# CONNECTING THE LOGISTICS ENTERPRISE

## with Internet of Things (IoT) Innovations


## Harnessing the Power of the IoT with Enterprise Sensor Integration (ESI)

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# The Internet of Things: A Connected World

There's a lot of hype surrounding the Internet of Things (IoT) – a world in which everything is smart and connected. It's all about making data come together in new ways, and it has the potential to change all aspects of our world.

The IoT is about creating an efficient environment where massive amounts of data is captured from a network of "things" – sensors, software, electronics and actuators – and turned into actionable insights. It involves the collection and analysis of "Big Data" to aid in the decision-making process.

In the private sector, the Internet of Things connects smartphones, smart appliances, smart home thermostats, wearables and much more. The application of the IoT in the manufacturing industry – dubbed the Industrial Internet of Things (IIoT) or Industry 4.0 – leverages intelligent, connected devices to greatly improve operational efficiency, productivity, and profitability across manufacturing plants and supply chains.

There is also significant potential for IoT technology to revolutionize warfare and enhance situational awareness across the full spectrum of logistics management. Military IoT applications can deliver greater lethality and survivability to the warfighter while increasing efficiency and reducing costs. A connected battlespace can help commanders manage and interpret the sheer volume of data received from multiple sources – providing real-time, actionable intelligence.

In the area of military logistics, an interoperable IoT environment can significantly enhance supply chain management, which is essential to warfighter readiness. IoT tracking sensors, including RFID tags, are helping the U.S. Department of Defense (DoD) achieve its Total Asset Visibility (TAV) goals and total end-to-end visibility across the DoD logistics system.

A seamless and effective supply chain will ensure decision-makers have timely and accurate information on the location, quantity, condition, movement and status of assets and supplies. TAV provides a common operating picture, helping leaders manage unexpected disruptions.

To keep pace with IoT advances and meet cost-reduction goals, the military has capitalized on civilian IoT successes and lessons-learned. The DoD actively engages with industry leaders, including participating in conferences, such as *RFID Journal Live,* to keep abreast of the latest advances in Automatic Information Technology, or AIT.

In the commercial sector, the explosive growth of IoT technologies has also led to connectivity challenges. Many vendors' IoT solutions are not designed with interoperability in mind, which has led to a proliferation of proprietary devices that cannot share information with other sensors or networks. The DoD has also adopted a "stovepipe" approach to IoT technologies, which limits the ability to communicate across systems and services.

Radio Frequency Identification (RFID) is a family of technologies enabling hands-off processing of materiel deploying through the Defense Transportation System. Materiel marked with RFID tags may be remotely identified, categorized, and located automatically within relatively short distances. Active RFID tags can hold relatively large amounts of data, are continuously powered, and are normally used when it is necessary that the tag be readable from a longer distance. Passive RFID tags temporarily store a small amount of energy received from the tag reader in order to generate a tag response. Passive RFID is used at the item, case, or pallet level.

# ESI: Connecting People, Data and Processes

Tapestry Solutions, part of Boeing Global Services, has addressed IoT interoperability challenges with Enterprise Sensor Integration, (ESI). Serving as a gateway to the IoT, ESI is an innovative software platform that integrates disparate sensor technologies, including RFID, to connect people data and processes across manufacturing plants and supply chains.

ESI leverages technologies that Tapestry developed for Boeing, where it is also known as the Automated Identification Technology - Information Management System, or AIT-IMS. This middleware solution has interconnected nearly every aspect of Boeing's asset management and supply chain – resulting in substantial cost savings with increased productivity, asset visibility and standardization. (See case study, page 4)

Unlike other IoT sensor solutions, ESI is a sensor-and-hardware "agnostic" solution with global enterprise scalability. As such, supply chain visibility is not completely dependent on one manufacturer or sensor type. With ESI, there's just one platform that can communicate with many different hardware and software vendors' IoT solutions. This ensures total asset visibility of equipment, tools, cargo and processes anywhere in the world. Among its vast capabilities, the technology:

- Provides automatic notifications when an assembly arrives on the loading dock or is shipped by a supplier
- Monitors assemblies and equipment for improper handling, temperature extremes and pilferage
- Tracks packages, equipment, tools and parts as they move through the factory
- Automatically sends a request to accounting to pay the supplier for a part

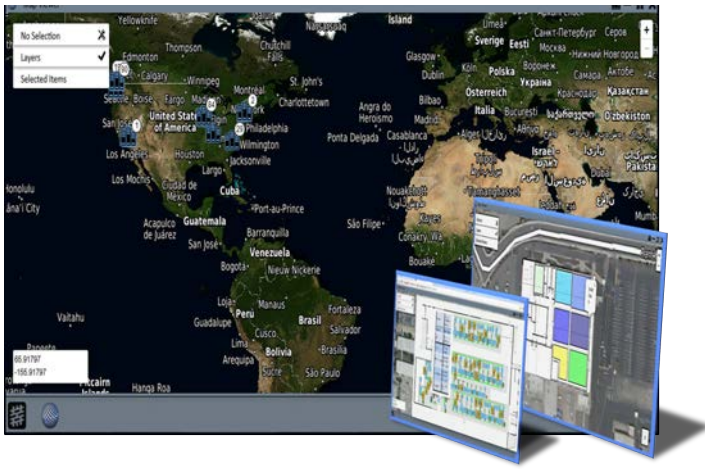
ESI connects a myriad of disparate sensors, including RFID position-information tags, passive and active; GPS WiFi tags; embedded hardware; and complex servers, including Enterprise Resource Planning (ERP) systems.

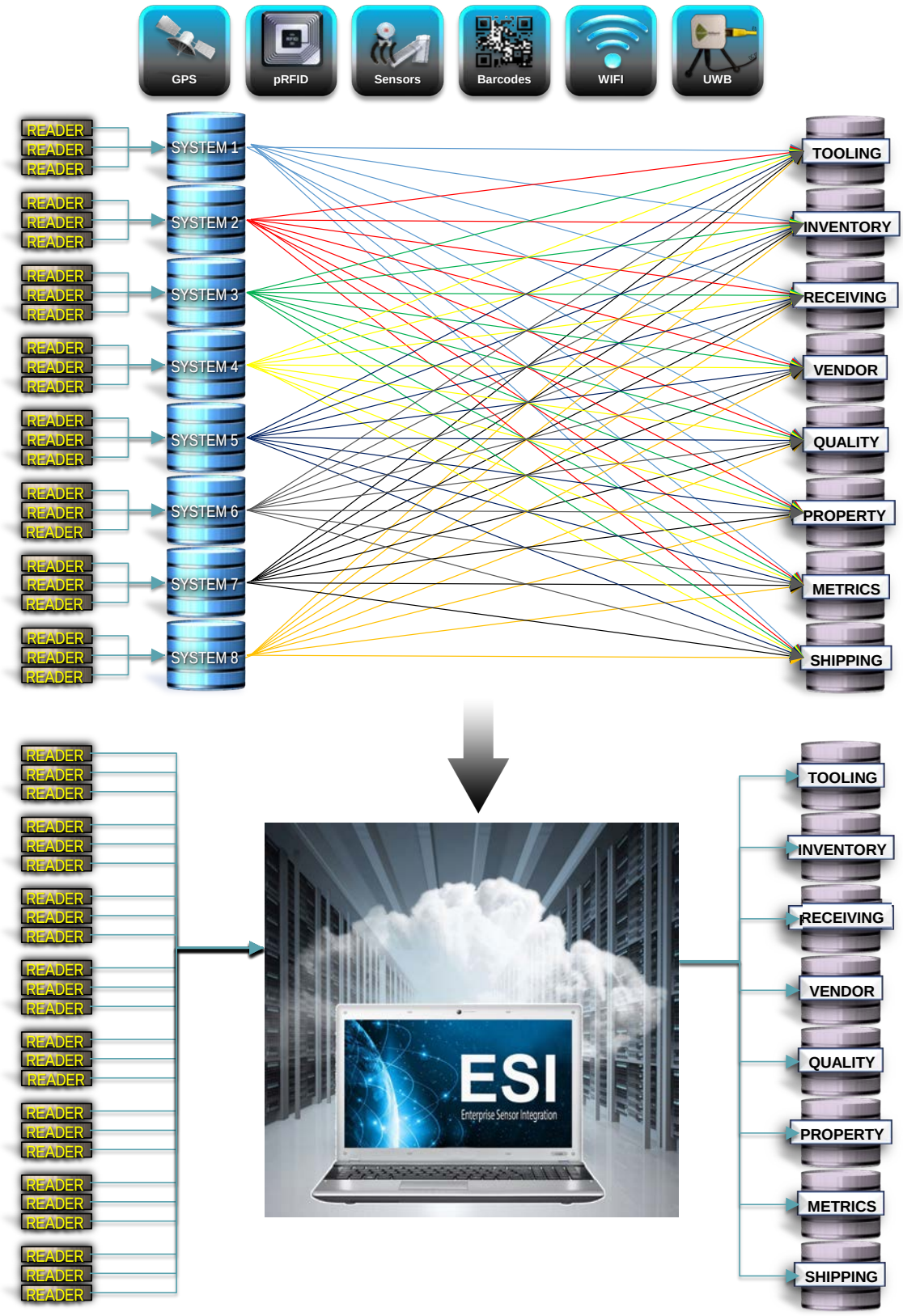
ESI also includes real-time alerts, and integration with sensors that monitor temperature sensors, pressure and humidity. With ESI, decision makers have total asset visibility of equipment, tools, cargo and processes for 360° supply chain clarity.

The software platform can be hosted in the cloud or on dedicated servers, and also seamlessly integrates customers' legacy and next generation systems.

ESI is a flexible platform that supports a broad range of missions and operations including:

- Global Supply Chains
- Industrial Manufacturing
- Depot Maintenance Operations
- Defense Logistics Operations
- Commercial Asset Tracking






***ESI connects disparate sensor technologies through a standard interface. It integrates multiple data sources through a common infrastructure, regardless of the hardware type, manufacturer or data format.***

# Case Study: The Boeing Company

Boeing's Everett Factory in Washington State – one of the world's largest manufacturing plants – was the first factory in the U.S. that successfully implemented the sensor integration technology. The AIT-IMS solution was required to help manage and track assets during production of its jumbo jet aircraft. Effectively tracking assets is vital for the plant's efficient operation, but not an easy task for a plant that covers nearly 100 acres with over 30,000 employees.

Assembling an aircraft here requires millions of parts and in some cases, more than 500 suppliers. Hundreds of specialty tools and equipment are also required, as well as the right engineers and other skilled employees. All of these must come together in a complex and highly choreographed dance to assemble an aircraft. If critical components, tools and employees aren't ready precisely when they are needed, it can slow or halt a massive assembly line. An automated information system was clearly needed, not only at Everett, but across the Boeing enterprise.

## THE APPROACH

Like other large enterprises, Boeing has more than 100 systems in place to manage assets and workflow processes. Tapestry was tasked with fusing all these systems and sensors together – everything from active and passive RFID, Wi-Fi and GPS tags, scanners and ultra-wideband wireless systems – while ensuring interoperability with its Enterprise Resource Planning system. Tapestry was able to quickly design, develop and implement a smart solution that has yielded long-term operational efficiencies for multiple Boeing factories.

## THE RESULT

ESI has interconnected nearly every aspect of the organization's asset management and supply chain across 27 major manufacturing sites comprising over 300 buildings. This unity of information, powered by sensor integration, has saved Boeing more than $100 million in the first year alone. The technology, proven to handle up to 6 -10 billion RFID tag reads each week.

Today, ESI saves Boeing an estimated $80 million in recurring annual savings through reduced labor costs, increased workflow efficiency, asset loss prevention, and improved decision-making based on the analytics data. Employees have an enterprise-wide, map-centric view of data pertaining to assembly schedules, quality control, location of assets and temperature regulation. Now, locating an asset is as easy as a click of a button – even if it's thousands of miles away.

# Case Study: BAE Systems

BAE Systems, an international defense, aerospace and security company, had an immediate need to find new technologies and techniques to accelerate manufacturing production processes in response to increased customer demands. The primary task was to replace existing manual processes with an automated, Radio Frequency Identification (RFID) solution to efficiently track and manage inventory, assets and workflow processes.

BAE Systems hoped to attain a near-real-time view into its assets and processes, and integrate that data with its existing sensor technologies and ERP systems. The company also wanted the solution to have sufficient scalability to grow with evolving enterprise needs.

Previously, the company had a largely manual process for tracking and managing inventory, assets and tools. It used a manual barcode scanning process to track and replenish inventory at multiple sites. Procurement teams released orders manually, which often resulted in longer than desired lead times.

## THE APPROACH

Tapestry commenced work at BAE Systems in July 2017, and successfully implemented the technology by 2018 at the company's Electronic Warfare Integrated Manufacturing Center in Nashua, NH, followed by other sites. The installation supported the following business use cases: automated material replenishment, asset and calibratable tool tracking, and work-in-process (WIP) tracking.

### MATERIAL MANAGEMENT

To track and replenish materials via RFID, BAE Systems selected a TwinBin RFID Kanban system with specialized material-storage containers. The system sends signals to suppliers once the stock level has been depleted to the determined re-order level. Orders are automatically generated every night, and the parts arrive at a pre-determined time at the material center. This has enabled BAE Systems to transform from a "push" scheduling process to a "pull," where there is a just-in-time inventory flow through its supply chain.

### ASSET & TOOL MANAGEMENT

For asset and tool tracking, BAE Systems has applied UHF RFID tags to tools used during the assembly process. The system can also track items as they enter and return from specific zones with associated alerts. This enables users to identify any misplaced tools or materials. ESI also monitors recalibration due dates on equipment.

### WORK IN PROGRESS

For WIP, RFID tags are applied to printed work orders as they are initiated, which enables tracking of each open order as it moves through the production floor. The work order then follows the movement of each product as it proceeds through the assembly process, allowing the company to track an order's status and identify possible bottlenecks.

## THE RESULT

ESI has automated the tracking of more than 200,000 assets, 30,000 parts and about 6,500 work orders at the BAE System plants.

Within the first year of deployment, BAE Systems reported that it saved 2,400 hours tracking work-in-progress, or WIP, and saved 1,248 hours in searching for missing items. The solution has also significantly accelerated manufacturing processes while improving quality.

With its proven success, BAE Systems captured an award for the "Best Manufacturing RFID Implementation" at the 2019 *RFID Journal LIVE conference.*

# Empower Forces with ESI

With its commercial success deploying IoT solutions, backed by its extensive military domain experience, Tapestry is well positioned to take ESI to the next level for military logistics and supply chain operations. ESI addresses the military's demand for a common operating picture and actionable intelligence by connecting disparate sensors and networks through a smart integration platform.

ESI has the potential to solve communications gaps caused by massive data collection from disjointed systems, rapid changes in globally dispersed operations, and increasingly complex distribution and supply chain operations. Together with automation, powerful analytics and cloud capability, ESI can help decision-makers quickly process and interpret Big Data in real-time to make better decisions faster. ESI can help the DoD meet its Total Asset Visibility objectives to "deliver the right items in the right quantities to the right place at the right time – and at the right price." ESI benefits include the following:

## ■ COST SAVINGS

Substantial cost savings are realized with improved inventory control, reduced asset misplacement and loss, and increased efficiency.

## ■ TOTAL ASSET VISIBILITY

ESI significantly improves operational visibility with mapping applications. The system visually displays where an asset tool is located, anywhere in the world, on maps and building layouts with a click of a button.


ESI provides traceability and accountability for equipment and assets as they move through the supply chain. It also integrates with sensors that monitor temperature, humidity and pressure levels of assets/supplies.

## ■ DECISION-MAKING

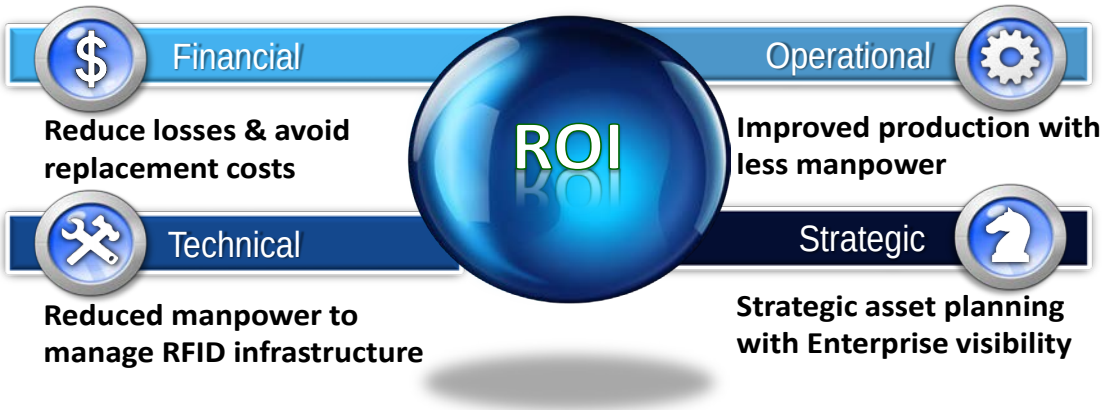
Real-time data and analytics provide actionable information to decision-makers; problems can be addressed and mitigated in a timely manner.

## ■ AUTOMATION

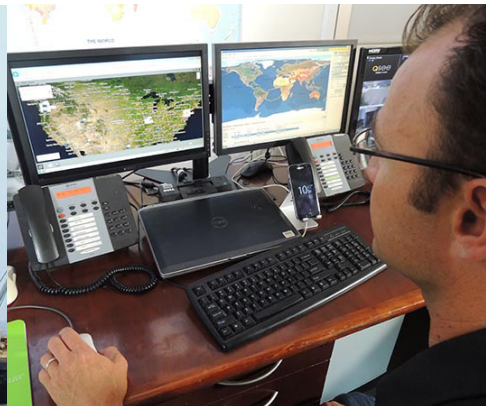
Accurate, timely data improves production cycle time and equipment availability. Automated workflow processes mean fewer manual inputs and bottlenecks, and increased productivity and efficiency.

## ■ STANDARDIZATION

ESI ensures standardization across the enterprise, allowing asset management and tracking systems to talk to each other in the larger IoT ecosystem.




***ESI saved Boeing over $100 million in its first year alone.***



Tapestry Solutions, Inc. is a global provider of information management software and services for defense, government and commercial markets. We help solve logistics challenges for the world's largest and most complex supply chains. We also provide mission planning, training and simulation support to maximize readiness for our warfighters.

Supporting customers from more than 50 locations worldwide, Tapestry Solutions is part of Boeing Global Services. Operating as one of Boeing's three business units, Global Services is headquartered in the Dallas area.

**For more information about ESI,**
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