

Enhancing DoW Operational Efficiency and Effectiveness through Streamlined Inventory Management and a Zero-Trust Model for Physical Items

“Wars are won and lost on logistics”

General Dwight D. Eisenhower

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Executive Summary

General Eisenhower once said, “Wars are won and lost on logistics”. Today, the Department of Defense (DoW) operates in an increasingly complex global environment, confronting multifaceted challenges across all branches. Efficient and reliable logistics and operational systems are essential. Inventory management is a critical component that directly impacts DoW's performance and readiness, especially in contested environments where operational effectiveness is paramount.

Traditional methods of inventory tracing and authentication rely on additive proxies like tags, QR codes, etchings, and other marks. These are susceptible to tampering, damage, removal, or counterfeiting, posing significant risks to supply chain integrity. While cybersecurity employs a Zero Trust model as the foundational standard for ensuring security, physical assets are still managed using less secure methods that can be exploited. A single counterfeit or tampered component—such as a computer board infiltrating the DoW network—could create vulnerabilities that undermine cybersecurity measures and compromise national security.

This paper introduces Alitheon's FeaturePrint® technology. FeaturePrint is a machine-vision technology that assigns a unique, persistent, and inherent identifier to each item—like a fingerprint is for a human being. By capturing minute surface variations—imperceptible to the naked eye—FeaturePrint enables irrefutable item identification, authentication, and traceability without the need for additional markings.

Key Benefits of FeaturePrint for the DoW:

- **Enhanced Security and Authenticity:** Eliminates counterfeit and gray market items by verifying items based on their inherent features.
- **Streamlined Inventory Management:** Simplifies and accelerates inventory processes both on-base and in the field, increasing productivity and reducing operational costs.
- **Reduction of Human Error:** Automates identification and tracing, minimizing mistakes associated with manual handling.
- **Improved Mission Reliability and Operational Readiness:** Ensures that only correct and authorized parts are installed in critical systems, avoiding costly mishaps and enhancing operational effectiveness.

FeaturePrint is a dual-use technology deployed with commercial customers in sectors such as aerospace, healthcare, and luxury goods, achieving accuracy rates exceeding 99.9% using standard industrial cameras and cell phones. Importantly, it requires no added proxies like QR codes, tags, or markers, which can be damaged, removed, transferred, or faked.

By adopting FeaturePrint, the DoW can align its physical inventory management practices with the stringent security protocols of its cybersecurity initiatives. This alignment safeguards critical assets against tampering and counterfeiting, enhancing overall mission readiness by ensuring that all components and equipment are authentic, correct, and fully traceable throughout their lifecycle.

This white paper will delve into these challenges in detail, provide an in-depth analysis of FeaturePrint, and outline actionable steps for its implementation within DoW.

Reach out to us at info@alitheon.com or join us in an upcoming informational session and see FeaturePrint live in action.

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"I have seen firsthand how incredible Alitheon's technology can be when applied to outdated Army processes like sensitive item accountability. The technology's ability to archive and recognize "digital fingerprints" of sensitive items such as weapons and night vision devices not only streamlines the monthly SI inventory process substantially, but provides fraud proof accountability of the commander's sensitive items with the potential for real time oversight from property book officers and higher echelons when integrated with current systems of record. The time saving and peace of mind provided to commanders at all echelons will be well worth fielding Alitheon's tech."

1LT, Quartermaster, Maintenance Control Officer, B Co, 2D BSB, 2-2 SBCT, JBLM

The Modern Battlefield: A Supply Chain Perspective

The modern battlefield extends into logistical networks critical for military operations. Efficient inventory management by the Department of Defense (DoW) ensures operational readiness, cost savings, and warfighter safety. Failures, like losing F-35 parts, risk mission success and increase costs. Securing supply chains against counterfeit goods, such as fake Cisco boards, is more vital than ever.

Streamlined Inventory Management Enhances Readiness

Efficient systems ensure timely availability of authorized supplies, reducing downtime, preventing shortages, and optimizing resources. Advanced tracking and verification minimize financial waste and bolster readiness, essential for a constrained defense budget.

Counterfeit Items Threaten Security

Counterfeit and fraudulent items jeopardize mission reliability and safety. A Senate report uncovered over a million counterfeit parts in defense systems, leading to equipment failures, higher maintenance costs, and security breaches. Robust verification ensures operational reliability.

Reducing Human Errors

Human errors in inventory undermine accuracy, causing shortages and overstocking. Automation addresses these issues with real-time tracking, automated identification, and regular audits, improving efficiency and reducing costs.

Mission Reliability and Warfighter Safety

Faulty or counterfeit equipment endangers warfighters through gear failures and communication vulnerabilities. Effective inventory management safeguards personnel and ensures reliable equipment for mission success.

By addressing these challenges, the DoW can enhance reliability, strategic responses, and protection of resources and personnel.



Alitheon's FeaturePrint® Dual-Use Technology Can Help

A Zero Trust Model

To address these critical challenges, Alitheon developed FeaturePrint, an optical-AI technology that provides a completely unique, persistent, inherent identifier for items and products—similar to how fingerprints uniquely identify individuals. FeaturePrint enables:

- **Zero-Trust Model:** Every item is identified, verified, and traced throughout its lifecycle.
- **No Modifications Required:** Items do not need additional markings or physical alterations.
- **Full Traceability:** Enhances transparency and accountability within the supply chain.

How It Works

FeaturePrint operates by leveraging inherent manufacturing variations:

1. **Initial Registration:** Capture an image of the item using standard industrial cameras or mobile devices.
2. **Machine Vision Analysis:** Advanced algorithms detect unique surface features resulting from manufacturing intolerances—minute variations imperceptible to the naked eye.
3. **Digital Fingerprint Creation:** These features are used to create a FeaturePrintID, a unique digital identifier stored securely.
4. **Verification and Authentication:** Subsequent images of the items lead to new FeaturePrints that can be compared against the database to irrefutably verify authenticity and identity.

By using the item's natural, unique, persistent, and inherent characteristics, FeaturePrint eliminates the need for external proxies such as tags or codes, making it a highly secure and non-intrusive solution.

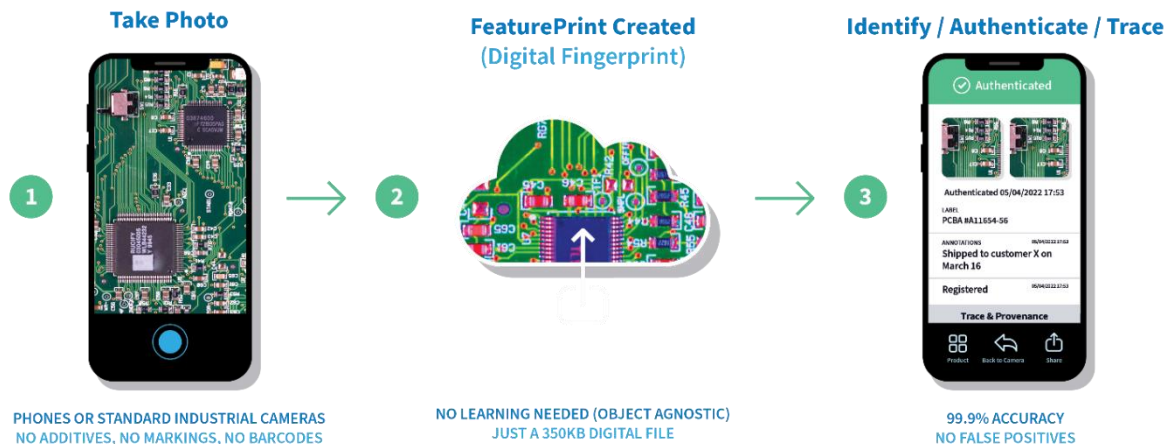


Image 2 – Depicts a simple 3-step process

[CLICK to watch a FeaturePrint Demonstration](#)

The Technical Aspects Explained

Taking Advantage of Manufacturing Tolerances

Manufacturing tolerances are the allowable variations in dimensions, material properties, and other specified characteristics of a product. These tolerances ensure that parts can be manufactured and assembled correctly, functioning as intended while accommodating deviations arising from limitations in manufacturing processes, material inconsistencies, and environmental conditions. For example, vibrations and tool wear during machining can cause minor dimensional variations, and variations in material properties like hardness and thermal conductivity can influence the manufacturing outcome.

The concept of manufacturing tolerances can be compared to the formation of snowflakes, where each snowflake is unique due to the specific conditions it encounters during its formation. Similarly, the manufacturing process involves various factors, including machine accuracy, operator skill, and material properties, contributing to the uniqueness of each manufactured product. These tolerance variations result in minute but present differences, giving each product its distinct characteristics even when produced in large quantities on the same machinery.

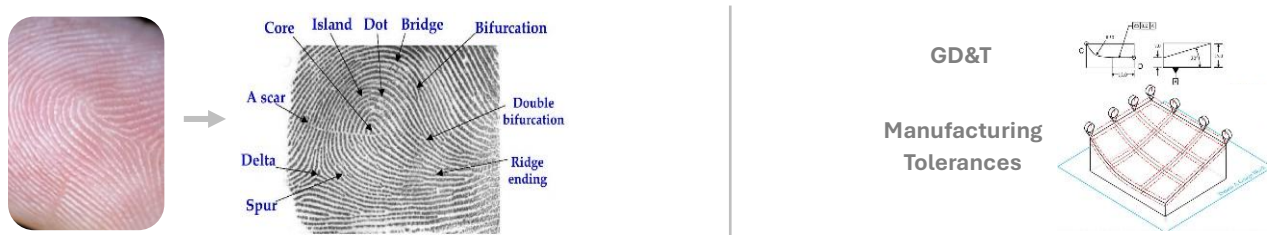


Image 3 – Depicts fingerprints and Manufacturing Tolerances

Leveraging Inherent Variations

FeaturePrint capitalizes on these inherent and unique identifiers. By detecting and codifying these minute differences, the technology enables:

- **Precise Identification:** Distinguishing between items that appear identical.
- **Non-Invasive Proxy Application:** No need to alter or add anything to the item.
- **Robust Security:** The same machine cannot replicate the inherent features, let alone counterfeiters trying to replicate these inherent manufacturing variations.

FeaturePrint is Accurate and Reliable

It is Dual-Use and Deployed

FeaturePrint® has been rigorously tested and deployed in various industrial, manufacturing, and supply chain operations, demonstrating:

- **Over 99.99% Accuracy:** In real-world identification and authentication scenarios.
- **Zero False Positives:** Ensuring that no counterfeit items are falsely accepted.
- **Extremely Low False Negatives:** With a rate as low as one in a trillion 10^{-13} , genuine items are not incorrectly rejected.

“I can attest that FeaturePrint stands out as one of the few intuitive innovations that combines ease of implementation at the ground level with the potential to transform accuracy, accountability, and efficiency while reducing risk to mission.”

James A. Hayes, Colonel (Ret), former Director of Current Operations and the Stryker Warfighters' Forum, I Corps, U.S. Army.

FeaturePrint is Simple to Integrate and Implement

Easy to Adopt

FeaturePrint® is designed for seamless integration into existing workflows:

- **Utilizes Standard Equipment:** Works with off-the-shelf industrial cameras and mobile devices.
- **Minimal Training Required:** User-friendly interfaces make it accessible to personnel without specialized technical expertise.
- **No Special Facilities Needed:** Can be implemented in current operational environments without significant infrastructure changes.
- **Ease of implementation:** The technology is so intuitive and easy to use that it lends itself to application at the lowest level. Within minutes, soldiers were able to understand and use FeaturePrint with ease.

Training and Personnel Development in Place

Adopting FeaturePrint® offers opportunities for:

- **Skill Enhancement:** Personnel gain experience with advanced technologies, enhancing their capabilities.
- **Professional Growth:** Training programs can lead to career advancement within the DoW.
- **Improved Efficiency:** Empowering staff with effective tools increases job satisfaction and productivity.

FeaturePrint Aligns with DoW Policies and Strategic Initiatives

Supports Policies

Implementing FeaturePrint aligns with key DoW directives:

- **DoW Instruction 4140.01:** *DoW Supply Chain Materiel Management Policy* emphasizes the need for efficient and effective supply chain management.
- **DoW Instruction 4140.67:** *DoW Counterfeit Prevention Policy* mandates measures to prevent counterfeit material in the DoW supply chain.

Aligns with Strategy

FeaturePrint supports broader DoW objectives:

- **Modernization Efforts:** Enhances technological capabilities in line with the DoW's push for modernization.
- **Cybersecurity Strategies:** Strengthens physical asset security, complementing cybersecurity initiatives.
- **Interoperability:** Facilitates coordination among different branches, improving joint operation capabilities. FeaturePrint reduces risk to the command (through property accountability) and thus reduces risk to mission while informing assessment of strategic readiness.

“FeaturePrint offers groundbreaking capabilities that dramatically improve inventory management and readiness reporting, from the small unit level to the Army Enterprise and beyond. Its seamless integration into existing processes with expansive potential—extending upstream to supply chain partners—positions this technology as an invaluable application for advancing operational efficiency and effectiveness.”

James A. Hayes, Colonel (Ret), former Director of Current Operations and the Stryker Warfighters' Forum, I Corps, U.S. Army.

FeaturePrint is a Strong Foundation For a Lot More

Scale and Adapt

FeaturePrint is scalable and adaptable to:

- **Emerging Threats:** Continuously evolves to counteract sophisticated counterfeiting methods.
- **Diverse Operational Environments:** Applicable across various settings, from secure facilities to field operations.

Integrate with Other Technologies

- **Blockchain Integration:** Combining FeaturePrint with blockchain technology for immutable and transparent supply chain records.
- **Internet of Things (IoT) Connectivity:** Real-time monitoring of assets through connected devices, providing instant alerts on inventory status.
- **Artificial Intelligence and Machine Learning:** Leveraging AI for predictive analytics and further automation of inventory management processes.

Embracing these technologies ensures that the DoW remains at the forefront of supply chain security and efficiency.

FeaturePrint Supports Global Security Beyond Our Borders

Evolving Threat Landscape

Global adversaries increasingly exploit supply chain vulnerabilities to:

- **Conduct Espionage:** Gaining access to sensitive technologies and information.
- **Disrupt Operations:** Introducing faulty components to degrade military capabilities.

Securing the supply chain is integral to national defense and maintaining strategic advantages over potential adversaries.

Cooperation with our Allies

Standardizing inventory management practices with allies can:

- **Enhance Collective Security:** Strengthen defense networks against common threats.
- **Improve Interoperability:** Streamline joint operations and resource sharing during coalition missions.

Collaborative efforts amplify the effectiveness of individual nations' defense capabilities.

FeaturePrint Supports Ethical and Environmental Considerations

It is Sustainable

Efficient inventory management contributes to environmental sustainability by:

- **Reducing Waste:** Minimizing overproduction and disposal of surplus items.
- **Conserving Resources:** Optimizing the use of raw materials and energy.

These efforts align with global initiatives to reduce the environmental footprint of military operations.

It Enhances Ethical Sourcing

Verifying the authenticity of components ensures compliance with:

- **Labor Regulations:** Avoiding products manufactured under exploitative conditions.
- **Trade Laws:** Adhering to international trade agreements and sanctions.

Maintaining high ethical standards reinforces the DoW's commitment to responsible operations.

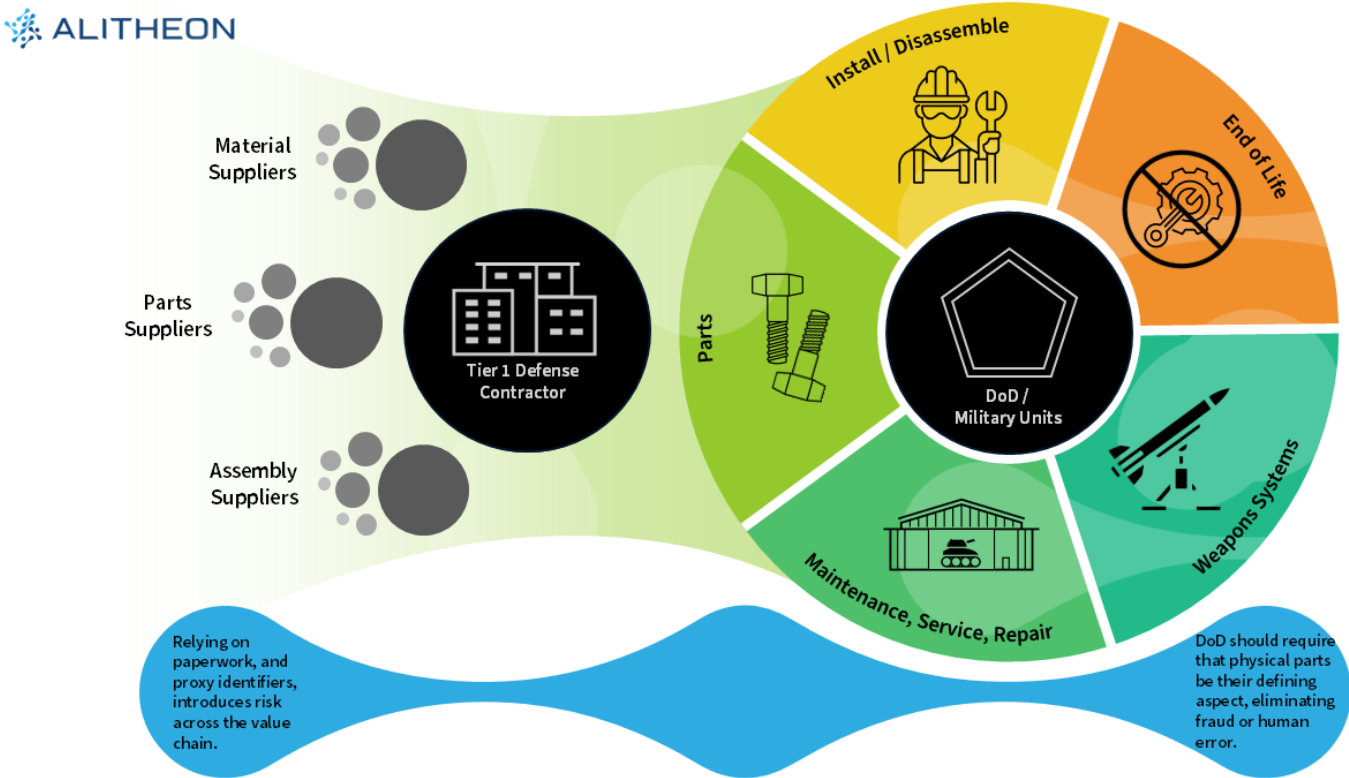
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James A. Hayes, Colonel (Ret), former Director of Current Operations and the Stryker Warfighters' Forum, I Corps, U.S. Army.

Conclusion

Streamlined inventory management is essential for enhancing the DoW's operational efficiency, reliability, and mission success. By reducing counterfeit items, minimizing human errors, and optimizing resource utilization, the DoW can significantly improve productivity and safeguard warfighter safety across all branches of the military.

Alitheon's FeaturePrint technology offers an advanced, practical solution to these challenges. Its precise item identification and authentication capabilities strengthen supply chain integrity without necessitating additional markings or substantial equipment modifications. Implementing such innovative technologies is crucial for maintaining readiness and effectiveness in an increasingly complex global environment.



Glossary of Terms

- **DoW:** Department of Defense
- **GAO:** Government Accountability Office
- **CFSI:** Counterfeit, Fraudulent, or Suspect Items
- **FeaturePrint:** Alitheon's proprietary technology for creating unique digital identifiers for physical items
- **Manufacturing Tolerances:** Acceptable variations in production dimensions and material properties
- **RFID:** Radio-Frequency Identification
- **IoT:** Internet of Things
- **COTS:** Commercial Off The Shelf

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Contact Information

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By adopting streamlined inventory management practices and leveraging innovative technologies like FeaturePrint®, the DoW can enhance operational efficiency, safeguard against counterfeit risks, and ensure mission success in an increasingly challenging global environment.