



AIRCRAFT VIRTUAL MAINTENANCE

A modern training solution students
need and deserve.



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Pinnacle's Modern Training Solution



Pinnacle Solutions, Inc. (Pinnacle) is an employee-owned business based out of Huntsville, Alabama with a global operational reach.

With famed special operations aviator Michael Durant at the helm, Pinnacle strives to be a leader in both the U.S. defense and international aviation industries. In support of our customers, Pinnacle leverages its broad range of experience in each of our three primary business areas – Engineering and Product Development, Services, and International Operations – to offer custom solutions tailored to the unique requirements of each customer. We view our customers as our business partners, working collaboratively to address their needs and the needs of their end users across all business sectors.

With a significant veteran and service member employee base, active programs, and long-term contracts focused on military aircraft maintenance, contractor logistics services, and training, Pinnacle has a unique view into the complex challenges our end users face in the field. This unique perspective has been vital during the COVID-19 pandemic. Now more than ever, Pinnacle has a clear view of our customers' needs for training and maintenance solutions adapted for the modern-day learning environment. Pinnacle's suite of virtual training products helps solve the limitations found in legacy training systems, which have remained virtually unchanged for decades.



Pinnacle's virtual training products line was established after we examined the significant limitations of existing training programs through the experiences of our veteran subject matter experts and active end users. Current legacy training programs utilize antiquated equipment that require physical proximity by those training and instructing. Additionally, working on physical equipment requires costly maintenance, as the hardware is susceptible to wear and tear after periods of use, and may even be dangerous. The inability to scale training on legacy devices represents another hindrance, since only a certain number of individuals can access the equipment required for training at any given time. All these weaknesses compound into what is currently an expensive, inefficient, and outdated training method.

Our customers and end users deserve a better training solution. Pinnacle's first order of business was addressing the need for physical access to the equipment. Our solution was designed to eliminate the risks to safety and equipment condition when interacting with physical hardware. Through the use of our virtual training products, we provide training instructors with a rich but flexible set of tools to facilitate the exchange of learning between experienced maintainers and the end users in training. By addressing and eliminating these legacy training weaknesses, Pinnacle delivers high value training in a significantly more accessible and cost-effective manner. It was with these requirements in mind that Pinnacle developed the Virtual Maintenance Trainer (VMT).

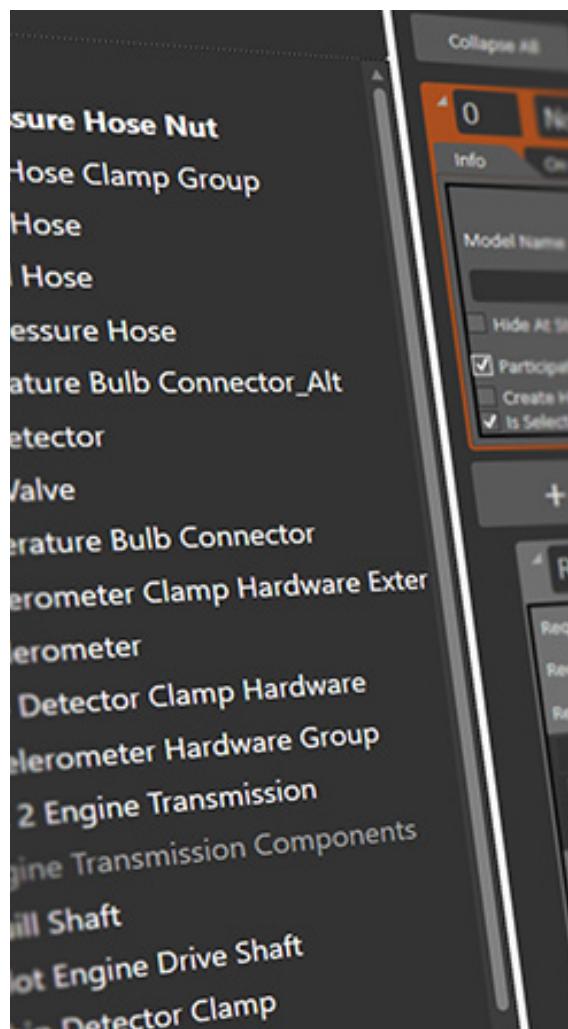
Virtual "X" Training

To develop the VMT, we created a powerful capability to support any organization's virtual training requirement through the integration of commercial off-the-shelf (COTS) software and hardware, custom processes, and development tools.

The Virtual "X" Training (VXT®) Core provides the development environment to reduce production time for all aircraft or equipment. In Pinnacle's VXT® suite, the "X" indicates that the VXT® Core can produce training products that support Virtual Training for any use case and any platform (e.g., aircraft, ground vehicle, unmanned system, radio, etc.). The "X" represents Pilot, Maintainer, Crew, Ground Support, or any other kind of training required.

Powered by VXT® Core, the VMT provides high fidelity virtual training as a service. The foundation of the VMT is the immersive 3D environment and highly accurate 3D modeled equipment. Utilizing the U.S. Government-approved or Original Equipment Manufacturer (OEM)-issued maintenance manuals and Subject Matter Expert (SME) knowledge, Pinnacle creates 3D models that serve as a virtual replacement to the physical hardware present in the field. As part of the 3D environment, end users use a comprehensive camera and navigation system to explore equipment and perform tasks free of physical constraints. Using the VMT eliminates any potential risks to student safety as they familiarize themselves with maintenance tasks.

While the 3D virtual environment removes the frustrations of physically navigating maintenance procedures, VMT user interaction is built from a robust simulation system. Simulating the 3D hardware interactions and properties ensures procedure performance accurate to what the end user will encounter in the field. This minimizes the probability of a student damaging an aircraft due to a lack of experience or dissonance between virtual and physical equipment. This benefit is further enhanced by VMT Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) integration. Students may use the VMT in VR, AR, or MR to interact with tools and parts that simulate movements and spatial considerations that will be encountered in the field.



Additionally, the VMT can serve as a robust solution for remote online training. Using any commercially available video conferencing software (e.g., Microsoft Teams, Zoom, GoToMeeting, etc.), our VMT is a convenient solution that removes the physical distance between students and instructors that is a barrier to effective training, or between dispersed users at diverse locations for maintenance task rehearsal. Pinnacle's VMT is a fully virtual solution, bringing the aircraft, student/technician, and instructor into the same room while physically distant.

The screenshot shows the Instructor Operating Station (IOS) interface. At the top, there are tabs for Student Station, Faults, Server Admin, Choose Student Lesson, and Course Admin. The Course Admin tab is highlighted in yellow. The IP Address is listed as 192.168.35.77. Below the tabs, there is a search bar labeled "Filter Students by Class:" with a dropdown menu set to "No filter".

Student List:

Student	Action
Student_01	▶
Student_02	▶
Student_03	▶
Student_04	▶
Student_05	▶

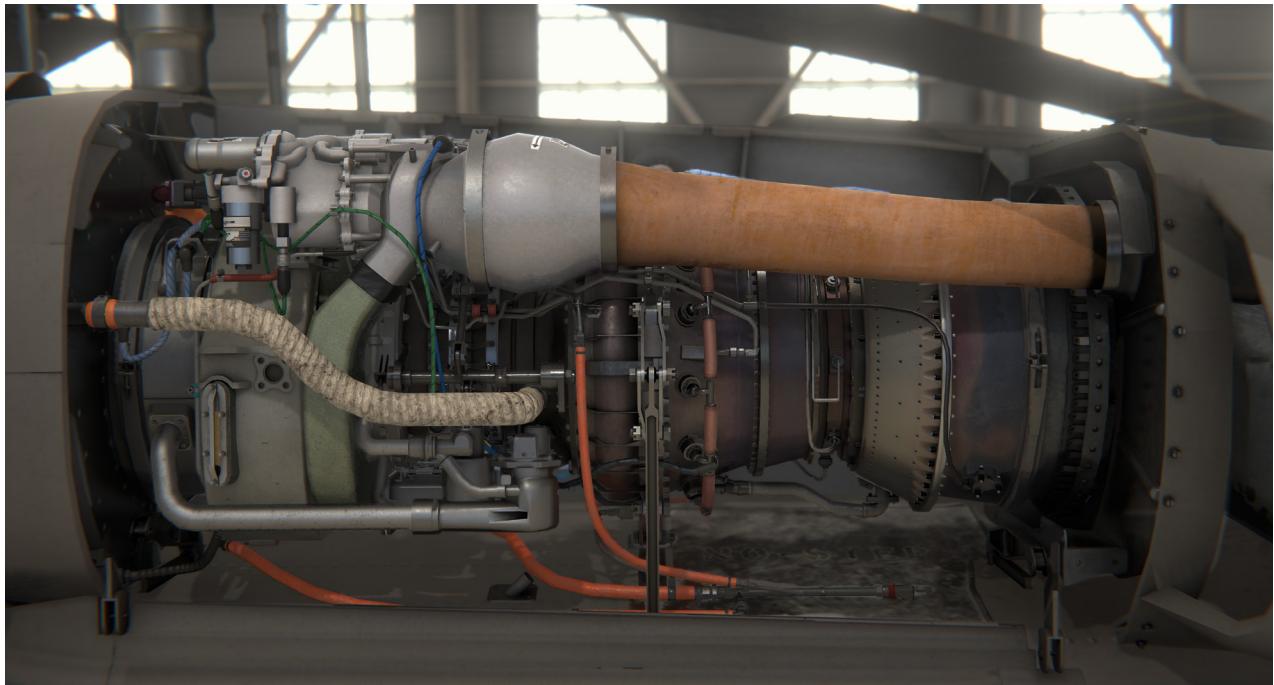
Student Progress:

Category	Task	Count
Doors	Doors : Introduction	-
	Door Seal Compression : Check	0
	Pilot and Cargo Door Repair/ Seal Repair : Removal	0
	Pilot and Cargo Door Repair/ Seal Repair : Installation	0
	Snapvent : Removal	0
	Snapvent : Installation	0
	Window Replacement : Removal	0
	Window Replacement : Installation	0
Hinge Replacement	: Removal	0
	: Installation	0
Drive System	-	-
	-	-
Engine Oil Supply System	-	-
	-	-

At the bottom, there are buttons for "Add New Class" and "Add New Student".

The VMT system is divided into two components, the **Student Station**, and the **Instructor Operator Station (IOS)**.

Simulation of the physical hardware and virtual environment is the staple of the Student Station. From the Student Station, users can practice all maintenance and repair tasks required to maintain the physical hardware. The IOS allows the instructor to monitor student station user performance and control all training or rehearsal scenarios. From the IOS, the instructor can create classroom setups, curriculum, and monitor class progress per student and lesson. The VMT system allows training to be directed by an instructor or to be self-paced by a student working independently. Several IOS features are available within the Student Station to facilitate the instructor's ability to examine on-screen virtual equipment closely. The instructor can also make notes and visual cues in a presentation format remotely on multiple workstations with students performing different tasks.



The VMT's underlying technical systems available through VXT[©] Core are adaptable to all measure of hardware and equipment. This allows for consistent internal VMT development across a breadth of platforms ranging from military aircraft, such as the UH-60M Black Hawk, to commercial grade tasks, like replacing a flat tire on a vehicle.

The breadth of tools and flexibility in virtual training applications provide a robust environment for instructors to define their curriculum. Pinnacle currently supports VMT training operations for the UH-60M, UH-60L, MH-60M, CH-47F, MH-47G, MD-530F, and C-208B aircraft across a wide range of fielding configurations based on end user needs, from full established classrooms to single multi use student stations.

By removing the physical hardware and bringing immersive training to students and instructors in all situations, **the VMT delivers the modern training solution students need and deserve.**



Pinnacle's VMT Whitepaper 2021
www.pinnacle-si.com