



# DoD Supply Chain Challenges

*Why We Are Where We Are and What To Do About It.*



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**DoD Supply Chain White Paper: Why We Are Where We Are and What To Do About it.**

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## Preface

As of the writing of this White Paper there are 81 Cargo Ships backlogged in Southern California's two cargo ports. About 40% of the United States import market comes through these ports. One of these cargo ships can hold up to 6200 containers and take ten days to download. The ports have gone to 24 hours 7 days a week operation, but the US trucking industry and rail industry has yet to catch up on internal distribution in the United States. Add a requirement for all DoD Contract Carriers to be vaccinated by 8 November and the crisis is apparent.

This current situation did not develop overnight. It is a result of the confluence of Globalization, Capitalistic Markets and COVID 19. It's effect on DoD's Supply Chain's position can be understood as a threat to US National Security.

This paper helps describe how the Defense Industrial Base got to this point and makes some recommendations to reform some of the practices, policy and behavior found in the Defense Industrial Base as well as the US Government.

## 1.0 The Confluence of Globalization, Capitalism and COVID 19 on the DoD Supply Chain

**Globalization** has been occurring for a long time. The Industrial and Management Ages of the 60's and 80's resulted in outsourcing and offshoring. The book, The Nature of the Firm, written by Economist Ronald Coase focuses on the creation of the Firm as an Organization. He argues that the size of a firm (as measured by how many contractual relations are "internal" to the firm and how many "external") is a result of finding an optimal balance between the competing tendencies of the costs. In general, making the firm larger will initially be advantageous, but the decreasing returns will eventually kick in, preventing the firm from growing indefinitely. Simply put, once a "Firm" has been established, there is a need to determine what should remain within the boundaries of the firm and what should be contracted out or outsourced in today's language based on cost.

Oliver E Williamson can be described as the father of Transitional Cost Economics Theory. His theory identifies the cost of creating boundaries. Again, focused on the economic costs of not doing something within the organization or even to bifurcate within the organization by creating boundaries that have hidden cost. These costs that help create price points in competition are sometimes at the heart of problem and are found in capitalism.

**Capitalism** can and often does lead to no transparency between industry competitors and between the Government and Industry. Depending on where you read it, it took Maersk three weeks to divulge to the US Government they had received a cyber-attack. In some instances, this caused a delay in the download of critical fuel overseas for US Forces. Likewise, the Colonial Pipeline Ransomware incident caused a significant threat for critical fuel supply to the Atlantic Fleet. At the time of the incident, US Civilian Pipeline companies only had visibility of about 8% of what their peer companies were transporting through pipelines. The Defense Industrial Base characterizes this as competition, intellectual property, value propositions and secret sauce. Often putting stockholder's wants and needs in front of that of National Security.

**The Opposite of Capitalism** is often found in offshore competition to US Industry. It is often a State-Owned Enterprise (SOE) that run commercial activities to generate money for the government. The power of the government is behind these SOEs by the way of local labor laws, tax exemptions and resourcing. The bigger problem is that they are often a third or fourth tier level supplier or sub to a US Company and the US Company is not aware of it. They know it's much cheaper, (Transactional Cost Economics) and it make them more competitive in their market. The true effect of the backlog of container cargo has yet to be diagnosed, but the effect on the US Supply Chain is impactful. This is causing duplicate orders because what has been ordered has not arrived causing a Bullwhip Effect in the Supply Chain.

**COVID 19** caused what one might name the Perfect Storm for the DoD Supply Chain. In 2018 there was increased focus on readiness by Secretary of Defense Mattis. He directed the Air Force and Navy to get mission capable rates for four key tactical aircraft up above 80% by the end of September 2019. The year prior a focus on the readiness of the Nuclear Enterprise was a focus in the Air Force. The Army was getting ready to fight tonight on the Korean Peninsula and preposition consumable inventories along with a desire for an increase in Supply Availability was the focus.

The Defense Logistics Agency (DLA) made record investments in consumable repair parts for at the time, all three services. Easily summing a few billion dollars in Obligation/Contract Authority over a three-year period. The lead time for most of these repair parts were between 12 to 24 months because of the obsolescence of the weapons system and the incompatibility with the commercial repair parts market. Obligation Authority is only the permission to create a contract and promise to pay when it arrives on the shelf in a DoD Warehouse. There has been a move to create Indefinite Delivery / Indefinite Quantity (IDIQ) Contracts where the DoD Supplier would need to take the risk of inventory while being measured with a Time To Delivery (TTD) metric. These work well with sole source suppliers who can depend on them being the only source of supply. The perfect storm was as this surge in readiness requirement of supply started to arrive onto DoD Shelves and the Working Capital Funds started to pay for their delivery. COVID hit and OPTEMPO along with its retail sales hit rock bottom. This increased inventory levels and depleted the Working Capital Funds. Draconian methods were taken to reduce inventory levels while increasing cash in the Working Capital Funds. This included cancelling and reducing purchase orders which negatively impacted business plans of DoD suppliers.

There were some innovative acquisition actions taken regarding COVID for the purchase of PPE, Test Kits and other medical device procurement. Other Transaction Authority (OTA) was used which is a legal binding instrument used to engage industry and academia for a broad range of research and prototyping activities. Also, the Defense Production Act (DPA) developed during the cold war was used in response to COVID. It was used to crack down on hoarding, limit exports of medical goods and increase production of critical supplies

Another effect that COVID has is the Vaccine Mandate. It was the subject of discussion at both the National Defense Transportation Association Annual Conference and the Professional Services Council Annual Conferences Oct 2021. The 8 November Mandate for COVID Vaccinations is reshaping the DoD Civilian Commercial workforce. The US Transportation Industry in particular has lower than average population vaccination rates. The Class A licensed US long haul drivers was estimated to be as low as 30%.

## 2.0 DoD's share of the US Market

**Reality of DoD influence** in US Domestic Markets depends on the commodity. There are over six million National Inventory Item Numbers (NIINs), two million are active NIINs and about 380K are very active NIINs. Below is a table that describes the range of participation by DoD Supply Chains in the US Domestic Markets.

DoD Supply Chain	% of US Domestic Market
Subsistence	Less than 5% <i>Note 1</i>
Medical	Between 5-10% <i>Note 2</i>
Construction & Non-Program of Record Equipment	Less than 5%
Clothing and Textile	98% <i>Note 3</i>
Fuel	~ 6% <i>Note 4</i>
Repair Parts	90% <i>Note 5</i>

**Note 1.** DoD buys more Fresh Fruits and Vegetables for the USDA School Lunch Program than for DoD Dining Facilities across the DoD.

**Note 2.** Some specialty DoD Medical supply chain items are specifically for DoD uniformed personnel for Combat. These would represent 100% of that demand, but most dollars spent in this space is commercial medical supplies from prime vendors with a customer direct delivery.

**Note 3.** The Barry Amendment restricts DoD from using funds appropriated or otherwise available to DoD for procurement of clothing, fabrics and fibers not produced in the United State. This makes the US Textile Industry dependent on DoD dollars and orders. No other Federal Department that purchases uniforms has this restriction, e.g. TSA, CBP, DHS, USFS and USDA.

**Note 4.** Some specialty fuel represents 100% of the market like Jet Propellant Thermally Stable Fuel (JPTS) for the U2 and Jet Propellant 5 (JP5) for Aircraft Carrier Aviation.

**Note 5.** The most challenging supply chain. Competes with DoD OEMs that are in active production of a Weapon System and requires long lead times, solid forecasting, and inventory on-hand.

Not all Supply Chains require the same frugality, elasticity or flexibility in their Supply and Demand. This would lead one to believe that one commodity may be more important than others when it comes to National Defense. However, a specific crisis, Manmade or Natural can bring any DoD Supply Chain to the forefront for National Security. A Colonial Pipeline Ransomware Attack risking fuel supply to the Atlantic Fleet, COVID Pandemic requiring PPE and medical supplies for the DoD and Federal Government and Hurricane Maria response requiring DoD to provide telephone poles, generators, fuel and food to Puerto Rico are all important to National Security in that time of need. Each DoD Supply Chain is vital to National Security when there is a need.

### **3.0 Executive Order 13806 of July 12, 2017 Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States**

This Executive Order directed by the previous administration required coordination with the with the Secretaries of Commerce, Labor, Energy, and Homeland Security, and in consultation with the Secretaries of the Interior and Health and Human Services, the Director of the Office of Management and Budget, the Director of National Intelligence, the Assistant to the President for National Security Affairs, the Assistant to the President for Economic Policy, the Director of the Office of Trade and Manufacturing Policy, and the heads of such other agencies as the Secretary of Defense deemed appropriate to provide to the President a report that identifies the military and civilian materiel, raw materials, and other goods that are essential to national security.

The report required the identification of manufacturing capabilities essential to producing the goods for emerging capabilities, intelligence, homeland, economic, natural, geopolitical, or other contingencies that may disrupt, strain, compromise, or eliminate the supply chains. The report must include problems as a result of the elimination of, or failure to develop domestic supply chains that are sufficiently likely to arise so as to require reasonable preparation for their occurrence. The report also required and assessment of resiliency and capacity of the manufacturing and defense industrial base and supply chains of the United States to support national security needs upon the occurrence of the contingencies. It must include an assessment of manufacturing capacity of the United States and the physical plant capacity of the defense industrial base, including their ability to modernize to meet future needs. I was also to include gaps in national-security-related domestic manufacturing capabilities, including non-existent, extinct, threatened, and single-point-of-failure capabilities, supply chains with single points of failure or limited resiliency, especially at suppliers third-tier and lower, energy consumption and opportunities to increase resiliency through better energy management

This Executive Order in its full text identifies that there are or may be vulnerabilities in the Domestic US Supply Chains that warrant attention. Much like the present Administration's Executive Order the alarm bells were rung over four years ago. Much progress has been made and much has been left to be done. The hurdles continue to be the nature of a free market and the lethality of commercial market competition. The report from this EO is in the next section of this white paper.

#### **4.0 Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States Report directed under Executive Order 13806**

On September 2018 a 146 page report was published which was required in July 21, 2017 Executive Order (EO) 13806 on Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States. The report identified that America's manufacturing and defense industrial base ("the industrial base") supports economic prosperity and global competitiveness and arms the military with capabilities to defend the Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States.

It also reported that the industrial base faces an unprecedented set of challenges: sequestration and uncertainty of government spending; the decline of critical markets and suppliers; unintended consequences of U.S. Government acquisition behavior; aggressive industrial policies of competitor nations; and the loss of vital skills in the domestic workforce. Combined, these challenges – or macro forces – erode the capabilities of the manufacturing and defense industrial base and threaten the Department of Defense's (DoD) ability to be ready for the "fight tonight," and to retool for great power competition. The report explained the macro forces impacting the industrial base, identifies primary categories of risk, illustrates impacts within sectors, and provides recommendations for mitigation. These Five Macro Forces Driving Risk into the US Industrial Base Included:

- Sequestration and Uncertainty of US Government Spending
- Decline of US Manufacturing Capabilities and Capacity
- Deleterious US Government business and Procurement Practices
- Industrial Policies of Competitor Nations
- Diminishing US STEM and Trade Skills

The new recommendations by the Secretaries of the Defense, Energy and Labor in this report Included:

- Create an industrial policy in support of national security efforts
- Expand direct investment in the lower tier of the industrial base
- Diversify away from complete dependency on sources of supply in politically unstable countries
- Work with allies and partners on joint industrial base challenges
- Modernize the organic industrial base to ensure its readiness
- Accelerate workforce development to grow domestic STEM & critical trade skills
- Reduce the personnel security clearance backlog
- Further enhance efforts exploring next generation technology for future threats



- Submit legislative proposal for FY2020 to establish an Industrial Base Analysis and Sustainment program to address manufacturing and industrial base risk within the energy and nuclear sectors.
- Work with the Departments of Defense, Education, and Commerce to determine critical manufacturing and defense industrial base
- Work with states to reduce occupational licensing barriers preventing qualified workers from quickly and efficiently meeting needs in other regions, thereby aiding geographic movement of individuals possessing critical skills to areas in need of human capital for production and maintenance (e.g. shipyards, depots, and production plants)

This Assessment was risk based on both Traditional and Cross-Cutting Sectors. As one can surmise, the Five Macro Forces Driving Risk into the US Industrial Base continue to exist today.

The new recommendations have resulted in some traction but overcoming economic reasoning to a free-market environment where capitalism drives behavior seems to continue to be the biggest challenge.

## 5.0 Executive Order 14017 of February 24, 2021 America's Supply Chains

The Assistant to the President for National Security Affairs (APNSA) and the Assistant to the President for Economic Policy (APEP) in coordination with the Secretaries of Commerce, Energy, Defense, Transportation, Agriculture and HHS were required to submit a 100 day assessment. Sectoral Supply Chain assessments from Secretary specific to their department is due within one year of the issuance of the Executive Order.

The assessments by Sector will include:

- The manufacturing or other needed capacities of the United States
- Gaps in domestic manufacturing capabilities, including nonexistent, extinct, threatened, or single-point-of-failure capabilities
- Supply chains with a single point of failure, single or dual suppliers, or limited resilience, especially for subcontractors, as defined by section 44.101 of title 48, Code of Federal Regulations (Federal Acquisition Regulation)
- The location of key manufacturing and production assets, with any significant risks identified in this section posed by the assets' physical location
- Exclusive or dominant supply of critical goods and materials and other essential goods and materials, by or through nations that are, or are likely to become, unfriendly or unstable
- The availability of substitutes or alternative sources for critical goods and materials and other essential goods and materials
- Current domestic education and manufacturing workforce skills for the relevant sector and identified gaps, opportunities, and potential best practices in meeting the future workforce needs for the relevant sector
- The need for research and development capacity to sustain leadership in the development of critical goods and materials and other essential goods and materials
- The role of transportation systems in supporting existing supply chains and risks associated with those transportation systems
- The risks posed by climate change to the availability, production, or transportation of critical goods and materials and other essential goods and materials

This Executive Order unlike the one in 2017 includes a wider swath of government assessment and includes climate change risk. The 100 Day Review has been published but the real work will be in the report due by each sector a year later. It will be interesting to see how the sectors intertwine. Right now, DoD/DLA purchases more supplies for the whole of government than the Army and Marine Corps combined.

## **6.0 Building Resilient Supply Chains, Revitalizing American Manufacturing and Fostering Broad-Based Growth, 100-Day Review Report directed under Executive Order 14017**

In June 2021 the White House Published a 250 page Report, 100-Day Review under Executive Order 14017 which included reviews by the Departments of Commerce, Energy Defense and Health and Human Services. The executive summary was signed by Jake Sullivan, Assistant to the President for National Security Affairs and Brian Deese, Assistant to the President for Economic Policy and Director of the National Economic Council.

The report assesses supply chain vulnerabilities across four key products: semiconductor manufacturing and advanced packaging; large capacity batteries, like those for electric vehicles; critical minerals and materials; and pharmaceuticals and advanced pharmaceutical ingredients (APIs). These product reports are the work of a task force that was convened across more than a dozen departments and agencies, consultations with hundreds of stakeholders, public comments submitted by industry and experts, and deep analytic research by experts from across the government.

Departments and Agencies have already begun to implement the reports' recommendations. These include steps to strengthen U.S. manufacturing capacity for critical goods, to recruit and train workers to make critical products here at home, to invest in research and development that will reduce supply chain vulnerabilities, and to work with America's allies and partners to strengthen collective supply chain resilience. Both the public and private sector play critical roles in strengthening supply chains, and the Administration will continue to work with industry, labor, and others to make America's supply chains stronger.

The 100-Day Review Report makes clear: more secure and resilient supply chains are essential to our national security, our economic security, and US technological leadership. The work of strengthening America's critical supply chains will require sustained focus and investment. Building manufacturing capacity, increasing job quality and worker readiness, inventing, and commercializing new products, and strengthening relations with America's allies and partners will not be done overnight.

The 100-Day Review Report defines why resilient supply chains matter as well as describing a new approach. It describes that the US private sector and public policy approach to domestic production priorities efficiency and low cost over security, sustainability and resilience has resulted in supply chain risk as pointed out earlier in this white paper. It does reveal that this approach to strengthen domestic supply chains will be attacked sector by sector since there are different vulnerabilities and risk by sector. The reports due a year from issuance of the Executive Order are hopefully reflected in next year federal budget.

Both Executive Orders associated with Supply Chain directions has a reflection of the challenge of the day. The 2017 EO included considerations for Sequestration and Uncertainty of US Government Spending while 2021 EO included climate change.

## 7.0 Supply Chain Risk Management (SCRM)

Supply chain risk management (SCRM) is the process of taking strategic steps to identify, assess and mitigate the risk in end-to-end supply chains. A comprehensive approach to SCRM involves **the management of all types of risk**, for all tiers of supply and for all risk objects (suppliers, locations, ports and more).

There are dozens of defense contractors that offer a Supply Chain Risk Management Tool for DoD Services and Agencies to purchase and use. The more failures seen in supply chain operations, the more SCRM tools are produced to illuminate.

The GAO Report published in December 2020 which identified that Federal Agencies need to take urgent action to manage supply chain risk found that few of the 23 civilian Chief Financial Officers Act agencies had implemented seven selected foundational practices for managing information and communications technology (ICT) supply chain risks. They describe supply chain risk management (SCRM) as the process of identifying, assessing, and mitigating the risks associated with the global and distributed nature of ICT product and service supply chains. Many of the manufacturing inputs for these ICT products and services originate from a variety of sources throughout the world.

The US Air Force has a Program Manager and Program known as the Mission Assurance Decision Support System (MADSS). They report that this program provides a common picture to all levels of command/operations through correlation of information from numerous authoritative data sources as well as user inputs. It's a web-based application accessible via SIPRNet with primary and COOP systems hosted by DISA.

There are many risks associated with Supply Chain Operations. DoD Organizations that need to measure this risk are sometimes not aligned. One organization can be fixated on cyber risk while another is focused on the economic fragility of a supplier that is a sole source. Others can be concerned on the physical distribution and nodes from the factory to the user. Once many of the SCRM tools are dissected, they too are focused on a few attributes of risk, usually those that are more easily measured. It will be very difficult to find an end all SCRM tool that measures all risk. Just like this most recent Executive Order the Supply Chain Risk was parched out for study by department and sector.

The biggest supply chain risk may be the effects of capitalization itself which drive competitiveness especially when DoD drives Lowest Price Technically Acceptable (LPTA) and Firm Fixed Price (FFP) acquisition strategies instead of Best Value which may need to include the value of protecting the supply chain. Its almost taking a Diplomatic, Information, Military and Economic (DIME) approach to supply chain operations instead of a capitalistic, lowest cost competition which drives behavior to find the most least expensive ways to knit together a supply chain which often finds the supply chain overseas in cheaper labor markets.

## 8.0 What we can we do to maintain a reliable DoD Supply Chain

**The single most important factor to both business and the health of any DoD Supply Chain is maintaining a continuous flow in the supply chain.** Starting, then stopping, then starting again effects the defense industry supply chain base both for suppliers of goods and weapon system manufactures. When industry signs on for an Indefinite Delivery Indefinite Quantity (IDIQ) contract to provide repair parts as an example, their company designs a business plan around that contract which includes revenue over the life of the contract. They take the risk of having inventory on hand based on projected delivery orders against that contract. When a demand forecast changes and orders stop, in many cases production lines stop making that item. Something else is going to replace that production which is halted because of the costs of keeping their workforce and facilities productive. When more repair parts are needed after halting orders for six months, it takes time to restart production of that line. This lead time often results in the actual user of the repair part to order more than required based on the lack of trust in the supply chain to deliver.

This is considered the “Bullwhip Effect” and is defined as the demand distortion that travels upstream in the supply chain from the retailer through the wholesaler and manufacturer due to the variance of orders which may be larger than that of sales. How DoD reduces this effect will need to be balanced against risk associated with increased DoD Inventory. In the days of a constrained Operations and Maintenance (O&M) Budgets and unhealthy Service and Defense Working Capital Funds there needs to be some resolution in how supply chains in DoD are funded and operate. Acquisition Strategies also need to be examined, especially in how DoD approaches sole source and obsolesce. DoD might get to a point where specific NIINs are considered as risk to the National Defense Strategy with a code where Acquisition Professional are directed to use different acquisition strategies instead of being forced down a road that is dictated otherwise. Many Acquisition Professional will report that this ability already exists, but experience shows more of a one size fits all with regard to policy when dealing with the 40K Contracting Officers in the DoD.

**Key to illumination is seeing yourself, the enemy and the environment, a total end to end view. Once that is achieved, you must have the right metrics to understand vulnerability, risk and decision making.** Metrics are required to illuminates the supply chain and all its components which include second, third and fourth tier suppliers and the distribution network used to deliver the supply. The debate will start with, illumination takes away a company’s competitive advantage or value proposition. It will sometimes end with, “I don’t know where that comes from – it just arrives because it’s Free on Board (FOB) destination where the supplier maintains title of the material until it arrives at destination. **DoD Industry Suppliers must be required to see themselves, end to end in their own supply chain in support of the DoD.** This requirement should be written in DoD Contracts and become inspectable by the DoD. The cost of this should be included in the price of the contract

This illumination needs to include product distribution problems to solve.

- Locations of production.
  - Where is the product being produced?
  - Is the production facility offshore with foreign influence?
  - Is the production facility located in a place that is frequently exposed to natural disasters: Floods, Hurricanes, Forest Fires, Tsunami, etc?
  - Is the production facility located in a place subject to economic conditions that would find the workforce moving to higher paying jobs?
  - Is the production facility location prone to labor unions with a risk of strikes?
- Locations of distribution points of origin
  - Are the distribution points offshore with foreign influence?
  - Are the distribution points located in a place that is frequently exposed to natural disasters: Floods, Hurricanes, Forest Fires, Tsunami, etc?
  - Are the distribution points located in places subject to economic conditions would find the workforce move to higher paying jobs?
  - Are the distribution points prone to labor union laws that have a risk with strike?
- Location of Storage and characteristics that represent risk
  - Are the storage locations offshore with foreign influence?
  - Are the storage locations located in a place that is frequently exposed to natural disasters: Floods, Hurricanes, Forest Fires, Tsunami, etc?
  - Are the storage locations located in places subject to economic conditions that would find the workforce move to higher paying jobs?
  - Are the distribution points prone to labor union laws that have a risk with strike?
- Economic health and labor conditions of those locations of the Supply Chain
  - What percent of the workforce is retirement eligible?
  - What is the average annual turn-over of the workforce?
  - What are the perishable skills in the workforce that requires time to develop?
  - What is the unemployment rate of the local economy?

The solutions below can be applied once the supply chain is illuminated to both the specific commercial enterprise executing business and DoD.

- Pursue Multiple Manufacturers and expand consumable sources
- Seek to consolidate manufacturing locations
- Pursue innovative contracting strategies that grows the DIB and invites commercial competition
- Create multiple distribution routes with multiple carriers
- Challenge boundaries that become barriers to the supply chain
- Identify the risks described above and rehearse the actions which the commercial enterprise will execute as well as DoD's actions that will be executed when required to minimize the effects on the DoD Supply Chain.

## **Artificial Intelligence (AI) and Additive Manufacturing (AM) in the DoD Supply Chain**

Artificial Intelligence is a constellation of many different technologies working together to enable machines to sense, comprehend, act, and learn with human-like levels of intelligence. Imagine if Artificial Intelligence could be used to improve demand forecasting by just 10%. Weapons system platform data, projected optempo by environment and historic data by each specific weapon system could be used to increase forecasting accuracy, decrease DoD Inventories and keep the Service and Defense Working Capital Funds flush with cash.

Additive Manufacturing is a transformative approach to industrial production that enables the creation of lighter, stronger parts and systems. As its name implies, additive manufacturing adds material to create an object. Imagine if Additive Manufacturing could be used at the point of need for just 10% of the DoD Supply Chain. Imagine if there was an AM capability in every Maintenance Depot, Flight Line Maintenance Back Shop, Shipyard, and the Division Rear. This would result in the reduction of inventories a combat unit would need to carry forward, as well as reducing the material going forward in the ground or air lines of communication. This would make the logistics tail shorter and more effective.

## 9.0 Conclusion

President Dwight D. Eisenhower ended his presidential term by warning the nation about the increasing power of the military-industrial complex. The remarks on 17 January 1961 were given during his televised farewell address to the American people. President Dwight D. Eisenhower was also behind establishing the Industrial College of the Army Forces (ICAF) on Ft McNair in Washington DC. One wonders what his remarks would include today as it pertains to the fragility of the DoD Supply Chain and National Security. Two recent US Presidents have found it important enough to Direct Executive Orders on the subject.

The Confluence of Globalization and Capitalism was and is ripe for US National Supply Chain Interruption and Crisis when unplanned natural or manmade disasters occur in global locations of the DoD Supply Chain. **The continuous flow of DoD Supply Chains is paramount to the health of the Supply Chain.**

The end-to-end Illumination of the Supply Chain is key for both industry and the DoD who depends on the health of the DoD Supply Chain. A commercial enterprise supporting DoD should not use the excuses of competition, competitive advantage, or Intellectual Property Rights as a reason for being blind in seeing themselves. DoD should demand this illumination and access to it.

Once Illumination of end-to-end DoD Supply Chain is achieved, innovative solutions in acquisition and contingency plans should be developed in partnership between DoD and Industry to address risks of DoD Supply Chain interruptions causing National Security Risk.

**Innovation** in everyday activities through the use of **Artificial Intelligence** and **Additive Manufacturing** in the near to midterm horizon is paramount to be able to better predict demand forecasts and to create and produce material closure to the point of need. This will shorten the logistics tail, reduce inventory and transportation need while allowing Work Capital Funds to remain healthy and effective.



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