

787 Training for Pilots and Mechanics

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ADVANCED TRAINING
TECHNIQUES RESULT IN
SHORTER, MORE
EFFICIENT TRAINING
FOOTPRINTS.

Believing that the new digital technology of the 787 Dreamliner required a digital training solution to maximize training effectiveness and value to customers, Boeing has developed an all-digital, Internet-based teaching system for flight and maintenance training, along with training tools that connect real-time to a virtual airplane and airplane systems. The use of personal desktop computers, interactive computer-based training, three-dimensional images, and desktop simulation make it possible to do much more efficient training. Modern flight training devices and simulators combine with these tools, digital delivery, and currency based on fleet commonality to offer significantly shorter courses than on previous Boeing training programs. These new training programs are available at subsidiary Alteon's global network of 787 training locations.

In much the same way that training moved from viewfoils on the 747, 757, and 767 to electronic training for the Next-Generation 737 and the 777, the training system and new simulation devices for the 787 use technology to take learning to the next level.

But the 787 training program is more than just a training program. A strategic decision was made to build an electronic performance support system rather than a traditional training program. It is designed to be an integrated electronic environment that's available to, and easily accessible by, each trainee and structured to provide immediate, individualized access to a full range of information, from flight and maintenance technical

documents to airplane troubleshooting and systems information. These programs are offered through Alteon, Boeing's training subsidiary.

This article describes Boeing's development of a new training program from the ground up that takes advantage of and complements the 787's design and technology, e-enabled and digital technology, and respect for the environment. It also outlines the guiding principles behind 787 flight and maintenance training. All training programs detailed in this article are subject to regulatory agency approval and may be modified during the approval process before they can be used to train airline pilots and mechanics.

Technological advances in the airplane inspired similar technological advances in training. This approach puts the trainee as close to the actual airplane as possible.

TRAINING TECHNOLOGY INSPIRED
BY THE AIRPLANE

The new 787 training system reflects many of the advanced technologies in the 787 Dreamliner itself. This approach puts the trainee — whether in flight training or maintenance training — as close to the actual airplane as possible. The effectiveness of this approach means shorter, more efficient training footprints. For example, a 777 pilot can complete 787 flight differences training in five days with no full-flight simulator, and the maintenance training Line and Base Course is 50 percent shorter than the 777 course. Distance learning options reduce time at the training center and prepare students for formal training.

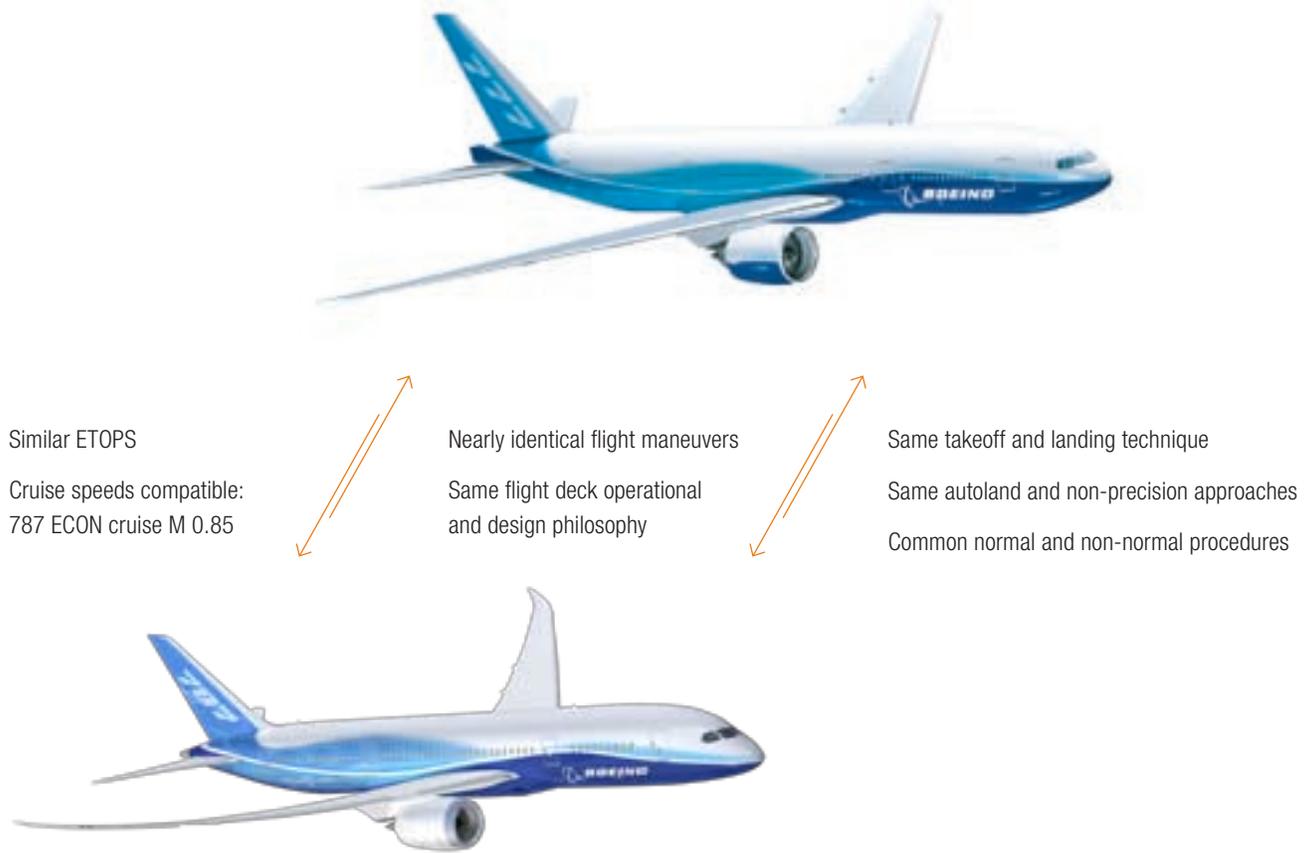
Simulation-based training. One of the objectives of the new training system is to replicate the airplane — not just the flight deck — and bring real, performance-based information to pilots and mechanics. This led to the use of real-time simulation in the maintenance training environment that allows practice on the same tools in the classroom that the mechanics actually use in the field on the airplane.

It also inspired the use of flat panel, touch-screen trainers that have simulated functionality, as well as real hardware where tactile feel is important. These simulators can be used to train pilots on all aspects of operation, including the new heads-up display and electronic flight bag features of the 787 without the need for costly fixed-base simulators.

**HIGH DEGREE OF PROCEDURAL COMMONALITY
BETWEEN 777 AND 787**

Figure 1

The high degree of commonality between the 777 and 787 means it will take as few as five days of training for 777 pilots to qualify as 787 pilots.



E-enabled and digital technology. Technological advances in the airplane inspired similar technological advances in training. For instance, the airplane is e-enabled and so is training, including training delivered just in time at the point of use. The development work in progress targets a Web-managed, distance-learning capability that brings training to the trainee in a paperless training environment. Enhanced technical data for flight training will include linkable features in the Flight Crew Operating Manual and Flight Crew Training Manual. The system also provides training that familiarizes mechanics with the 787's real-time, current airplane performance support data that is accessed through the Web portal MyBoeingFleet.com.

Respect for the environment. An e-enabled airplane supports a more environmentally progressive training solution. Distance learning enables more training to be conducted locally. Digital Web-managed training, training support products, and the use of tablet personal computers for note-taking eliminate the need for paper along with the attendant production waste, transportation, distribution, storage, and revisions.

FLIGHT TRAINING

The philosophy behind the 787 flight training program is to leverage airplane commonality with the 777 and other Boeing models, enable students to achieve a high degree of proficiency, and continue to build on the success of the Shortened Transition

and Rating (STAR) courses. The STAR courses reduce the transition time for pilots current on other Boeing models by eliminating tasks and objectives that are common between those models and the 787. In keeping with the concept of training technology inspired by the airplane itself, 787 flight training incorporates modern simulation tools, Web-managed academics, and performance support data to provide an effective training environment that mirrors the actual airplane. Training is available through Alteon, Boeing's training subsidiary, at a global network of 787 training centers.

Commonality. The 787 is designed to be operationally common with the existing Boeing fleet, with the highest commonality with the 777 (see fig. 1). For instance, even though it may look



787 FULL-FLIGHT SIMULATOR

Figure 2

The 787 full-flight simulator is a Level D device with six degrees of freedom; wide day, night, and dusk visuals; and selectable customer options. It includes dual heads-up displays and electronic flight bags and a brief/debrief station. The line-oriented simulation training verifies proficiency in normal procedures. The simulator is

designed to train pilots to become proficient in visual maneuvers, instrument landing system (ILS) and non-ILS approaches, and missed approaches using integrated approach navigation, non-normal procedures with emphasis on those affecting handling characteristics, and wind shear and rejected takeoff training.

different, the 787 flight deck operates just like the flight deck on a 777. As a result, it takes as few as five days of training for 777 pilots to qualify as 787 pilots. The pilot pool for operators of 777/787 mixed fleets is the same, and 787 pilots will spend less time training and more time flying.

The commonality extends to other Boeing airplanes as well. For example, Boeing is developing other short courses, such as a course from the 767 to 787, which could be as short as eight days. (As a comparison, it would take more than 21 days to train these pilots to fly a non-Boeing airplane.)

Proficiency. 787 pilot training is based on a complete, detailed task analysis of pilot actions required to fly the airplane. These tasks define the pilot knowledge, skills, and crew resource management abilities necessary to perform those actions. Systems instruction is reinforced with hands-on

training. Pilot training courses meet the regulatory requirements of the U.S. Federal Aviation Administration and the European Aviation Safety Agency. Courses are approved for Federal Aviation Regulations Part 142 and Joint Aviation Requirements-Flight Crew Licensing (Type Rating Training Organization). Course lengths may be adjusted based on the pilot's experience and English language ability, and can vary based on individual operator circumstances and requirements.

Shortened transition and rating.

STAR courses allow pilots with experience on different Boeing models to train together, giving both the airlines and their pilots more flexibility.

As a comparison, courses to train pilots on non-Boeing models require that the pilots have identical backgrounds and career paths to train together. This requirement forces airlines to send the crews through more costly full-transition training.

A global network of 787 training centers. Alteon will have nine full 787 training suites around the globe to support the growing number of 787 operators. Having 787 training centers closer to customers' home base reduces operators' training-related costs, such as crew downtime.

The locations include two in the United States, and one each in China, England, India, Japan, and Singapore, with two locations yet to be announced. Each training suite includes a full-flight simulator (see fig. 2), a flight training device (see fig. 3), desktop simulator-based training, maintenance training tools, and a door trainer. Most of these Alteon-designated 787 centers will be ready for training in advance of the first airplane delivery.

787 launch customer ANA (All Nippon Airways), as well as Northwest Airlines and Shanghai Airlines, are home to three of the Alteon training centers that include 787 training suites and sophisticated maintenance training classrooms.



787 FLIGHT TRAINING DEVICE

Figure 3

The 787 flight training device provides flight crews with the same flight management and control systems as the full-flight simulator, making it ideal for instrument familiarization and reinforcing knowledge of airplane systems. It develops proficiency in all normal procedures, simple non-normal procedures, the flight management system, autoflight operations, and display operations, including electronic flight bags and heads-up displays. It also enables flight crews to become familiar with complex non-normal procedures.

Flight Training Courses and Services

Boeing 787 Flight Training offers a number of options designed to match the experience and needs of a wide variety of students. Below is a list of offerings.

Full Transition Training

20 days

Shortened Transition and Rating (STAR) Training

13 days

777 to 787 Differences Training

5 days

Airplane Training*

Route and Line Training (Initial Operating Experience)*

Instructor Pilot Training*

Dispatcher Training

5 days

Performance Engineer Training (Generic)*

787 Emergency Exits/Doors Training

1 day

Flight Attendant Transition Training

2 days

* The number of days varies depending on the airline and regulatory requirements.

Note: Course lengths listed are targets and may change subject to task analysis/course design, validation, regulatory approval, and airplane design changes.

Rather than having to use a standard training program, operators who purchase the 787 Dreamliner can select from a variety of training resources.

Distance learning. Distance-learning training options enable students to complete portions of the computer-based training segment of a selected course at their home station prior to arriving at the training center. Individually paced, highly interactive computer-based training is available for all airplane systems and can be customized to major airplane options, including engine type, displays format, and units (pounds or kilograms). The courseware is managed through Alteon's online Learning Management System.

Training flexibility. Rather than having to use a standard training program, operators who purchase the 787 Dreamliner can select from a variety of training resources. Each customer receives "training points" that may be redeemed (until two

years after its last airplane is delivered) for a choice of Alteon training services (see "Flight Training Courses and Services"). This allows airlines to customize training packages to meet their unique training requirements.

MAINTENANCE TRAINING

The maintenance training program for the 787 leverages and integrates with the data support program of the airplane data support program. The emphasis is on performance support with the fundamental premise of the training program being to help airlines use the electronic data tools quickly, efficiently, and with confidence. Specific features of the program include:

MAINTENANCE PERFORMANCE TOOLBOX

Figure 4

The Boeing Maintenance Performance Toolbox is an electronic performance support system designed to provide assistance in learning and performing tasks.



Simulation of the work environment.

This new training approach maximizes the use of actual airplane maintenance data in the classroom environment. Students practice using a laptop computer to troubleshoot real-world scenarios. Because the laptop is the main troubleshooting tool on the 787, the classroom practice exactly replicates the actual work environment. The primary interface for 787 support data is the Maintenance Performance Toolbox (see "Maintenance Performance Toolbox," *AERO* first-quarter 2007), which accesses maintenance procedures, fault isolation procedures, parts information, and other maintenance data in electronic form on a laptop computer (see fig. 4). At the conclusion of the training program, 787 maintenance training

students are able to effectively use the Toolbox to troubleshoot and solve maintenance issues.

Performance-based. 787 maintenance training focuses on better job performance rather than on system knowledge. Though system knowledge is necessary for effective performance, it is more important for the training program to have a solid foundation of learning objectives and base the training on measuring how effectively the students can accomplish the objectives.

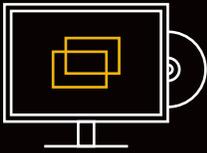
The training program integrates the classroom and the airplane operational environment. This involves two distinct elements. First, the classroom environment is student-centric, not instructor-centric. The majority of activities involves higher-level learning in which the students analyze and

evaluate real-world problems and then solve those problems to a specific level of proficiency. Second, student evaluation goes beyond multiple-choice tests. Evaluation focuses on a higher level of knowledge, with an emphasis on comprehension, application, and analysis of information.

Web-based. Portions of the course, such as a pre-course assessment, are available any time, any place via the Web through the Alteon learning management system. In addition, maintenance and training data are available through MyBoeingFleet (see fig. 5). The key element is to make the information easy to access and compatible with the connectivity required to access other 787 support data.

The Three Pillars of 787 Maintenance Training

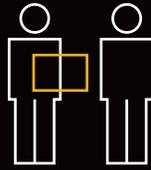
1



Foundation Training

includes an initial assessment of a student's level of knowledge and a subsequent "prescription" of training materials to prepare the student for classroom (i.e., formal) training. This ensures the student's understanding of certain system concepts (such as central maintenance computer or engine indicating and crew alerting system messages) before the formal classroom training begins. The foundation training is delivered on a digital video disk (DVD) or via the Internet. Alteon's learning management system monitors the results of a student's assessment test, determines training modules that must be taken, and monitors completion of these modules.

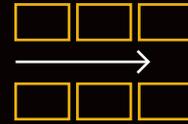
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Formal Training

is the classroom portion of the training. The training includes instructor-led sessions, student-paced computer-based training, and a series of troubleshooting exercises that are line maintenance scenarios. Assessments, including exams and other methods of evaluation, are given throughout the training to measure student achievement of the objectives and to assess student performance using the electronic troubleshooting and data support tools, such as the Maintenance Performance Toolbox. The students' proficiency in obtaining data is also monitored to ensure they are using the Toolbox efficiently. This provides an assessment of how well students will perform required tasks when they return to their jobs.

3



Future Training

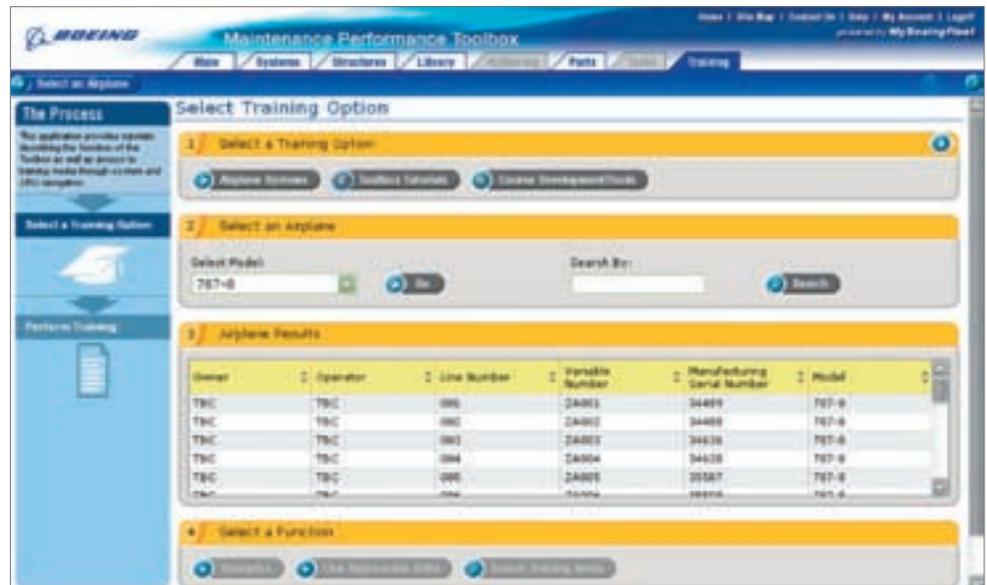
is the ability to access maintenance support data to provide just-in-time training at the point of use for 787 maintenance personnel. All maintenance support data used for training is accessible by the airlines' mechanics and engineers at any time. Boeing also will research future training opportunities to assist the airlines (i.e., creating training for a new change to the airplane).

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ONLINE TRAINING ANY TIME, ANY PLACE

Figure 5

787 maintenance and training data are available through MyBoeingFleet.com, a secure Web portal that is available to Boeing airplane owners; operators; maintenance, repair, and overhaul shops; and other third parties.



787 maintenance training focuses on better job performance rather than on system knowledge.

Just in time at the point of use. By using electronic tools in the classroom, the training directly carries over to the work environment. This facilitates the mechanics' ability to review maintenance support media when and where actual maintenance occurs.

Shorter, relevant courses. By reducing the amount of instruction that is standup, direct, and knowledge-based (rather than performance-based) and focusing on using electronic performance support tools, the courses achieve their objectives in much less time.

SUMMARY

The goal of the Boeing 787 Dreamliner flight and maintenance training is to provide a digital training experience for students, along with real-time, current support data that can be accessed by pilots and mechanics for recurrent training in the field and for online troubleshooting by the mechanic.

The new support data available on the 787, along with access via the Web portal MyBoeingFleet.com, allows for more efficient, high-quality training, and distance learning via the Internet, following formal training.

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