



XML & documentation strategies for aviation

The application of technically driven standards and better utilisation of state-of-the-art software will be important when managing approved aviation data. Together with *Gordon Dennis*, commercial director of Koala publishing, *Rus Sutaria* of ARCGlobal.info explores the opportunities presented by XML based documentation when considering aviation safety.

Documentation standards in aviation are not technological, but primarily functional. The basis of aviation documentation is the 'Guidance on the Design, Presentation and Use of Emergency and Abnormal Checklists' (CAP 676); its intention is to tell the industry how to write manuals, with a view to the prevailing operation. To this effect, CAP 676 is nothing more than guidelines on how to write the manual in terms of structure, and ensuring that the data contained therein is written clearly and is easily

assimilated. It does not make recommendations with regard to technology. CAP 676 has a function that continues regardless of the technology platform. UK-based information management company Koala offers a solution that provides for the dissemination of one source of documentation out into numerous technological platforms. Commercial director of Koala publishing Gordon Dennis is quick to point out that the regulators would still need to see a printed manual as a part of the approval process, and so this particular option stills exists by default.

The technological platforms themselves have become increasingly varied, from the introduction of electronic flight bags on next generation aircraft to the introduction of tablet pc applications for engineering ground ops, as well as on-board solutions for classic pressure instrument flight-decks. Independent of technology standards, CAP 676 also has an important role to play with regard to introducing safety management issues such as human factors & situational awareness.



Documentation of this nature must be easy to understand, and where an emergency or critical situation exists, CAP 676 needs to reinforce the point that aviation professionals must be able to carry out procedures and take decisions which are implicitly correct – thereby avoiding second-guessing and ultimately making the wrong decision.

Where the hardware and software is concerned, a separate standard must exist. However, it must sit alongside CAP 676 and not replace it. One solution could be to incorporate XML standards into CAP 676, perhaps as an addendum, but a more comprehensive standard along the lines of an ICAO annex may well be the best way forward. The introduction of dedicated Standards & Recommended Practices (SARPs) could be the starting point.

However, it is important to state that these SARPs should not dictate how these requirements should be delivered. Therefore where documentation is concerned these guidelines must be careful not to even suggest the use of an XML platform, much less an XML transform to produce a compliant product.

XML — the documentation standard for aviation?

XML as a software platform is fast becoming the technological platform of choice with

regard to aviation documentation. This may suggest that the industry is moving toward an XML based standard, and may prompt regulatory authorities to consider the incorporation of XML as part of a regulatory standard.

The truth is that XML standards are already in place in many important areas of air transport. Consider air traffic control (ATC) and the application of Aeronautical Information Exchange Methodology (AIXM). Developed jointly by Eurocontrol and the FAA, this XML based standard has been devised for interchanging information between parties who are responsible for building information resources to do with ATC.

The FAA also utilises AIXM as its 'information backbone' to constantly disseminate documentation between different departments within the administration. The benefit of this approach is that only one set of data is available, rather than numerous sets of data scattered all over the United States. Changes are made only once and then distributed to whoever needs them.

The incorporation of document standards such as CAP 676 into areas like flight operations and aircraft engineering & maintenance might be the logical next step.

Where XML applications are concerned, XML starts from a position of document validation into that which is termed as a 'SCHEMA'. Intrinsicly, this is a set of definitions that tells the user how to write a document of this type. An inherent facet of XML is that you can (and should) validate each document. This provides the first quality check as to the document's semantic integrity.

In theory, a new SCHEMA could be written for every new application. In practice this is considered to be a bad business decision. The argument for this is that if a standard exists in the industry at the moment, then there must be an extremely good reason for not using it. Invention of a separate SCHEMA is more often than not a rocky road. Good examples of this practice are ATC AIXM, Airbus Less Paper Cockpit (LPC) & S1000D, which has several different SCHEMAS associated with it.

The central benefit of the application of SCHEMAS, together with XML standards, is the open playing field offered to the entire industry. These standards are published, and the documentation business can legitimately utilise these standards to ensure that their solutions are compliant both in terms of the regulations and industrial practice.

'Interoperability' will also be important. Since the advent of ICAO in 1944, a lot of information has progressively been made available electronically. The problem has been that documentation formats have never been standardised, and are generally incompatible. If the

reader progresses from the notion of basing documentation standards around XML and standard SCHEMAS, and the basic information has been assimilated into the XML format, it is not important that the work has been developed utilising a different SCHEMA to the one you are using. This is because the process of transforming from one SCHEMA to another is quite simple and inherent in the nature of XML.

The development and implementation of XML and standard SCHEMAS presents an opportunity for documentation organisations like Koala to engage with the larger suppliers and OEMS in collaborative agreements designed to outsource DM development. This point is further reinforced by comparing air transport from the 1970s, a vertically integrated industry, to the situation today where OEMS and major suppliers are at the top of the supply chain. Supply chain functionality, not least efficiency, is already dependent on the application of previously discussed standards, with documentation standards like XML being a case in point.

Failure on the part of any buyer or supplier to assimilate a document standard that reinforces the supply chain, could preclude them from both sales and purchasing opportunities. Not the ideal way to run any business, much less an air transport operation where cost control and efficiency are more important than ever.

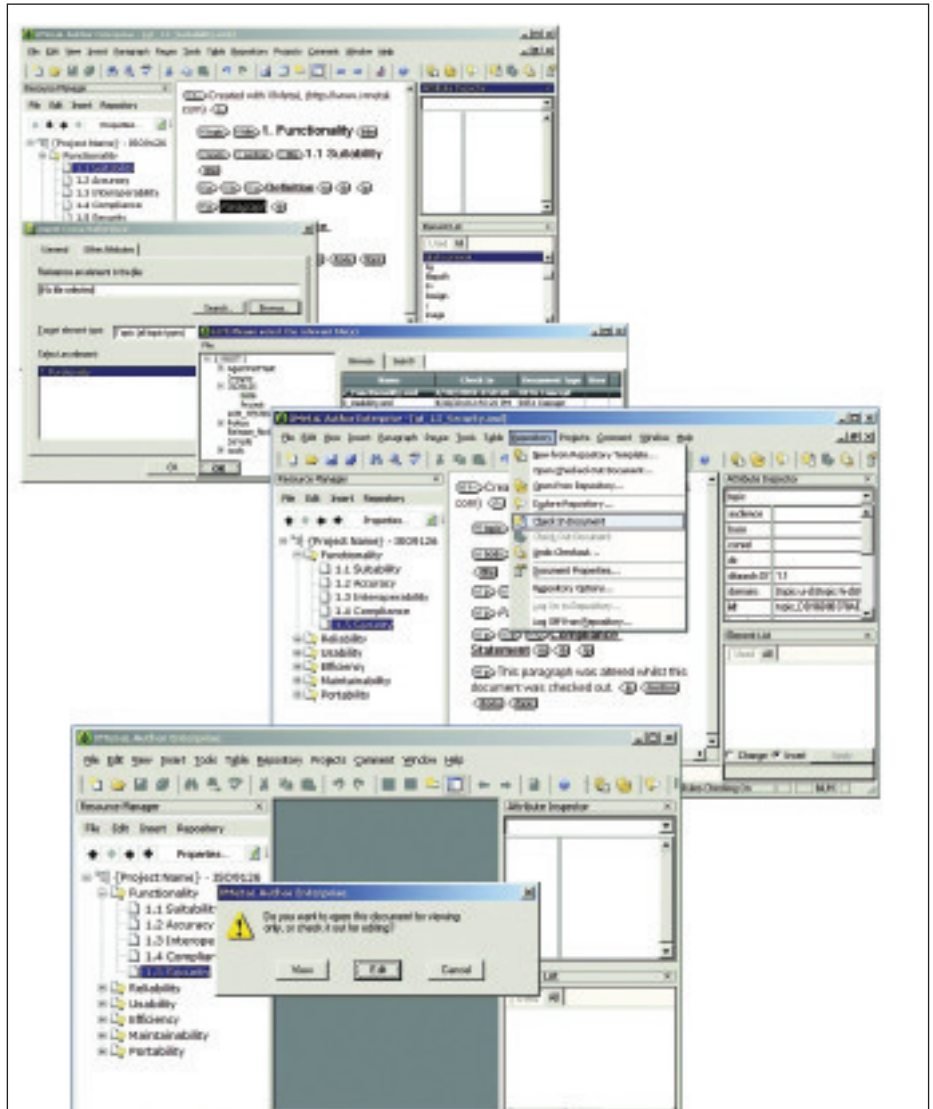
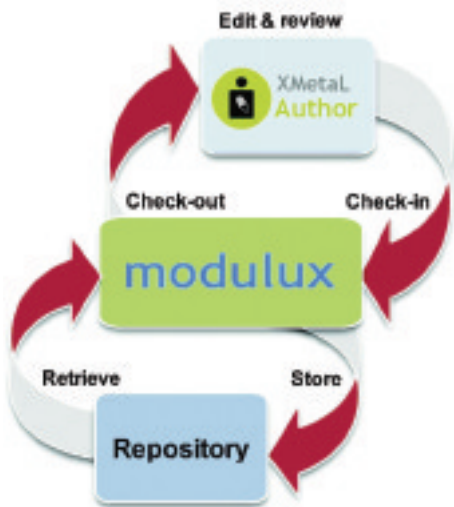
Now that air transport is no longer vertically integrated, the need for 'collaboration' is more important than ever. This is mainly due to a perceived and perhaps increased demand for documentation management in areas of air transportation that are not immediately apparent.

Everything that occurs in terms of processing information must be a collaborative effort because a lot of specialists will need to be involved. The end result to successful collaboration will be a powerful dynamic that is capable of coping with a supply chain structure in air transport which is never really the same from one moment to the next.

A utopian collaborative ideal is unlikely to ever be reached, however, there are degrees of collaboration across the entire industry. Military aviation has adopted S1000D (yet another XML based standard) on aircraft like the A350 Military Variant and the A400M; as such our military colleagues are further down the road towards this utopia. The problem in civil aviation is that there is still a lot of legacy equipment in use which is likely to continue in operation, perhaps for the next 20 or 30 years.

The technological opportunities for documentation

The opportunities for XML based EFB solutions that are both 'stand-alone' and integrated



are both wide and varied. A company's ability to handle whole libraries of legacy documentation will be central to success.

This particular business approach is not an accident for Koala, as all of their clients have large banks of documentation that is either in pdf format, or hard copy. Their success lies in an unparalleled ability to assimilate the data quickly and efficiently.

A second and perhaps more important element is that of regulation. As an example, for a MRO to gain its Part 145 approval, documentation in terms of the MOE, approved maintenance data etc must exist. In a sense, well developed procedures and practices for aviation are as much dependent on XML based documentation as documentation is dependent on the need for approved procedure.

Electronic Flight Bags (EFB) are regulated — surprisingly broadly in the opinion of Koala. There are three classes of EFB:

- 1 A simple laptop PC (not wired into the aircraft power-supply or physically mounted on a structure).
- 2 A simple laptop (wired into the aircraft power supply & physically mounted on a structure).
- 3 Fully integrated design solutions (Not a lap-top).

The approval standard, like anything else in aviation, has to come from the regulatory

Modulux is Koala's DITA component management system and is designed to place control of DITA content in the hands of the authors.

authority. If the product is to be successfully utilised, this is key. The regulators will continue to insist that a printed version of the documentation must also exist. It is this document that is subject to the approval. Therefore, any enhancements in terms of functionality via EFB must be based upon the original paper-based document. Additionally, EFB providers must also prove that the electronic version of the particular manual accurately reflects the approved paper document in terms of the actual data.

The reader will have already noted that comprehensive success in this regard undoubtedly lies with the application of software than can easily assimilate infinitely large amounts of information into an easily accessible repository. However this is only half of the story. For product development to be taken seriously by OEMs and operators, the documentation organ-

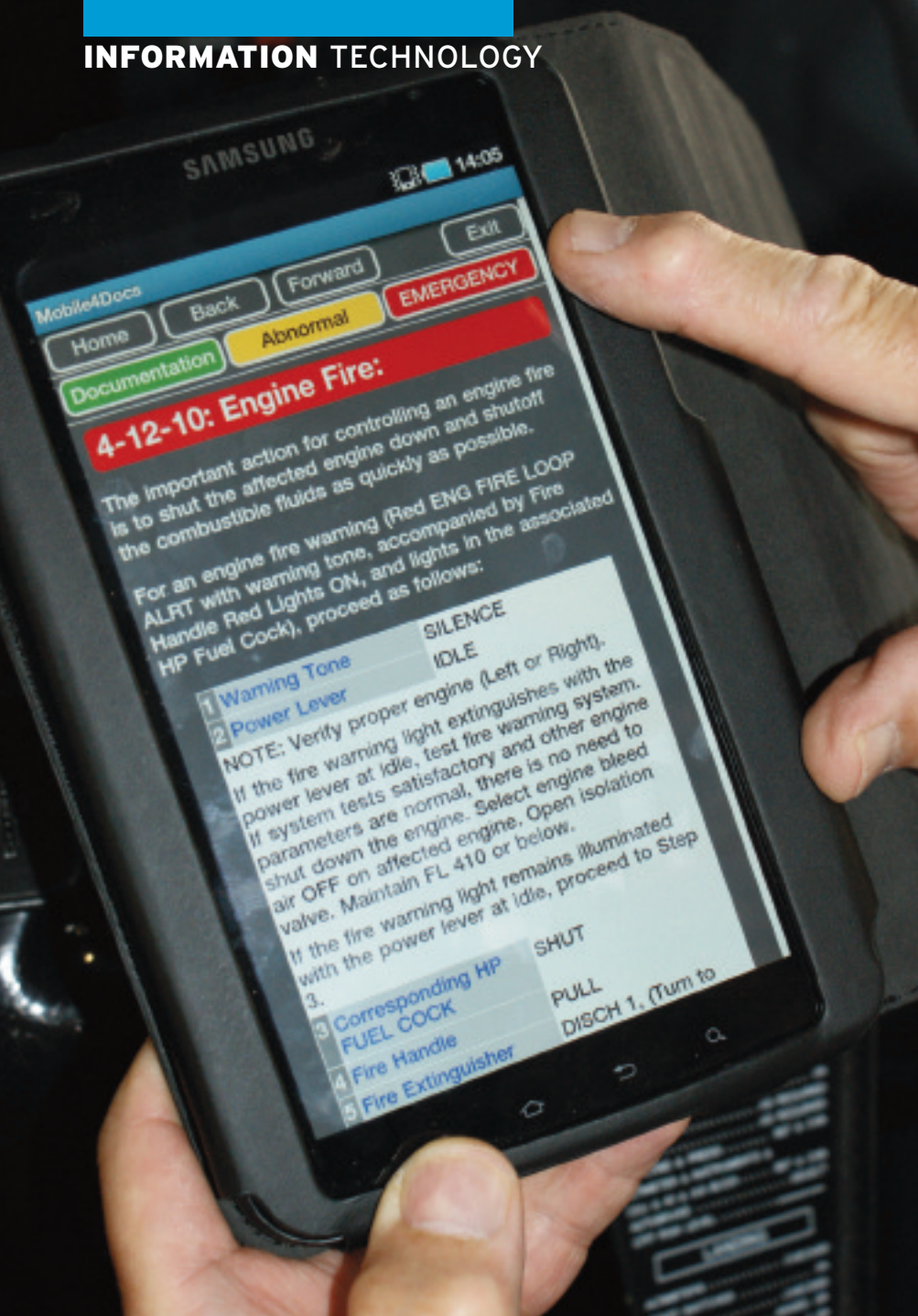
isation will need to engage a number of subject matter experts that are specialists in their own aviation field. It is important to stress that these are by no means IT professionals.

The benefit of this approach is such that the SMEs can critique the data and perhaps introduce corrections & enhancements prior to the data being outputted into the desired platform.

Development of XML documents into other generic aviation products

Aviation training

We have already discussed at length the potential opportunity that XML offers as a documentation tool that can be used throughout global aviation. One further development opportunity that needs discussion is the application



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of XML repositories to the development of training courses and aids.

Airport infrastructure — hangars, passenger & cargo terminals, airfield ops etc

The beauty of XML based software is that its applicability is almost infinite. The operation of any airport, much less international hubs, is a complex business of logistics, facilities management and engineering. Koala's approach is to utilise pre-developed technological demonstrators for, say, aerodrome manuals, whilst bringing their AIP experience to bear with regard to SOPs. Koala's Dennis points out that any penetration into airport infrastructure is

still very much in the early stages, but it is an exciting new opportunity for the business.

A key challenge for this kind of project will be the accessibility of information by all personnel associated with the operation. The questions that must be asked are:

- 1 Does the required data need to be instantly available or 'on-demand'?
- 2 Does the data need to be mobile?

If the answer to both questions is yes, then there will be a need for not only an on-demand software platform, but for it to be portable in terms of the technology that the software is mounted on.

The last thing any operative wants is to have to balance a heavy 15" laptop in one hand whilst driving a vehicle or walking in the course of the required activity. This is patently unsafe. The solution perhaps, is to select a product that is a fraction of the weight, and not as bulky to handle, whilst doing something else at the same time. The latest raft of 'Android' based tablet PCs will be a significant inclusion into a value-added sales package.

Additionally, airport infrastructure needs to revisit IT infrastructure in terms of gaining access to updated information by means of Wi-Fi. As a case in point, Koala has developed aerodrome manuals, and entirely mounted the information on an Android-based tablet. The benefit of which is twofold:

- 1 All of the required information is entirely accessible to the operative in his or her hand, anywhere in the airport, terminal, hangar or back-office.
- 2 Updated information can be easily uploaded into the tablet by simply walking into the terminal or office and engaging with a Wi-Fi connection.

Initially, the data repository is constructed utilising a standard called Darwin Information Typing Architecture (DITA). Prior to updating any particular module, or document in this regard, an assessment has to be carried out as to the impact that the change will make. For example, a particular module may be used by this Manual 1, training course 2 & Manual 3.

When the module has been updated, the system is therefore capable of changing the three previously mentioned documents. However, the system is also capable of withholding a particular update from a particular document, so the software provides the flexibility of a complete update in one go, or completing selective updates of particular

documents. The benefit of the single source approach is that it can be updated at a single point that can be automatically disseminated to all of the intended targets.

Safety awareness & XML

A strong background in risk management is essential to safety awareness, and for any development project. Comprehensive risk registers need to be developed, together with the application of failure mode effect analysis & fault tree techniques. Fault tree analysis will pinpoint the quantitative contribution each risk element makes to the overall risk, and likewise will quantify the reduction of overall risk when taking mitigating actions to counteract a particular risk element.

One of the bigger challenges that the industry seems to be wrestling with is that of a lack of universal standardisation. Legacy documents have traditionally been simple black & white affairs and suffer from the absence of any colour convention. Most notable is that the convention of green for information, amber for caution, and red for warning simply does not exist in any legacy document. Other issues include the use of CAPITALISATION, which is strictly not allowed per CAP 676 where the author needs to emphasise a particular point, or elevate the importance of a particular piece of data.

Virtually none of the legacy documents apply these conventions. The concern is that there are an inordinate number of flight manuals that follow the capitalisation convention, which is in complete violation of CAP 676. It seems apparent that two standards are in play in this regard – an industry standard and a regulatory standard. Koala’s response is one of pragmatism & realism, and Dennis points out that standardisation can only be completed through subtle persuasion and professional recommendation. “We can’t force someone who works for an OEM to write the manual in a certain manner,” he explains.

The only thing that can be done is to point out to the OEMs & the operators that:

- 1 The CAP 676 convention should be strictly followed, and failure to do so is actually a violation.
- 2 There are no additional cost penalties changing the existing documentation to the CAP 676 standard as opposed to doing it the old way.

XML based documentation techniques contribute to or enhance safety awareness. However, it is important to stop viewing documentation as an art, and start treating the



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discipline as a science, since the aviation product also incorporates the documentation.

The principle object of aviation is one of safety, therefore, badly or incorrectly documented procedures can and usually do contribute to potentially catastrophic events. An area that would benefit the most from an integrated ‘safety awareness’ approach through documentation is human factors based maintenance. The question of elevating maintenance human factors & CRM to the next level should result in continuous safety awareness. The ‘Law of Primacy’ suggests that if an aviation professional has been taught in a certain way, then it is difficult to ‘un-teach’ him, and then train him in the right way. Therefore it is important to ensure that the documentation is correct from the outset, not only factually, but also in the way it is presented.

Conclusion

Well written documentation which is well presented, at the right time and in the right way once promulgated throughout the organisation inherently promotes safety and best practice, on condition that it is well integrated into a system that copes with change by just pressing one button. Therefore it is important for all of aviation to realise that documentation must be considered an integral part of the product, rather than as an irritating add-on. ■



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