

Transition

An example of Air Force supported SBIR/STTR technology that has been transitioned into an Air Force or other DoD system or subsystem or used by Air Force test ranges and facilities or maintenance depots.

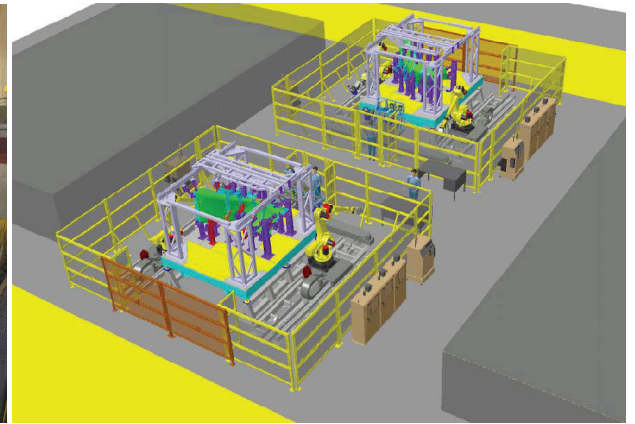
SBIR Topic Number:
AF063C-011

SBIR Title:
Terminally Guided Robots and Robotic Applications in Confined Spaces

Contract Number:
FA8650-07-C-5519

SBIR Company Name:
Variation Reduction Solutions, Inc.,
Plymouth, MI

Technical Project Office:
AFRL Materials & Manufacturing Directorate, Wright-Patterson AFB, OH



Left: An Inlet Duct Robotic Drilling (IDRD) cell at work. Right: An artist's concept of IDRD cells.

F-35 Robotic Inlet Duct Hole Drilling Cells

- Fifth generation fighter aircraft, such as the F-35, require higher positional hole drilling accuracy for inlet ducts from the inside-to-out, necessitating an innovative robot guidance architecture that differed from traditional robot or computer numerical control (CNC) drilling applications
- In 2007, Variation Reduction Solutions, Inc. (VRSI) teamed with other companies to design, build, and demonstrate a production prototype Inlet Duct Robotic Drilling (IDRD) cell that was able to robotically drill an F-35 Carrier Variant (CV) left hand inlet duct
- VRSI has entered into a business arrangement with Comau to take the lead integrating contractor role in marketing the IDRD production cells
- As a direct result of the work accomplished creating the inlet duct drilling cell, the AirForce Research Laboratory's Manufacturing Technology Division and the F-35 Joint Program Office (JPO) have started two Phase III SBIR spin-offs from this technology
- Three F-35 Inlet Duct Robotic Drilling (IDRD) cells are being transitioned to the Joint Strike Fighter (JSF) Program

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Air Force Requirement

In the past, robotic drilling cells have been used for civilian and military aircraft. The drilling cells used robots with drilling end effectors and positional software routines that provided acceptable drilling accuracies required for fourth generation tactical fighter aircraft. However, fifth generation fighter aircraft, such as the F-35, required higher positional hole drilling accuracy, and drilling these inlet ducts from the inside-to-out demanded an innovative robot guidance architecture that differed from traditional robot or computer numerical control (CNC) drilling applications.

SBIR Technology

In 2006, the Air Force Research Laboratory's Materials and Manufacturing Directorate, Manufacturing Technology Division, initiated five Phase I SBIR Program contracts to demonstrate the project technology feasibility. Subsequently in 2007, a single Phase II Critical SBIR contract was awarded to Variation Reduction Solutions, Inc. (VRSI). VRSI teamed with and subcontracted three small businesses and a large business integration contractor (Comau) that orchestrated the technology teaming approach. They designed, built, and demonstrated a production prototype Inlet Duct Robotic Drilling (IDRD) cell that was able to robotically drill an F-35 Carrier Variant (CV) left hand inlet duct.

This Phase II SBIR project completed demonstration of the design for drilling all F-35 duct configurations; the left, right, and aft ducts for the three F-35 variants (the Conventional Take Off and Landing (CTOL), the Short Take Off and Vertical Landing (STOVL), and the CV). The successful demonstrations have allowed the supplier(s) to ramp the design from development and demonstration cell level to the IAL integrated production level architecture.

VRSI and Comau have now reversed their Phase II SBIR roles with Comau taking the lead integrating contractor role to market the IDRD production cells. Northrop Grumman Corporation (NGC) has conducted all the required design reviews for each element of the new IAL. To date, the program has matured the technology to Manufacturing Readiness Level (MRL)-8, and NGC has issued a purchase order to Comau for three production cells for the J353 (left hand), the J354 (right hand), and the J356 (aft) ducts.

As a direct result of the work accomplished creating the inlet duct drilling cell, Air Force ManTech and the F-35 Joint Program Office (JPO) have started two Phase III SBIR spin-offs from this technology, which are funded by the JPO. Specifically, the JPO/AFRL Team have funded and contracted a follow-on Phase III SBIR entitled Robotic Applied Drilling System (RADS). This new robotic drilling system will supplant an existing large gantry system with a spatially controlled modular drilling system based on the IDRD guidance metrology.

The second spin-off project is entitled Fastener Insertion Live Link System (FILLS). This new system will provide the capability for JSF to create a digital thread to expedite fastener kitting, ensure proper fastener-to-hole location and reduce fastener installation time, again using technology from inlet duct drilling. This Phase III SBIR program will provide a system that allows for an accurate fastener count to expedite kitting time and reduce the time required to install the fasteners using an advanced fastener projection system for the F-35 upper center fuselage.

Transition Impact

Three F-35 Inlet Duct Robotic Drilling (IDRD) cells are being transitioned to the Joint Strike Fighter (JSF) Program. The cells are being integrated into Northrop Grumman Corporation's (NGC) new F-35 Integrated Assembly Line (IAL) center fuselage production operations. NGC is procuring the inlet duct cells that will drill left, right, and aft composite inlet ducts and aluminum frames. The new cells will be installed and operational in 2010 with full-rate production capability for the F-35 by 2014.

Company Impact

This SBIR project led to VRSI receiving a Defense Manufacturing Technology Achievement Award in 2009 for its outstanding technical accomplishments.

VRSI has been providing customers with state-of-the-art vision solutions for metrology, industrial robot guidance, and inspection since 1998.



SBIR/STTR

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