



NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
MANUFACTURING EXTENSION PARTNERSHIP

U C C E S S S T O R Y

THE NATIONAL ACCOUNTS PROJECT

THE JOINT DIRECT ATTACK MUNITION (JDAM) PROJECT

SUMMARY

The National Institute of Standards and Technology Manufacturing Extension Partnership (NIST MEP) awarded a 12-month (beginning August 2002) contract to TechSolve to develop and coordinate the implementation of a national account services strategy (National Accounts Project). In response to the contract, TechSolve has established a system that provides seamless delivery of comprehensive assistance to manufacturers that require support in more than one State. The system provides large national manufacturing clients with a single point of entry into the NIST MEP network of MEP Centers. Typically, a manufacturer that has suppliers or plants in multiple States coordinates with multiple MEP Centers in order to obtain the assistance needed. The Joint Direct Attack Munition (JDAM) Project¹ (described below) serves as an example to illustrate the effectiveness of the NIST MEP national account services strategy.

¹ The JDAM Project started in April 2000.

TECHSOLVE'S ROLE

TechSolve is a nonprofit member organization that serves as one of the NIST MEP Centers that helps companies to eliminate waste and increase productivity. They work with suppliers to map out their operations and identify ways to improve efficiency company-wide. TechSolve also works with companies to expand production levels while minimizing the investment of large amounts of new capital. TechSolve specializes in implementing lean manufacturing and providing machining solutions to companies and throughout supply chains.

Using the national account service strategy for the JDAM Project, TechSolve is assisting the U.S. Department of Defense (DOD) and The Boeing Company² (Boeing) to accelerate the manufacture of kits that turn “dumb bombs” into “smart bombs.”³ TechSolve is providing lean

² Boeing is the largest aerospace company in the world. It is the largest manufacturer of commercial jetliners and military aircraft. In terms of sales, it is the largest exporter in the United States.

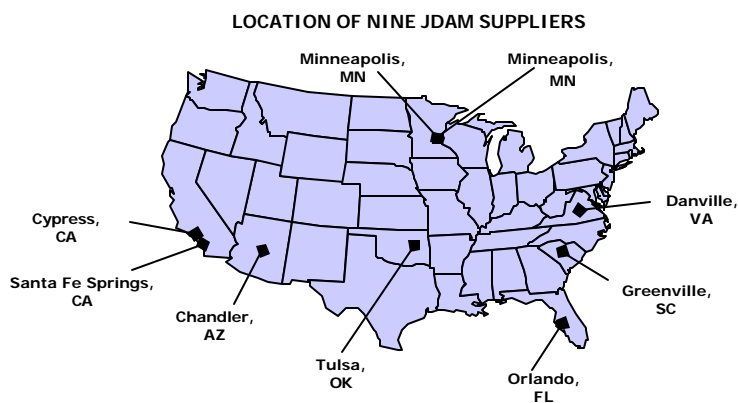
³ JDAM is a low-cost guidance kit that converts unguided free-fall bombs into accurately guided “smart” weapons. JDAM adds to existing inventories of 1,000 and 2,000 pound conventional bombs a new tail section containing Inertial Navigation System/Global Positioning System guidance.

“That’s what makes this program so important – we’re totally dependent on our suppliers.”

David Ryan
Boeing, SMEI

manufacturing expertise in a strategic supply chain initiative. The kits convert existing unguided warheads into smart bombs, which are known for their accuracy and reliability.⁴ In September 2002, the Pentagon awarded Boeing a \$378 million contract for an additional 18,000 bomb kits, bringing production to approximately 2,800 kits per month. The kits cost \$21,000 and are considered cost-effective when compared to other weapons such as the Tomahawk cruise missile, which can cost up to \$500,000 each.⁵

Twenty-two suppliers provide the components of the kit; there is only one supplier for each of the components of the JDAM bomb. Using a single point of entry into the NIST MEP system, TechSolve currently works with nine⁶ of these suppliers to speed production of the kit components.⁷ The nine suppliers are



⁴ The smart bombs can be launched from up to 15 miles away from the target in any weather and the JDAM kits are accurate to within 40 feet of the intended target.

⁵ Another cost savings is realized through the JDAM kits because the guidance system gives bombs a better chance of hitting a target than with traditional cluster bombing. This decreases the number of bombs required to eliminate a target and reduces collateral damage to civilian sites located in the surrounding area.

⁶ TechSolve began working with six suppliers and expanded to nine.

⁷ To obtain a representative cross section of suppliers, Boeing selected the suppliers based on a set of criteria that included a return on investment (ROI) potential, military versus commercial dollars, and supplier commitment.

located in seven different States⁸ and final assembly of the kits occurs at Boeing’s Integrated Defense Systems assembly facility, which produces guidance systems. In working with the nine suppliers, TechSolve faced three major challenges:

1. Increasing capacity;
2. Improving on-time delivery rates; and
3. Improving the quality of products.

TechSolve’s key partners on the JDAM Project include: Boeing, the U.S. Air Force (USAF), California Manufacturing Technology Center (CMTC), the Oklahoma Alliance, and the nine suppliers. TechSolve worked with David Ryan, the Program Manager for Boeing’s Small Medium Enterprise Initiative (SMEI). Ryan said that TechSolve has been a major asset in getting the materials to Boeing much faster, even as its demand for parts was doubling. The Pentagon had conceived of the initiative with Boeing in an effort to find ways to help suppliers improve their overall production.

TechSolve also worked with USAF’s Mike Grabinger, Manufacturing Engineer for the USAF, who said that “This is a win, win, win situation for DOD, Boeing, and the suppliers.” Grabinger explained that DOD gets its end product, Boeing gets the supplies it needs to build the JDAM, and the suppliers get assistance in making permanent changes to their facilities that will last beyond this project.

CMTC serves as a subcontractor to TechSolve and offers technical assistance to the two suppliers in California. The Oklahoma Alliance worked initially to develop relationships with the suppliers.

⁸ These states include: Arizona, California, Florida, Minnesota, Oklahoma, South Carolina, and Virginia.

WHO'S WHO

Name	Organization	Position
Scott Buchko	TechSolve	Program Manager
David Ryan	The Boeing Company	JDAM Program Manager
Mike Grabinger	U.S.A.F.- Eglin AFB	Manufacturing Engineer
Tom Lappin	Woven Electronics	Lean Champion

GOALS OF THE JDAM PROJECT

TechSolve developed a set of general goals for the JDAM Project and a set of long-term goals. The three general goals are:

- To transform suppliers into lean organizations to meet price, quality, and delivery goals;
- To achieve sustainability; and
- To make the suppliers strong, viable manufacturers.

The long-term goals for the JDAM Project to be attained over the next three to five years are:

- To increase production by 400 percent (with minimal capital expenditure to suppliers or customers), with a 25 percent reduction in freight costs for the items being shipped to Boeing because of the synchronization between Boeing's production cycle and its suppliers;
- To increase inventory turns; and
- To decrease inventory obsolescence.

HOW TECHSOLVE WORKED WITH THE SUPPLIERS TO SOLVE THE PROBLEM

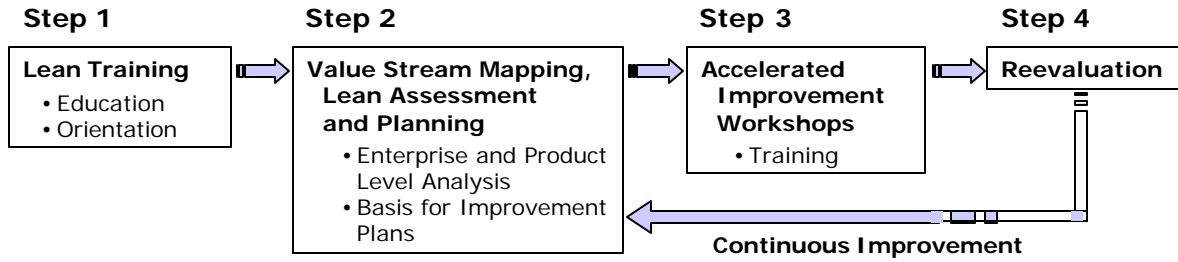
To achieve these goals, TechSolve and Boeing relied on the principles of the JDAM SMEI Program, which is a standardized approach that focuses on lean manufacturing processes; recognizes demand pull system benefits; identifies opportunities for accelerated improvement; establishes a baseline to validate supplier development; optimizes Boeing's lean principles training, and promotes supplier relationships.

The first step in the approach is *lean training*.⁹ TechSolve and Boeing provided training for up to 30 people for one week at each of the nine suppliers. The training focused on lean manufacturing (NIST MEP suite of lean manufacturing classes). Lean manufacturing concentrates on creating greater production efficiencies through maximizing value-added activities, while minimizing waste- producing exactly what the customer needs exactly when it is needed, in the exact quantity needed.

The process evaluates the entire chain of events that create a product for a

⁹ Prior to beginning lean training, the suppliers were required to sign an agreement stating that no employees would lose their jobs as a result of the training (i.e., staff expressed concern that they would lose their jobs if the companies identified methods to become more efficient).

JDAM SMEI LEAN TRANSFORMATION PROCESS



customer. Lean manufacturing differs from traditional manufacturing in that traditional manufacturing philosophies stress high utilization of machines and manpower with less emphasis on cycle time or manufacturing waste. Typical benefits from lean manufacturing include: productivity improvements, reduction in work-in progress, increase in space utilization, improved quality, and reduction in lead times.

TechSolve wanted to be able to demonstrate to the suppliers that they could see viable results within one week of starting the training. They recognized that the small suppliers did not have the resources to implement these changes and an outside team was essential to the process. To date more than 2,200 hours of lean training has been provided to the suppliers.

The second step in the approach is *value stream mapping*,¹⁰ *lean assessment*, and *planning*. TechSolve and CMTC conducted value stream mapping at each of the nine suppliers and Boeing administered a lean assessment. These tools were then used to chart the

individualized plan for each of the suppliers for the next two years. The third step in the approach is *accelerated, improvement, workshops* (AIW) events. Boeing certified TechSolve and CMTC to lead these events.¹¹ TechSolve held five to seven sessions at each of the suppliers on a quarterly basis.

The fourth step in the process is *reevaluation*. Each year TechSolve conducts the entire assessment again and reviews the value stream maps (e.g., current state map and future state map). TechSolve determined that rechecking the assessment is critical to success. Boeing’s Ryan believes that the key to the success of the process lies in their standardized and highly structured approach. During the course of the JDAM Project, they never deviated from the process. Ryan said, “Everyone had a common starting ground. The suppliers received six months of up-front training. They knew the vocabulary, the goals, and what to expect.”

LOGIC MODEL

The logic model is an important and insightful framework for evaluating changes in manufacturing firms or for tracking their progress. The following logic models propose a causal chain of events over time and each step in the chain

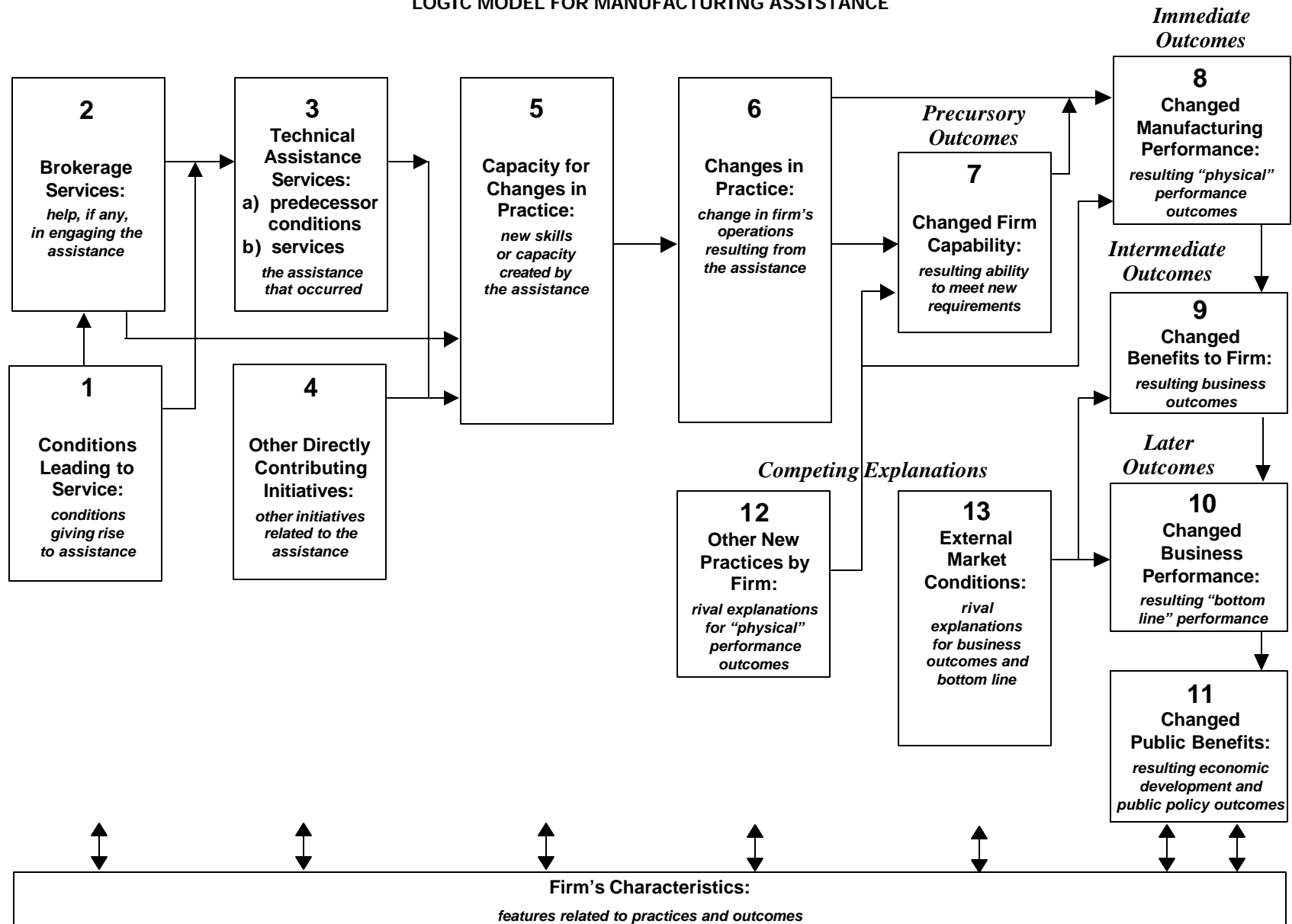
“Suppliers produce 80 percent of the value-add in most defense products. In the case of the JDAM Project, the suppliers produce 95 percent.”

Scott Buchko
TechSolve

¹⁰ A value stream is all the action (value-added and non-value added) currently required to bring a product through the main flows essential to every product. Their value stream workshops taught suppliers how to compress the time required to move product through the value stream by eliminating waste and improving flow of material and information. Maps are created of a current and future state process.

¹¹ They are the only outside group to have this certification.

LOGIC MODEL FOR MANUFACTURING ASSISTANCE



“They have learned to ‘see’ the waste in their process. Once you learn to see it, you will always be able to see it.”

Mike Grabinger
U.S. Air Force

can represent both the outcome of a previous step and a cause of a later step.

The complete chain then purports to be an operational explanation of how some action has taken place. As an example of the JDAM Project, the logic model shows a series of 13 numbered boxes along with an unnumbered contextual conditions box at the bottom. The organization of boxes is the logic model- the flow of events that might be considered possible when: 1) a technical assistance service (Box 3) is presumed to lead to 2) a change in manufacturing practice (Box 6) that in turn is assumed to lead to 3) changed business performance (Box 10).

KEY OUTCOMES

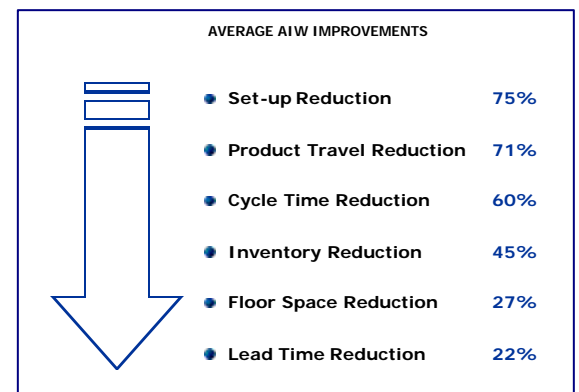
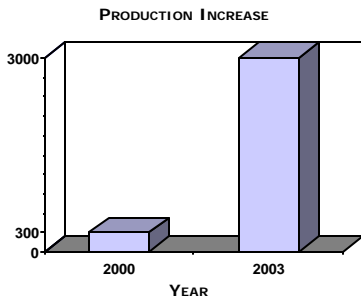
TechSolve and Boeing concur that successful deployment of the JDAM bomb is the most successful outcome. Boeing estimated that at the beginning of the JDAM Project suppliers had the capability to produce 300 kits per month. Now as a result of the training, the suppliers have the ability to reach production rates that will allow the delivery of 3,000 kits per month. In terms of significant outcomes to date, the average AIW improvements across suppliers include reduced cycle time by 60 percent, reduced set-up by 75 percent, reduced lead time by 22 percent, reduced product travel by 71 percent, reduced inventory by 45 percent, and reduced floor space by 27 percent.

All of the suppliers involved in the JDAM Project experienced significant outcomes. As one specific example of outcomes achieved by a supplier, one supplier has reduced its fin manufacturing lead time by 46 percent, decreased

product travel by 92 percent and people travel by 53 percent, created standard work and increased work scope without additional labor, and eliminated ergonomic issues by designing holding fixtures for de-bur operations.

Tom Lappin, Lean Champion at Woven Electronics, reported “The most visible outcomes were the increase in inventory turns by 400% and cycle time improvements (reduced job time by 40 percent).” Lappin said that Woven Electronics would not have been able to accomplish this without assistance from TechSolve. He reported that TechSolve used an integrated approach and were continually involved, visiting them on a quarterly basis. Lappin believes that “The key was that you were always building on what you learned before – the reinforcement and follow-up were critical.”

As another example, one supplier eliminated one shift (third shift) by increasing the productivity of the first two shifts. Another supplier also has added 11 staff to their company as a result of an increase in business related to the implementation of lean manufacturing techniques. Even the largest supplier, recognized the benefits of lean manufacturing. They have readily embraced lean manufacturing and the continuous improvement process and have been able to reduce the cycle time associated with the build process.



Boeing estimates that the suppliers have realized more than \$16 million in savings. For example, one supplier saved \$11,000 through reduced test cycle time. Two other suppliers saved approximately \$440,000 as a result of a sub-tier (quality plating) reduced penetrant requirement. As a result of AIW process improvements, another supplier saved \$665,000 in total purchase order reduction. The largest supplier saved \$15 million through process and product improvements and reductions in the number of fill stations required for the surge requirement and space/lease facility cost avoidance.

Competitiveness is critical to these companies as supply bases shrink. As a result of the lean training the nine suppliers have received, they have become more competitive by becoming more efficient and eliminating waste. These improvements have helped the suppliers to realize cost savings and respond more quickly to customer demands. Operational improvements also are key to winning and maintaining business and increasing affordability. Grabinger, USAF, believes that the suppliers understand and grasp what lean manufacturing can do for them.

“They have learned to ‘see’ the waste in their process. Once you learn to see it, you will always be able to see it.” The hope is that the suppliers will be able to implement lean manufacturing techniques on their own after this project. The plan is to continue deployment of the JDAM Project approach across all of the suppliers for the JDAM, focusing on critical technologies using the NIST MEP national accounts services strategy.

TechSolve has successfully implemented the NIST MEP National Accounts Project so that Boeing and the U.S. Air Force have had access to the seamless delivery of comprehensive assistance and services to nine regionally dispersed suppliers through a single point of entry into the NIST MEP network of MEP Centers.

B E N E F I T S	
Boeing	<ul style="list-style-type: none"> Improved part quality Increased ease of assembly Lower part cost Increased schedule confidence Shortened development cycle times
Suppliers	<ul style="list-style-type: none"> Improved supplier performance leading to increased business base New technology for legacy projects
Industry	Validation of the benefits of using discrete “above the shop floor” and “on the floor” lean practices
U.S. Air Force	Improved quality products at a lower cost

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