



AIT Drilling Technology

Flex Track, NCDJ Mini and Side of Body Drillers

and an integrated machine vision system, which performs machine-to-part referencing and AIT's scan and correct vision algorithms. It also offers optional through the bit coolant delivery, and a pressure foot that provides part clamp up, and skin position feedback for precise countersink control.

Throughout the drilling process, a single vacuum hose continuously picks up drilling swarf and coolant, maintaining a cleaner and safer work environment.

Onboard Control System

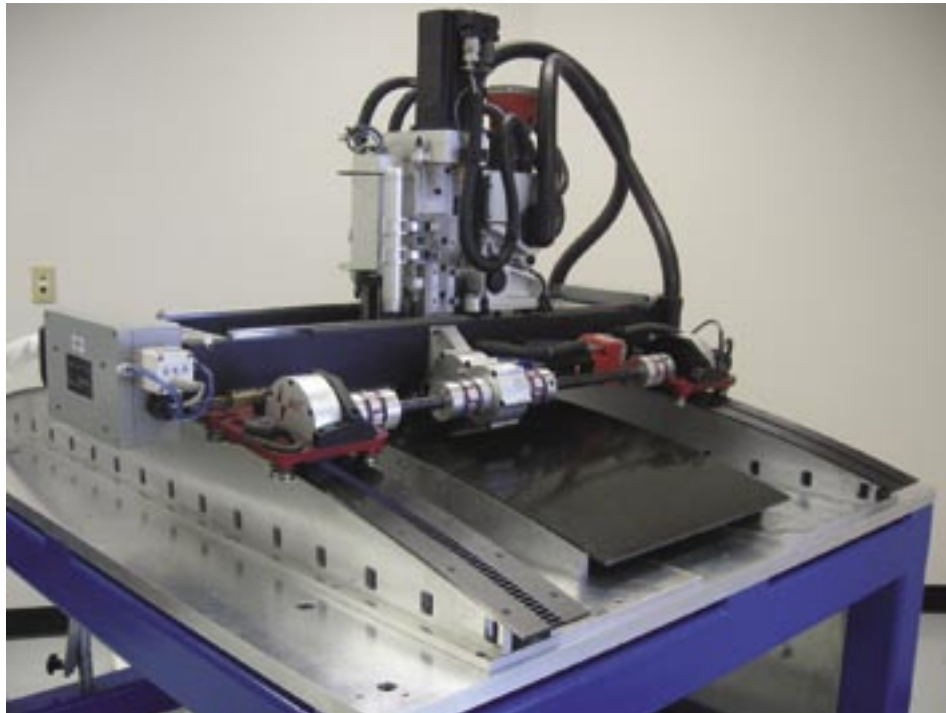
The onboard control system functions as the brains of the machine. The NC part program is fed to the integrated onboard control system, which interprets the program and directs the servo motors where to position the carriage assembly and drilling head. It also provides critical information about the part being drilled, such as RPM, feed rate, clamp force, tool geometry, and part thickness.

User Interface

The user interface of the control system is AIT's graphical user interface – or GUI, which is delivered to the operator via a

FIGURE 1 ◀ Flex Track driller with onboard controls.

FIGURE 2 ▶ Boeing 787, Flex Track driller at Everett, WA, facility



From the circumferential Flex Track driller to the patented Numerically Controlled Drilling Jig to the Side of Body Driller, AIT drilling machines offer robust, scalable, and flexible systems for any size aircraft. They are designed and developed specifically to speed the intensive process of drilling thousands of holes – all with incredible accuracy.

FLEX TRACK DRILLING MACHINE

The Drilling Unit

The lightweight drilling unit (Figure 1) sits on a dual set of flexible vacuum tracks affixed directly to the plane's fuselage (Figure 2) and conforms to the shape of the airplane. During the drilling, the unit rides along the track system, which also stabilizes the drilling unit and ensures accurate positioning throughout the drilling process. This engineered precision means substantially better quality and reduced rework for our customers – all equating to less time and money spent overall.

The carriage assembly accurately positions the drilling head in X and Y axes, using servo control closed loop feedback. The drilling head consists of a spindle with an HSK-32C tool holder interface



TECHNOLOGY OVERVIEW

pendant touchscreen computer. The intuitive touchscreen computer is inherently easy to use and simplifies the drilling process. By organizing similar control functions onto similar screens, this grouping feature reduces human error and speeds the overall drilling process. Plus, it makes the ramp-up to train others in its use a much shorter process. Operators don't even need to be familiar with CNC programs or machines to operate our drilling machine. They are able to get to work sooner with the AIT drilling system – usually within hours.

Features

- Machine vision system for scan-and-correct algorithm
- Drillers use standard CNC code with AIT-developed controls
- Multi-material stacks up to 1.125"
- Linear encoder for precision countersink control (0.003" depth)
- Drill spindle load cell to detect broken or dull bits
- Onboard control system

- Dual track drive system
- Titanium drilling capability (peck cycles, etc.)
- HSK-32C spindle interface
- Hole diameter capacity – 5/32" to 7/16" for composite, aluminum, and titanium stacks
- Simple, easy-to-use graphical user interface – with pendant controls
- Circumferential drilling stand that houses auto-drilling system and allows access to 100% plane circumference (Figure 4)
- Vacuum system collects chips and coolant

Flex Track Advantages

- Lightweight unit for portability, smaller "footprint," and cleaner factory environment
- Scalable for any size aircraft
- Intuitive GUI for ease of use, fewer human errors, and faster ramp-up

FIGURE 3 ➤ 767 mini driller on a transportation dolly.

FIGURE 4 ✂ Global Aeronautica 787 flexible tracks at Charleston, SC, facility.



FLEX TRACK DRILLING PROJECTS

Boeing 787 Dreamliner Flex Track Driller

- Four drillers per stand with 8 total supplied

Global Aeronautica 787 Flex Track Driller

- Simultaneous drilling within 4 quadrants
- Provide lifting mechanism for raising the satellite antenna components and tools

NUMERICALLY CONTROLLED DRILLING JIGS

To overcome many of the disadvantages associated with conventional drilling machines, AIT developed and implemented its mobile numerically controlled, multi-axis mini-drilling machines. In fact, a new wing design for the Boeing 767 in late '90s drove need for AIT to develop its patented Numerically Controlled Drill Jig (NCDJ) (Figure 3).

The small, mobile NCDJ possesses extensive computing power to download positions of hole sites and to control end effector positioning. The mini-driller conforms to various jig configurations regardless of the program model or position on the wing.

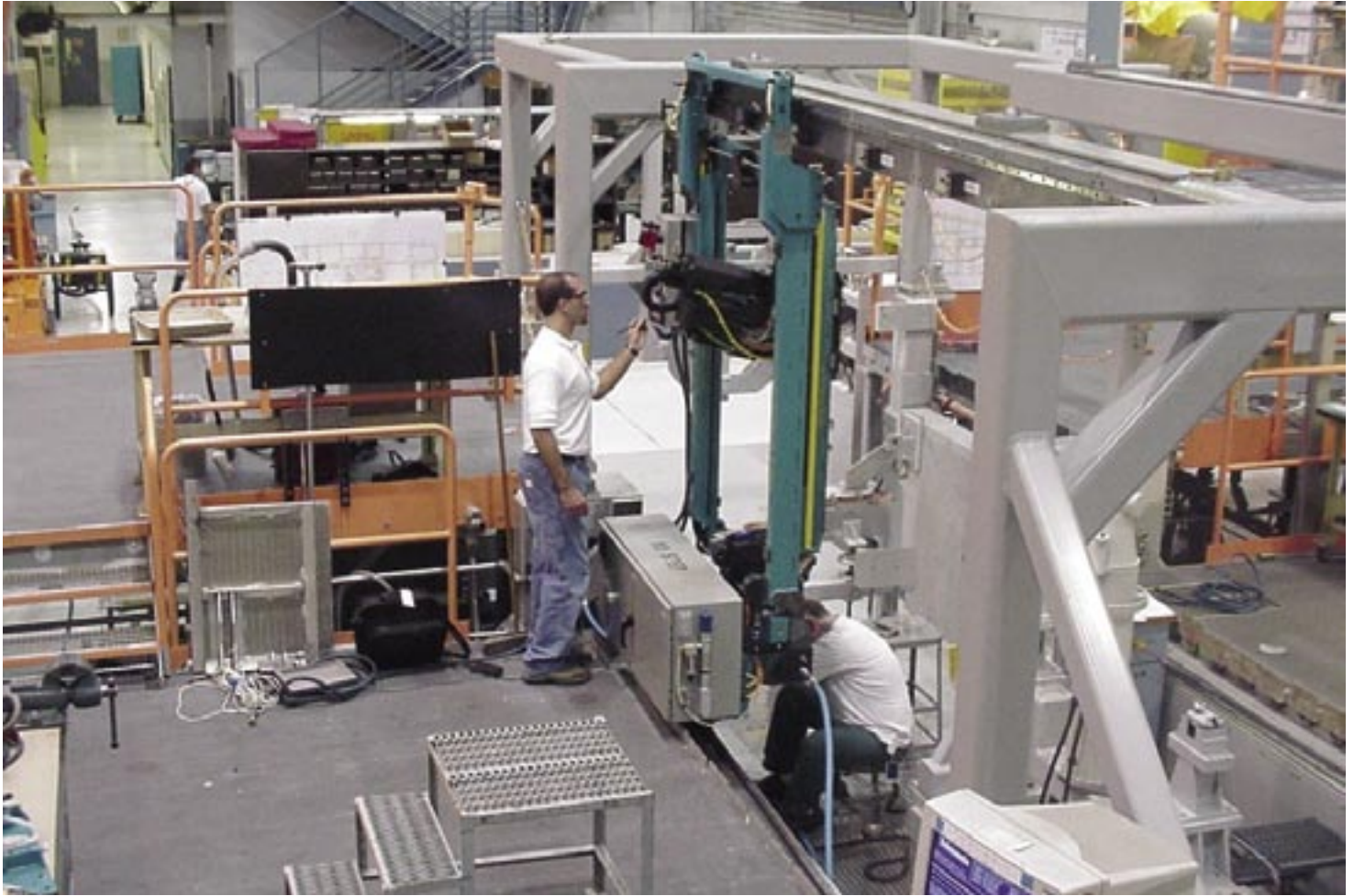


FIGURE 5 ▲ NCDJ 5-axis drilling machine used to drill F/A-18 forward fuselage.

Frame Assembly: The primary support structure for the mini-driller and its components – the axis carriages, the spindle, and the control system cabinet. Compact and portable so the entire machine may be stowed when not in use.

Control System Cabinet: The primary power distribution unit for the system, housing the servo motion controller or real-time controller (RTC), fuses and terminal blocks, master control relays, and digital I/O rack and servo amplifiers.

Spindle Assembly: Positioned by X and Y motors. The spindle drive directly turns the drill bit at commanded speed and direction. The spindle assembly feed drive (Z-axis) controls the rate at which the drill enters the spar. A lubrication system provides coolant to the drill bit during drilling. A vacuum system removes chips generated during drilling.

Pendant: A mobile touchscreen computer that serves as the operator interface for the system. It is mounted in a carrying case to allow mobility near drill location and portability with the mini-driller. Plugging the pendant into the system connects the pendant to the Ethernet network to interface with the RTC.

Boeing 767 Stage 2 Spar NC Drilling Machines

- Prime contractor/integrator
- Provided 8 mobile machines to drill pilot and full-sized holes
- Multiple flexible drilling machines share spar FAJ
- Automatically verifies drill bit before drill sequence

Boeing F/A-18E/F Forward Fuselage NC Drilling Machines

- Portable 3- and 5-axis drilling machines (Figure 5)

- Drill and countersink fastener holes in floors and panels
- Drill right- and left-hand fuselage panels in existing jigs
- Use scan-and-correct feature to index driller to subassembly

NCDJ Advantages

- Flexibility – Conforms to various spar configurations regardless of program model or spar hand and can work along entire length of spar
- Size – Maximizes work area while minimizing tooling costs with reduced driller size
- Ergonomics – Eliminates the need for movement of heavy powered feed drills from hole to hole, streamlining the manufacturing process
- Cost Savings – Eliminates need for fixed drill templates saving money associated with their design, fabrication, and maintenance



**Airbus UK A340
Leading Edge NC Drilling Machine**

- Mobile 3-axis drilling machine (Figure 6)
- Replaces approximately 200 Bushed Drill Templates
- Drill and ream up to 1" D holes in aluminum / titanium stack
- Drill in zones for multiple operations
- Drill 2 models and right- and left-hand spars

**Boeing F/A-18E/F
Outer Wing NC Drilling Machine**

- Stationary 5-axis drilling machine
- Drill and countersink fastener holes in outer wing assembly



FIGURE 6 » Airbus A340 leading edge NCDJ drilling machine.

FIGURE 7 » Global Aeronautica 787 Side of Body Driller at the Charleston, SC, facility.



SIDE OF BODY DRILLER

The AIT Side of Body Driller is a portable driller that may be moved between different assembly lines, as required.

Global Aeronautica 787 Side of Body Driller

- Stationary 4-axis drilling machine
- Drill and countersink fastener holes in 44 to 45/11 side of body
- Use scan-and-correct feature to index driller to subassembly
- Present drilling data to operator in M&G format and GUI
- Integral pressure foot clamp-up
- HSK-50C tool changer
- Onboard lubrication and vacuum system
- Drillers built complete at AIT Canada

Side of Body Driller Advantages

- Right-sized, lean manufacturing equipment
- Reduced tooling costs resulting from engineering changes
- Increased flexibility and ergonomics

About AIT

Advanced Integration Technology (AIT) is a leading industrial automation company delivering turnkey factory integrationsolutions to the Aerospace industry. Accustomed to managing multiple large, simultaneous, international projects, AIT has served as the full-scale integrator to some of the most prominent Aerospace companies' cutting edge projects. Relying on the strength of our diverse team of engineering pros, AIT has earned a leading position as the predominant turnkey integrator and prime contractor to the world's foremost Aerospace companies – including Airbus, The Boeing Company, Bombardier, Spirit AeroSystems, and Vought Aircraft Industries. Our precision-engineered technology and automation have enhanced the industry's ability to manufacture aircraft in less time and with greater exactness and flexibility. Learn more at www.aint.com



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