Mouse-operated? The future of technical training

The pressure of evolving technology is constantly changing the role of the maintenance technician. Laptops on the ground now interface with the aircraft and the ability to interrogate onboard systems is an essential skill. *Daniella Horwitz* spoke to five companies about technical training requirements.

Today training requirements for an aircraft maintenance technician are very different from what they were a decade ago. Some of the old troubleshooting skills have been lost, but this is mitigated by the fact that aircraft now require a different type of maintenance. On modern aircraft the maintenance technician can function check many of the systems using the centralised maintenance system (CMS), effectively allowing him to isolate faults from the flightdeck. Steve Pennington, director of maintenance training for Alteon, Boeing's commercial aviation training unit, observes that aircraft systems are more integrated then they ever have been, and the CMS much more powerful — "The 777 led the way for us with an advanced central maintenance function and the 787 takes that to the next level."

The A380, 787 and 777 are complex aircraft and technicians need to be trained to an extremely high level of confidence to be effective working on them. Much of the complexity derives from the software functions, or the way that the system is designed and built. Software updates or reloads are a major maintenance task — not the case 15 years ago. As David Benoff, a director of Connecticut-based maintenance training provider, Global Jet Services (GJS), notes, nowadays airframes, data buses and engines are intertwined and troubleshooting and rigging is more about how one uses a laptop and less about measuring for clearances and adjusting mechanical limits.

At the end of 2008, Lufthansa Technical Training (LTT) went live with its new A380 maintenance simulator in Frankfurt. While planning for the launch, the company learned that multiple servers are necessary for each workstation to run the simulation. "Yes, the systems get more and more complex. But not only the avionic systems — think about the new multiplex entertainment systems, the highly sophisticated seats and cabin intercom and all other data systems," says Klaus

Schmidt-Klyk, VP marketing, sales and business development at LTT.

"This is not an area where simple discussion will suffice", explains Mike Lee, director of maintenance training, at New York-based aviation training company FlightSafety International. "Our customers, regardless of the operation they are working in, must be able to utilise the technology to maintain the aircraft. This is not an area where you can think or hope you know how to do it when it the time comes — you must know how."

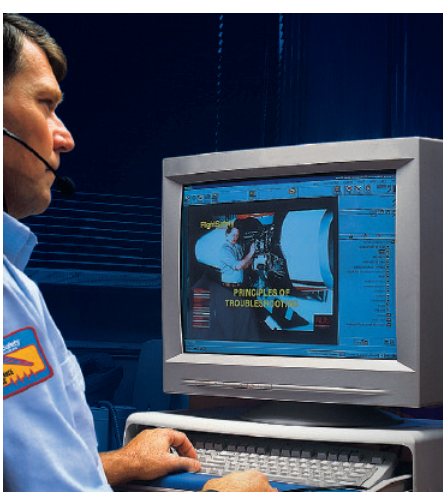
Modern components are electronically operated and integrated into the aircraft systems - today engines/airframe/electronics can be regarded as one field. To a large extent avionics remains a separate field, but the B1/B2 license structure means that technicians have to pick up some avionics knowledge to become B1 certified (B1 is an engine/airframe/ electrical systems qualification and B2 is an avionics qualification). As aviation feels the effects of the downturn, there is a strong driver for the workforce to get dual qualifications — airlines are likely to retain better-qualified personnel. Lee adds that avionics specialists are also seeing great changes in their area of expertise with the advent of the mouse-driven cockpit and he is certain future avionics technicians will come from the IT discipline.

Evolution of training methods

The combination of methods used to effectively train a quality maintenance technician has increased. Schmidt-Klyk says that due to new legal requirements more task-oriented practical training, either at the aircraft or by using maintenance and flight training devices (MFTDs), is needed to improve the skills of mechanics or trainees. In recent years e-learning has formed a bigger part of the training at LTT because of the flexibility offered. He says this applies in particular to their EASA Part 66 Basic training for Modules 11 to15 where a combination of computer-based training/web-based training (CBT/WBT) combined with practical elements pays off.

Jeff Roberts, group president, innovation, civil training and services at CAE, a global provider of integrated training solutions, says in 2002 the company introduced a training philosophy and simulation-based tools that have changed the way maintenance technicians train today. CAE's interactive 2D and 3D trainers run on the same simulation software as the full-flight simulators and give technicians the opportunity to perform and rehearse practical operations in realistic conditions, without any safety risk. "Technicians need to learn by doing, so we are providing practical and operationally-oriented learning programmes on virtual aircraft that each student can work on independently and as many times as need be, either in the classroom or at a convenient location. This improves retention and instils good judgement skills while continuously reinforcing the technicians troubleshooting capabilities, which is ultimately how training translates to operational effectiveness," explains Roberts.

At FlightSafety, there have been two major changes to training methods in recent years. Firstly, the company has developed and begun using the Matrix system, which uses the simulator code throughout the entire training process. This vertical integration allows the company to present the same simulation in the classroom and on the training aids that customers are used to only seeing in the simulator. The second change is the incorporation of practical training within the classroom. FlightSafety, in partnership with Gulfstream, has introduced the total technical training (TTT) programme which integrates the classroom with practical on-the-job training utilising the aircraft, test benches, 3D animation and simulation. "This extremely successful format provides realism for the technician that has not been obtainable with previous methods. We will be incorporating this training technique with other OEMs in the near future," says Lee.



At CAE courses have been adapted to improve a technician's troubleshooting skills, and new ones have been made available post-training. Programmes are decreasing in length and becoming more modular, cutting the amount of time technicians are taken off the line for training. A greater variety of courses is also being made available online and available for on-the-line training. "We've also seen the use of more computer-based synthetic/simulated devices in training, reducing the need for higher end large-scale simulation devices or actual aircraft," says Roberts.

Synthetic training devices, such as desktop simulation and photographic training aids, have long been used to supplement theoretical training; however, Pennington sees an increased acceptance of them as a viable alternative to training on a live aircraft. He says technology advances mean a wider range of training devices allow trainers to bring the aircraft into the classroom and offer a more interactive, controlled learning environment than can be achieved on the hangar floor. The benefit is that it makes practical training safer and cheaper (limiting the need for an aircraft to be out of service), while offering a high-quality learning environment.

Can a computer ever replace a human being? The 787 and A380 have extremely sophisticated ground support and aircraft maintenance tools, all of which are computerised. It is hard to see how one could teach those aircraft without access to computer-based tools. Flight training is one area that makes extensive use of CBT to replace the instructor. CBT is a good resource for filling in the gaps until it is time to take another instructor-led class. Benoff expands: "A student takes an initial class on avionics for a specific aircraft. Even though they come back armed with knowledge, they will forget things over the next year. By introducing CBT, that same student can use the illegible notes he/she took along with the computer and keep knowledge levels up to speed. This improves a technician's response time to downing gripes."

CBT is a standard part of the maintenance training curriculum. It is highly interactive and entertaining for students, however, instructors regard it as no more than one of many important teaching tools. Roberts explains: "CBT remains a desired mode of training for certain types of training while instructor-led training is more suited for other types. CAE sees a blended training approach as the ideal training method. The role of the instructor is changing, they are required to do less in the area of dispensing information and more in diagnosing styles and challenges and

accelerating learning." Pennington views CBT as a misleading term — "it really covers everything training schools offer today, but one should be careful to delineate between computer-led training, distance training, student-led training and instructor-led training".

Only human

Up to 80 per cent of aviation incidents and accidents can be traced to a human action. This is why pilots and maintenance technicians undergo Human Factors (HF) training, which focuses on they way humans relate to their environment and is designed to prevent 'human error'. Open communication and the utilisation of all available resources is a fundamental principle of HF training.

FlightSafety views HF training as crucial because the increase in technology and complexity of equipment demands total communication between all those working on, or operating, the aircraft. The company's offerings in the HF field are wide-ranging and many programmes have been added by its shared resource provider, GJS. This company uses safety management systems (SMS) and aviation interpersonal maintenance management (AIMM) tools to implement HF best practices. "A person can be aware that they have distractions in their life through human factors, but SMS addresses how the hangar will deal with it, and AIMM teaches the individual how to resolve it," explains Benoff. CAE's new e-Learning HF course heightens awareness of factors that cause human error, better enabling students to assess a situation

and recognise a chain of events that may lead to an accident or incident.

Alteon had previously seen HF as a standalone course, but now increasingly views it as an integrated part of the training programme. Pennington explains: "When we talk about practical training, maintenance is really a skills-based function, which you don't really carry out on your own; you carry it out as part of a team. The HF element is important for students to understand. We encourage them to work more as a team and consider not just the technical aspects of what can impact the function, but the human interactions as well."

Trends

Traditionally maintenance technicians receive theoretical training followed by practical and finally on-the-job-training. However CAE believes the spread does not optimise the learning, nor does it promote reaching the training objectives in the quickest way. It states that when theoretical and practical training are taught hand-in-hand — now possible with more synthetic devices — students absorb the materials better. The objective is to mix theory and practice in an optimal way to create a better competency-based training environment.

In the US there is a trend towards competency-based training. Outside the US, there is a trend towards the hour-based model. Most training organisations are trying to balance their curriculum to meet all regulatory requirements, not just domestic requirements.

The hours-based model is viewed as somewhat outmoded because it is not a failsafe way of testing a student's ability. "I would like to see a much tighter regulation of basic training than we do at the moment... Really you can only ever be certified to do a job, if we know that you are competent to do that job," remarks Pennington.

An example of successful competency training is the 'white glove' approach. This is non-intrusive troubleshooting from the flightdeck, using cockpit indications, training manuals and wiring diagrams, requiring in-depth system knowledge. Benoff notes that many technicians attack a gripe by breaking out the tools and pulling off panels, without taking the time to understand the problem. But usually the answer is in the fine details. Before diving in, the technician needs to confirm the fault, and isolate the probable cause (root cause analysis) by interpreting the indications. Pennington adds that fault isolation is a highly-skilled task and that the actual physical replacement of a component requires a lower skill set. The white glove approach is also a safer action because technicians are not climbing over the aircraft trying to perform different tests in a hazardous ramp environment.

Economic constraints

Many airlines are looking to defer orders in 2009, and one could expect a slackening of maintenance demand. However, Benoff says there will always be a need for qualified technicians and it is non-certified technicians that may be hurt by the recession. Lee thinks that while new technicians are coming out of the initial training programmes, there is a lack of current technical aircraft knowledge: "The gap between basic training and aircraft specific training is growing wider by the day as new technologies come on line at a record pace. The number of initial training schools continues to drop in the US and that seems to have something to do with the relevance of their programmes."

LTT believes that current circumstances give training institutions time to cope with the upcoming problem of maintenance manpower demand in the world. Schmidt-Klyk explains: "In the next two years the demand for qualified mechanics will probably remain static due to the economical global crisis — but in 2011 it will rise disproportionately high as will expected man-hours. So between 2009 and 2011 we have to qualify mechanics to satisfy the demands in 2011 and beyond."

In Pennington's opinion, the question is more of a shortage of quality training facilities. These are costly to set up as they require instructors, expensive synthetic training tools and at least one aircraft. Also, without some kind of direct business tie-in, (such as Boeing-Alteon) financial returns are variable.

Often, training budgets are cut during a downturn. Some training providers have training packages that are pre-purchased one to five years in advance. This type of agreement allows customers to continue to train at a consistent level regardless of current economic factors. Another plus is that customers can identify the technician to be trained just prior to the course, allowing them not be locked into buying a course for a particular technician two years ahead. Pennington says: "The challenge to me as the OEM training provider is to find more effective ways of getting our training out to the airlines, so they still continue to receive best quality training, within some kind of financial model that works for them. We all know that training has a direct impact on safety and none of us want to see our industry's reputation for safety impacted in any way."

Essential characteristics

With all the issues discussed in this article, the characteristics of the maintenance technician are probably the one thing that does not change. "I think ideal aircraft maintenance technicians are the same as ever — professional, safety-orientated technical specialists. They have well developed practical skills, a very high level of decision-making capability and the desire to carry on learning throughout their career," declares Pennington.

Benoff believes it is necessary for a maintenance technician to have a positive attitude. "It's contagious and it makes working together in the shop enjoyable. We have enough pressure and negative press nowadays. Keeping it enjoyable and working together as a family is what turns a job into a career." He also believes that mentorship is very important. "Senior technicians have a responsibility to mentor the junior technicians, so they too can pass the knowledge along."

Lee thinks that a 'need to know' and cognitive thinking skills are the most important attributes. "They must continually strive to know everything they need to about their profession and the aircraft they work on. The safety of the occupants of that aircraft is and will always remain our paramount responsibility. To meet that responsibility, the technician must be able to logically and systematically diagnose and correct any system malfunctions or deficiency that requires cognitive- or linear-thinking skills."