



# F-35 Joint Strike Fighter Electronic Mate and Assembly System

**Lockheed Martin:** Fort Worth, Texas **Project Year:** 2003



**VIRTUAL F-35** By creating a virtual mating first, the physical mating process produced a faster, higher-quality result.

**F-35 LIGHTNING II** A single-seat, single-engine, stealth-capable military strike fighter, a multi-role aircraft that can perform close air support, tactical bombing, and air-to-air combat.



## Achievements & Benefits

- Met affordability challenge with AIT technology, integration, and equipment
  - Supporting three aircraft variations, significantly reduced labor and equipment costs with its flexible assembly automation
- Delivered superior quality in final assembly by successfully integrating Laser Tracker technology
  - First test plane close to that of a production quality aircraft
  - “Stealth signature” of aircraft maintained with clean lines
- Accelerated speed to market and military advantages from curtailed cycle and ramp-up times

**With an aging fleet of fighters**, the U.S. Department of Defense (and other international partners) needed a new next-generation, multi-role fighter that was as affordable as it was lethal. The resulting F-35 Joint Strike Fighter (JSF) contract was awarded to Lockheed Martin, in Fort Worth, TX, who called on AIT as their Prime Contractor to deliver an automated Electronic Mate and Assembly System – or EMAS.

## Electronic Mate and Assembly System

AIT developed its Electronic Mate and Assembly System to perform the final mating of the JSF forward, center, and aft fuselage assemblies as well as the wing assembly. Its engineers designed the assembly stations with the flexibility to mate the three F-35 variants called for in the contract: the F-35A, F-35B, and F-35C, each manufactured for specific uses by the military. With three variations being assembled on the same line, the goal of affordability was easily met because tooling costs for each aircraft were eliminated.

Quality construction was also critical to the cost-containment objectives set by the DOD. Two major factors contributed to the superior quality and processes in the F-35 assembly:

- Laser Trackers in the AIT EMAS guided the positioners into a precise mating configuration for each aircraft component.
- EMAS software mated the components in a virtual space before the actual physical mating occurred.

Because of these incredibly accurate automated measurements, the assembly schedule was also reduced, resulting in additional time and cost savings. In fact, the first test plane boasted near-production quality and its required “stealth signature.”



### System Features

AIT designed all of the technology incorporated into the EMAS to increase the speed of production and improve quality. Using state-of-the-art technology, laser tracking, and planned Indoor GPS, the EMAS facilitated aircraft alignment join by precisely locating parts and controlling aircraft geometry.

- 16 positioners
  - Included 3 integrated Laser Trackers each
  - Automatically measured key features to ensure precise alignment
  - Confirmed tolerances before errors occurred
- 4 major subassemblies (forward, center, aft, wings)
- Specialized control and graphical user interface (GUI) software
  - Software allowed operator to assign weights or alignment priorities to measured points
  - User friendly GUI

Each positioner, effectively a three-axis jack, functioned to support the F-35 JSF subassemblies and smoothly move them in a linear fashion as well as rotationally. The use of lasers allowed for real-time measurements to confirm tolerances and validate design, leading to a

more efficient, rapid, and accurate procedure. This improved method of assembly was controlled through the use of the GUI and/or joystick, making the system exceedingly user friendly.

The flexible, automated systems provide faster tool setup times, faster positioning of assemblies, and fewer hard tooling reconfigurations than conventional tooling – all benefits to Lockheed Martin and the military.

[EMPHASIS BOX] Delivering more aircraft assemblies than any other company, AIT has been a technological pioneer in automated aircraft assembly, creating many new technologies and bringing them to market first.

### Project Highlights:

- AIT Prime Contractor/Integrator - sole supplier to Lockheed Martin
- Positioning of 4 major subassemblies for final assembly
- 16 positioners with specialized controls and graphical user interface software
- Assembly positioning accomplished by Laser Tracker feedback
- AIT technology improved fuselage quality and sped production > 4,000 backlog

The F-35 JSF project was the first at Lockheed Martin's Fort Worth facility to employ this type of automated system. AIT technology helped accomplish the U.S. DOD's overall goal of creating the most advanced stealth fighter to date while reducing costs and achieving affordability.

With hundreds of Automated Assembly Systems in use worldwide, AIT has successfully utilized similar automation technology with other major Aerospace companies on a wide variety of aircraft geometries, materials, and technologies. ☎

### About AIT

Advanced Integration Technology (AIT) is a leading industrial automation company delivering turnkey factory integration solutions 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](http://www.aint.com)



**PERFECT FIT** The integrated Laser Trackers in the AIT EMAS created a precise alignment for the F-35's stealth signature.

**ON TARGET** Laser targets on the F-35 provide data about the component's position, while positioners slide the parts together for assembly.



### Contact Us

**North America Headquarters**  
2805 E. Plano Pkwy.,  
Suite 100  
Plano, Texas 75074 USA  
Phone: 1 972-423-8354  
Fax: 1 972-423-8469  
[www.aint.com](http://www.aint.com)

**Mechanical Design**  
22745 29th Drive SE,  
Suite 220  
Bothell, WA 98021 USA  
Phone: 1 425-398-7329  
Fax: 1 425-424-2310

**Manufacturing**  
3168 262nd Street  
Aldergrove, BC V4W 2Z6  
Canada  
Phone: 1 604-856-8939  
Fax: 1 604-856-8993

**Fabrication and Assembly**  
Unit B - 3252 262nd Street  
Aldergrove, BC V4W 2X2  
Canada  
Phone: 1 604-856-8939

**Europe Design and Support**  
Pol. Ind. Los Olivos  
C/Calidad 70  
Getafe, Madrid, Spain  
28906  
Phone: 34-91-6010147

**Innovative Mobility Systems AB**  
Umestan hus 2  
903 47 Umeå, Sweden  
Phone: +46(0)90-2010000  
[www.imobilitysystems.com](http://www.imobilitysystems.com)