed locally at the client. ARMAC prices RIOsys according to the value the system can deliver.

Most of ARMAC's customers and users are civil aviation companies, and its biggest users are SR Technics and Thomas Cook Airlines.

RIOsys is interfaced with M&E and ERP systems, and is able to handle a large number of data formats.

RIOsys uses algorithms to determine what number of each rotatable component to hold at each location on a route network to maintain a particular service and reliability level. The algorithms use data from the user's M&E system that relate to component removal and installation dates, and aircraft utilisation information. RIOsys also considers the purchase price of each unit, and its criticality with respect to the user's operation.

## Conduce Group

The Conduce Group is based in Nuneaton in the UK. It specialises in providing micro point, custom-built point solutions. Main contact is Paul Saunders, operations director (see table, page 61).

The point solutions it provides are based on mainly MS.Net for Windows and web applications. For native iPhone development Conduce uses Apple xCode and Objective-C.

Conduce says it is flexible on pricing and hosting solutions. It uses Amazon web services for all of its primary hosted solutions, although some of its clients prefer to arrange hosting themselves.

The specialist custom-built point solutions it provides are to solve unique



problems that are not solved by the large IT vendors. One example provided by Saunders is an iPad application for mechanics to remotely solve or troubleshoot a problem, and then order parts. Another is a system for flight attendants, called Defexx, to record cabin defects on a defect log on an iPad to replace paper records kept on clipboards.

Conduce also has an eTechlog solution at Thomas Cook Airlines, which operates 36 aircraft. This has been approved by the UK's Civil Aviation Authority as a system for paperless techlogs.

## Hexaware

Hexaware is based in Mumbai, India. It also has offices in the US and Mexico. Hexaware's point solution is HMRO Analytics Framework.

It has several functionalities that include maintenance schedule and events, cost analysis, operation analysis, inventory positions analysis and procurement analysis. The system is agnostic and can be hosted on any BI platform. Main contact is Ashley Peterson (see table, page 61).

The system is used by airlines and military customers, and it had eight live airline customers at the end of 2012.

Hexaware says that it saw a clear gap in analytics solutions, and business intelligence reporting. Its systems provide high level dashboarding, and an ability to drill down on specific key performance indicators, such as: average maintenance check turn time; maintenance costs; and levels of inventory held. Hexaware has developed these systems for M&E solutions Trax and cMRO, and is developing them for Mxi's Maintenix.

Hexaware is also developing a new

product for accelerating data migration when transferring data from a legacy M&E system to a new pureplay solution. Hexaware's solution will be an intermediate application, which is being used by Saudi Airlines Engineering while it implements Swiss-Amos. The system is not yet available, however.

## Holocentric

Holocentric is based in Sydney, Australia. It provides two point solutions: Holocentric Modelpedia and Holocentric Modeler based in .NET technology.

These solutions provide airlines with the ability to build business management systems (BMS) that can help employees achieve operational efficiency excellence and manage business information. Customers use Holocentric BMS to understand and optimise the complex details of strategy and processes.

Holocentric Modelpedia delivers the server-based information store and web-based access, and Holocentric Modeler delivers a powerful desktop-based modelling tool. Holocentric software allows the user to model complete systems and processes. An example is Project Marlin at Qantas Engineering. The Project Marlin team is working towards implementing one of its most significant business transformation projects in Qantas Engineering's history, which involves redesigning and standardising 512 business processes, reducing the number of computer applications from 300 to 30, and implementing a new maintenance, repair and overhaul process.

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