

EXECUTIVE ORDER 14005 “ENSURING THE FUTURE IS MADE IN ALL OF AMERICA
BY ALL OF AMERICA'S WORKERS”:
A STUDY OF POTENTIAL IMPACTS ON AEROSPACE SUPPLY CHAINS

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Abstract

Scholarly work, journalism, and United States federal government policies reflect the interest of both the public and the U.S. government in the state of supply chains. Though supply chains and Supply Chain Risk Management (SCRM) are not new terms or practices, they are in the spotlight of popular culture in the year 2022. The COVID 19 global pandemic shot the issue of supply chains to the forefront of many agendas as the public felt the pressure of global supply chain fault lines and shortcomings and global supply chains faced unprecedented challenges. The aerospace sector is no exception to pressures and complexities in its global supply chain. With globalization of supply chains under heavy scrutiny in the two years since the start of the COVID 19 global pandemic, special consideration and analysis must be given to government and commercial policies which aim to correct or repair supply chain issues. United States domestic content restrictions and legislation which require items purchased via federal procurement channels to be produced or manufactured in the United States are one area for consideration. This research project provides an overview of President Joseph Biden's Executive Order 14005 "*Ensuring the Future is Made in All of America by All of America's Workers*" and areas for consideration when assessing potential impacts of the executive order on aerospace supply chains. Policy recommendations and considerations are based on literature review, case studies, and industry experience. This study utilizes PEST (Political, Economic, Social and Technological) analysis and SWOT (Strengths Weaknesses Opportunity and Threat) analysis to test the policy recommendations and considerations offered.

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Introduction and Goal of Study

The goal of this study is to investigate the evolution of the Buy-American act, the expansion of the act under the Biden presidency, Executive Order 14005 “*Ensuring the Future is Made in All of America by All of America’s Workers*” signed by President Biden on January 25, 2021¹ and the executive order’s potential impacts on the aerospace sector with a focus on commercial industry and U.S. federal agency aerospace supply chains (also referred to as the aerospace sector). The Brookings Institute summarizes the purpose of Executive Order 14005 as:

“Its purpose is to create higher standards for federal agencies to use and commission products that are made in the United States. The executive order reasons that it will strengthen domestic supply chains and provide greater opportunity for domestic workers and firms...It requires that the Federal Acquisition Regulatory Council (FAR Council), tasked with ensuring federal agencies abide by FAR, amend FAR to: (1) rewrite the standard used to deem a product “domestic” to incorporate the value the production of this product added to the U.S. economy; (2) raise the floor for domestic product requirements; (3) increase price preferences for domestic products.”²

In July 2021, the National Aeronautics and Space Administration (NASA), along with the Department of Defense (DoD), and the General Services administration (GSA) responded to the executive order with a proposed rule, 86 FR 40980, to comply with and implement the requirements of the order.³

This investigation examines potential impacts of the executive order on the aerospace sector and aerospace agencies and provides policy options to help mitigate risks incurred as a

¹ “Tracking Regulatory Changes in the Biden Era,” Brookings (Brookings, May 6, 2022), <https://www.brookings.edu/interactives/tracking-regulatory-changes-in-the-biden-era/>.

² “Tracking Regulatory Changes in the Biden Era,” Brookings (Brookings, May 6, 2022)

³ “Federal Register :: Federal Acquisition Regulation ...,” accessed March 15, 2022, <https://www.federalregister.gov/documents/2022/03/07/2022-04173/federal-acquisition-regulation-amendments-to-the-far-buy-american-act-requirements>.

result of the executive order. This study utilizes PEST (Political, Economic, Social and Technological) analysis and SWOT (Strengths Weaknesses Opportunity and Threat) analysis to test the policy recommendations and considerations offered.

The intended audience for this research study includes members of the aerospace industry and aerospace agencies to include NASA. For the purposes of this study, the term impact, unless otherwise stated, is used to describe consequence or risk and the focus of this research is on the potential for increased consequences or risk introduced by Executive Order 14005 to the aerospace industry and agencies. It is important to note that this approach does not indicate a bias of the author. There are many potential benefits of bolstering the U.S. supplier base and the analytic tools utilized in this study (PEST and SWOT) can be used to examine those benefits as well. A review of beneficial impacts to the aerospace sector are included in the literature review section of this study.

The intent of this study, however, is to cause the reader to consider impacts (risk/consequences) of the executive order through critical thinking and alternative analysis with particular attention to implementation of the executive order and subsequent rules related to it and the development of future related policy. Effective risk analysis of this policy is a valuable tool in achieving beneficial impacts of the policy.

This study considers risk of consequences that may be realized in production timelines, delays in mission schedules, compromised product quality, increased product cost in the aerospace industry, as well as impacts on national security, particularly with interest in existing trade agreements and established global supply chains. Another notable national security point of consideration is that of advancement in aerospace product and mission and development, a field which has historically relied on international relationships in both research and development and

manufacturing. That reliance on international relationships to be fostered in the spirit of scientific advancement as opposed to seeing other nations as competitors is well stated in the words of Steven J. Dick, former NASA Chief Historian, who penned an essay highlighting the importance of international relations in space exploration. He stated “One of the benefits of space exploration is international cooperation. Although the Age of Space began in a fiercely competitive mode, political and funding realities have now shifted the balance toward cooperation.”⁴

Research Questions and Methods

This study seeks to assess the potential consequences and risk of the expansion of the Buy-American Act on the aerospace sector and aerospace agencies and aims to provide policy options and considerations in the implementation of Executive Order 14005.

This study presents a history of the Buy-American act, an overview of Executive Order 14005 and potential implications for the aerospace industry, as well as negative impacts on national security. Potential impacts are derived from case studies which have examined the impacts of Buy-American acts and executive orders throughout various industries. Through analysis of the case-studies and a literature review, potential impacts were formulated with a consideration for how the aerospace industry may experience similar effects of increased. This approach was taken due to the limited availability of research specific to the impacts on Buy-American/Buy-America legislation on the aerospace sector. By reviewing generalized case studies and literature, we can analyze potential risk that domestic content policies can introduce to the aerospace industry and agencies.

⁴ Dick, Steven J. “Why We Explore.” NASA. NASA, May 2, 2005.
https://www.nasa.gov/exploration/whyweexplore/Why_We_10.html.

These impacts were then utilized to form policy options and considerations. Those policy options and considerations were tested through PEST and SWOT analysis in an effort to give decision makers a holistic picture of the effectiveness of those policy options. Additionally, this study includes a review of research gaps and limiting factors, and future research opportunities.

Background

A Brief History of Buy-American / Buy-America Policies

United States domestic content restrictions and legislation require items purchased via federal procurement channels be produced or manufactured in the United States.⁵ The earliest of these is the Buy-American Act established in 1933 by President Herbert Hoover on his last day in office as president.^{6,7}

The Buy-American act has had many additions and revisions since its inception, with notable related executive orders occurring during the presidencies of Jimmy Carter, Ronald Reagan, Donald Trump, and Joseph Biden. The Buy-American act of 1933 is unique from the Buy America act of 1978, though the Buy America act of 1978 can be considered a part of, or an evolution of the original Buy-American act. While there is a technical differentiation between the definitions of the Buy America act and the Buy-American act, it is important to note that current literature does not exclusively make this distinction. Journals, media, and other reporting often use the terms interchangeably.

⁵ Kate M Manuel et al., “Domestic Content Restrictions: The Buy American Act and Complementary Provisions of Federal Law” (Congressional Research Service), accessed March 2, 2022, <https://sgp.fas.org/crs/misc/R43354.pdf>.

⁶ Andrea Durkin, “Evolution of Buy American Policies,” WITA, October 1, 2020, <https://www.wita.org/blogs/evolution-of-buy-american-policies/>.

⁷ 41 USC Ch. 83: Buy American, accessed May 1, 2022, <https://uscode.house.gov/view.xhtml?path=%2Fprelim%40title41%2Fsubtitle4%2Fchapter83&edition=prelim>.

While the original Buy-American act referred to goods procured with federal funds, the Buy-America act of 1978 specifically focused on federal procurement restrictions which impacted federally funded transportation projects.⁸ Through various executive orders, President Donald Trump further expanded the umbrella of the Buy-American act, as did United States presidents prior to him, with the act seeing its most recent expansion under President Joseph Biden. President Biden signed an executive order on January 25, 2021 “ensuring the future is made in all of America by all of America’s workers” which included the establishment of the “Made in America” office.⁹ As the Buy-American act has survived many presidencies and has evolved through executive orders by both republican and democrat presidents, the act has also been the subject of scrutiny and politicization throughout its history. The politicization of the act is an important compounding factor to consider when considering potential impacts of Buy-American policies and legislation.

Biden Era Buy-American Act Executive Order 14005 and Made in America Laws

President Biden signed Executive Order 14005 “*Ensuring the Future is Made in All of America by All of America's Workers*” within his first month serving as the United States President.¹⁰ The executive order aims to support manufacturing in the United States by increasing federal procurement spending on U.S.-made items. The executive order covers a bucket of legislation which it categorizes under the term “Made in America Laws” which is defined as:

“all statutes, regulations, rules, and Executive Orders relating to Federal financial assistance awards or Federal procurement, including those that refer to “Buy America” or “Buy American,” that require, or provide a preference for, the purchase or acquisition of

⁸ Kate M Manuel et al., “Domestic Content Restrictions: The Buy American Act and Complementary Provisions of Federal Law”

⁹ “Ensuring the Future Is Made in All of America by All of ...,” Federal Register, January 28, 2021, https://www.federalregister.gov/documents/2021/01/28/2021-02038/ensuring-the-future-is-made-in-all-of-america-by-all-of-americas-workers?mc_cid=5a6ab82ea4&mc_eid=UNIQID.

¹⁰ “Ensuring the Future Is Made in All of America by All of ...,” Federal Register, January 28, 2021,

goods, products, or materials produced in the United States, including iron, steel, and manufactured goods offered in the United States.”¹¹

The executive order is focused on reviewing federal agency adherence to existing Made in America laws and increasing accountability and centralizing the process for waivers from Made in America laws (the executive order defines a waiver as “an exception from or waiver of Made in America Laws, or the procedures and conditions used by an agency in granting an exception from or waiver of Made in America Laws.”)¹²

The two primary requirements of Executive Order 14005 include the “Review of Agency Action Inconsistent with Administration Policy” and “Updating and Centralizing the Made in America Waiver process”.¹³ In addition the executive order calls for the establishment of the Made in America Office.

President Biden’s Executive Order 14005 calling for a review of existing laws and implementation of existing rules may not seem like major legislation on the surface however it is important to understand how suppliers have relied on the waiver process to domestic restriction laws. The Buy-American act has many exceptions which can and have allowed a contractor or manufacturer to work around the rules within the Buy-American act. The exceptions come in to play particularly for end-products, where a contractor or manufacturer can often work around

¹¹ “Ensuring the Future Is Made in All of America by All of ...,” Federal Register, January 28, 2021.

¹² “Ensuring the Future Is Made in All of America by All of ...,” Federal Register, January 28, 2021.

¹³ “Ensuring the Future Is Made in All of America by All of ...,” Federal Register, January 28, 2021, https://www.federalregister.gov/documents/2021/01/28/2021-02038/ensuring-the-future-is-made-in-all-of-america-by-all-of-america-workers?mc_cid=5a6ab82ea4&mc_eid=UNIQID.

domestic content threshold rules. One source indicates “aerospace waivers from 2010-2014 represented \$4,342,000,000 of waivers during that timeframe”.¹⁴

Domestic content thresholds are restrictions that require a certain percentage of an end-product to be produced in the United States.¹⁵ Domestic content thresholds have very specific criteria. This criterion, while aimed at benefiting U.S. businesses by trying to keep production in country, can be quite difficult for a small supplier or a supplier with well-established global sub-tier suppliers to comply to. In some cases, the domestic threshold criteria could be a make-it or break-it for a supplier or decision point as to whether to manufacture product for a government procurement. Another consideration is volume of product. If a supplier is required to adhere to domestic content thresholds for a one-off procurement, which is common in the aerospace industry, particularly in space-related procurements, it may not be worth the investment to participate in the project. Changes to the waiver process and increased scrutiny of the waiver process has the potential to have larger-scale implications on existing supply chains as well, such as the issue of existing contracts and international obligations that may no longer qualify for a waiver in a federal procurement.

The White House, in a July 2021 press release, stated that President Biden’s Buy-American rule includes the “most robust changes to the implementation of the Buy American Act in almost 70 years”.¹⁶ The important distinction of this claim is the word implementation.

¹⁴ “Not Made In the USA Buy American Act Waivers and Connecticut Manufacturing Jobs,” Senator Chris Murphy, n.d., <https://www.murphy.senate.gov/imo/media/doc/Not%20Made%20in%20the%20USA-%20Buy%20American%20Act%20Waivers%20and%20Connecticut%20Manufacturing%20Jobs%20Report%2014.pdf>, 6.

¹⁵ “The Buy American Act and Other Federal Procurement Domestic Content Restrictions,” Congressional Research Service, March 31, 2021, <https://crsreports.congress.gov/product/pdf/R/R46748>.

¹⁶ “Fact Sheet: Biden-Harris Administration Issues Proposed Buy American Rule, Advancing the President's Commitment to Ensuring the Future of America Is Made in America by All of America's Workers,” The White

The focus of the executive order is not actually a call for immediate changes. The executive order reads more like a review of compliance and calls for a review of existing Made in America laws and rules, with a push to implement existing rules and move away from extensive waivers on such rules.

As of December 2021, the White House estimated federal procurement spending to be over \$600 billion annually and that approximately half of that spending is on manufactured goods.¹⁷ Manufactured goods equal “end-products”, a term which is used in Federal Acquisition Regulations (FAR). FAR 52.225-1 “Buy American-Supplies” defines end-products as “articles, materials, and supplies to be acquired for public use”. FAR 52.225-1 defines a domestic end-product as a product manufactured in the United States with 55% of its components as determined by cost also manufactured in the United States. If a product meets both criteria, then it is considered a domestic end-product. If not, it is considered to be a foreign manufactured product.¹⁸

The manufactured goods/end-product piece of this spending is significant in understanding the complexities of implementing a wide-spread executive order which attempts to mandate, with strict waiver requirements, a high percentage of U.S.-manufactured goods in federal procurements.

House (The United States Government, July 28, 2021), <https://www.whitehouse.gov/briefing-room/statements-releases/2021/07/28/fact-sheet-biden-harris-administration-issues-proposed-buy-american-rule-advancing-the-presidents-commitment-to-ensuring-the-future-of-america-is-made-in-america-by-all-of-americas/>.

¹⁷ “The Benefits of Increased Equity in Federal Contracting,” The White House (The United States Government, December 3, 2021), <https://www.whitehouse.gov/cea/written-materials/2021/12/01/the-benefits-of-increased-equity-in-federal-contracting/>.

¹⁸“FAR,” 52.225-1 Buy American-Supplies | Acquisition.GOV, accessed March 12, 2022, [https://www.acquisition.gov/far/52.225-](https://www.acquisition.gov/far/52.225-1#:~:text=End%20product%20means%20those%20articles,the%20contract%20for%20public%20use.)

[1#:~:text=End%20product%20means%20those%20articles,the%20contract%20for%20public%20use.](https://www.acquisition.gov/far/52.225-1#:~:text=End%20product%20means%20those%20articles,the%20contract%20for%20public%20use.)

When considering implementation of Buy-American policies, raw materials can be easier to trace the origin of the purchase, whereas manufactured goods or end-products introduce a complex myriad of compounding factors to consider. Supply chain visibility becomes an important factor when determining compliance with Buy-American policies. Supply chain visibility is defined as “the ability to track individual components, sub-assemblies and final products as they travel from supplier to manufacturer to consumer.”¹⁹ Research indicates a very small percentage of U.S. manufacturers across multiple-sectors actually have visibility into their supply chains.²⁰ Specific to NASA, the director of the NASA Goddard Supply Chain Conference was quoted in a NASA press release as saying “We know what’s above the waterline, but then it gets murky.”²¹, referring to an iceberg analogy to explain supply chain visibility into tiers of suppliers.

According to the White House, the Federal government is “the single largest purchaser of consumer goods in the world”.²² As such, U.S. policies on trade and federal government procurement have the potential for an array of rippling impacts in the global supply chain. On the surface, the idea of boosting United States manufacturing through federal procurements seems

¹⁹ Justin Biel, “What Is Supply Chain Visibility (SCV)? Definition & Examples,” Oracle NetSuite, accessed March 20, 2022, [https://www.netsuite.com/portal/resource/articles/erp/supply-chain-visibility.shtml#:~:text=Supply%20chain%20visibility%20\(SCV\)%20is,tracing%20%E2%80%94%20depends%20on%20the%20product](https://www.netsuite.com/portal/resource/articles/erp/supply-chain-visibility.shtml#:~:text=Supply%20chain%20visibility%20(SCV)%20is,tracing%20%E2%80%94%20depends%20on%20the%20product).

²⁰ “2017 Supply Chain Worldwide - Geodis.com,” accessed March 25, 2022,

https://geodis.com/in//sites/default/files/2019-03/170509_GEODIS_WHITE-PAPER.PDF.

²¹ “Supply Chain Conference Focuses on Risk Management,” NASA (NASA, December 6, 2018), <https://sma.nasa.gov/news/articles/newsitem/2018/12/06/supply-chain-conference-focuses-on-risk-management>.

²² “Fact Sheet: Biden-Harris Administration Issues Proposed Buy American Rule, Advancing the President's Commitment to Ensuring the Future of America Is Made in America by All of America's Workers,” The White House (The United States Government, July 28, 2021), <https://www.whitehouse.gov/briefing-room/statements-releases/2021/07/28/fact-sheet-biden-harris-administration-issues-proposed-buy-american-rule-advancing-the-presidents-commitment-to-ensuring-the-future-of-america-is-made-in-america-by-all-of-americas/>.

²² “The Benefits of Increased Equity in Federal Contracting,” The White House (The United States Government, December 3, 2021), <https://www.whitehouse.gov/cea/written-materials/2021/12/01/the-benefits-of-increased-equity-in-federal-contracting/>.

like a noble and much needed boost to the United States economy, particularly in the wake of the economic tumble which has resulted from the Covid-19 global pandemic. However, there are many compounding factors to consider when implementing changes to the Buy-American act, particularly with regards to aerospace manufacturing where support to a project may already be deeply rooted in contractual obligations and long-standing reliance on international suppliers.

In February 2022, the White House published a press release titled “The Biden-Harris Plan to Revitalize American Manufacturing and Secure Critical Supply Chains in 2022”.²³ The press release detailed the efforts over the last year in support of another supply chain related executive order, Executive Order 14017 directing an “all-of-government approach to assessing vulnerabilities in – and strengthening the resilience of – the United States’ critical supply chains”. Interestingly many of the executed and planned efforts listed in the press release relate to the concerns/potential impacts cited in the literature review portion of this study.

Supply Chain – Renewed Interest in an Established, Complex Issue

To understand the complexities and potential or realized impacts of Buy-American, in addition to having an understanding of the evolution of Buy-American from its inception in 1933 and in particular over the last 20-30 years, the role of politics in the act and the act’s relationship with national and global security, one must also clearly understand the term supply chain as the Buy-American act is essentially a roadmap for supply chains supporting federal procurements.

²³ “The Biden-Harris Plan to Revitalize American Manufacturing and Secure Critical Supply Chains in 2022,” The White House (The United States Government, February 24, 2022), <https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/24/the-biden-harris-plan-to-revitalize-american-manufacturing-and-secure-critical-supply-chains-in-2022/>.

The COVID pandemic has made the term “supply chain” a household term, however the term supply chain began to be used in the 1980’s and a definition was formalized in 1990’s.²⁴ A case study titled “The Development of Supply Chain Management Within the Aerospace Manufacturing Sector”, published in 2004, defines supply chain as “a series of organizations and activities that are required to convert raw materials and deliver them as finished products to the final user.”²⁵ While many definitions for supply chain exist, the definition provided in that case study closely aligns with the meaning of the term represented in this report. This definition was chosen because it succinctly describes the process of the chain from raw materials to delivery of final product to the end-user. While this definition has some gaps, it does provide a high-level overview that is applicable to supply chains in the aerospace sector. Gaps in the definition include sourcing the raw material, and post-delivery activity and support where applicable. Even still, much focus on creating a consensus supply chain or SCRM definition is focused on information technology supply chains, in particular software supply chains, which include elements not necessarily pertinent to this application. An example of this focus can be found in a 2005 study titled “Supply Chain Management: The Pursuit of a Consensus Definition.”²⁶

Globalization of Supply Chains

The impacts of Buy-American / Buy-America policies over last three decades are of particular importance because this is where true globalization of supply chains have come into

²⁴ “The History and Evolution of the Global Supply Chain,” Blume Global, accessed March 25, 2022, <https://www.blumeglobal.com/learning/history-of-supply-chain/>.

²⁵ R.R. Bales, R.S. Maull, and Z. Radnor, “The Development of Supply Chain Management within the Aerospace Manufacturing Sector,” *Supply Chain Management: An International Journal* (Emerald Group Publishing Limited, July 1, 2004), <https://www.emerald.com/insight/content/doi/10.1108/13598540410544944/full/pdf?title=the-development-of-supply-chain-management-within-the-aerospace-manufacturing-sector>.

²⁶ Gibson, Brian J., John T. Mentzer, and Robert L. Cook. “Supply Chain Management: The Pursuit of a Consensus Definition.” *Journal of Business Logistics* 26, no. 2 (2005): 17–25. <https://doi.org/10.1002/j.2158-1592.2005.tb00203.x>.

play.²⁷ Globalization of supply chains has meant not only a vast interconnected web of suppliers that extend throughout the globe, but also with that international trade relations and agreements, many of which have resulted in deeply woven international economic dependencies and expectations of future trade activity. Buy-American does not exist without globalization or the theory of globalization, and this rings true in today's supply chain as well as supply chains of 1933 when Buy-American was born. It was birthed because of a desire to meter the use of globalized procurement in federal acquisitions.

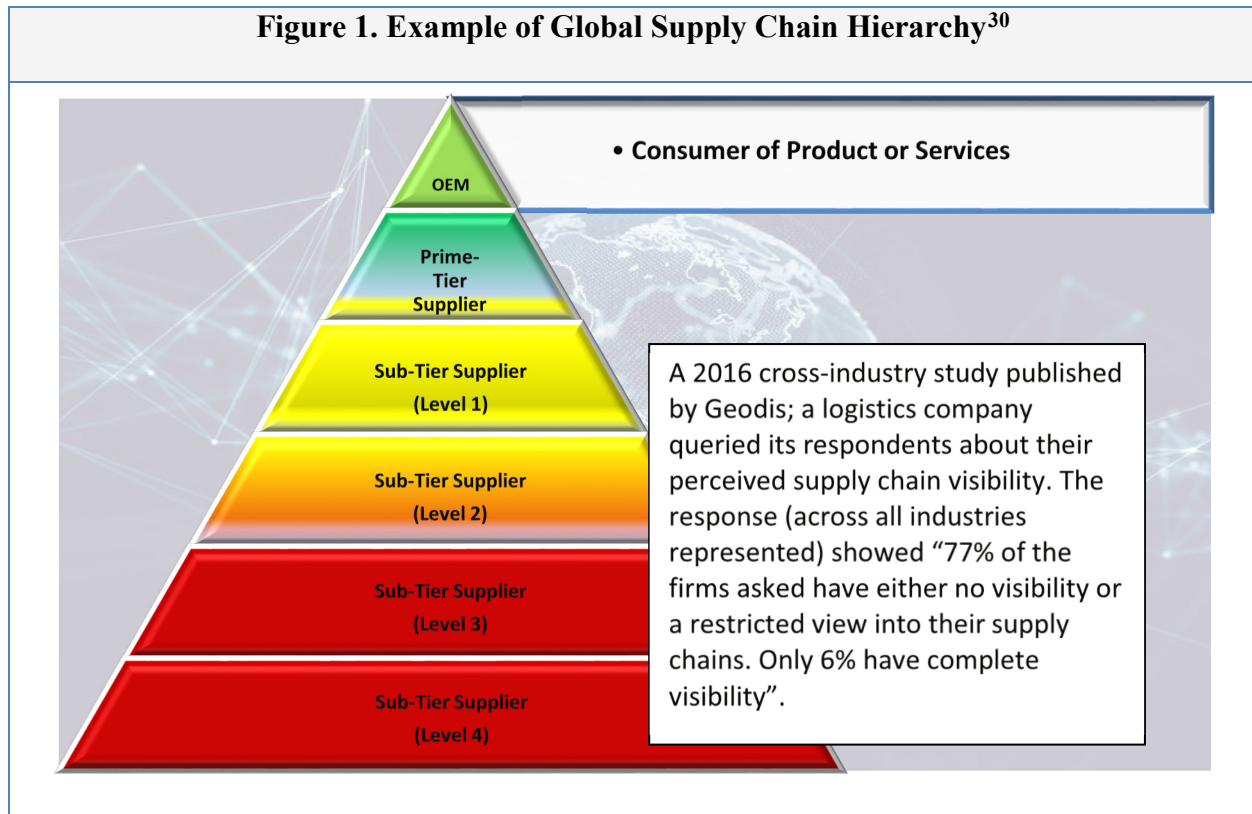
The term "globalization" is widely used when discussing world economics, and a subset of the term includes globalization of supply chains.²⁸ Globalization of supply chains is simply the reliance or use of manufacturers and/or resources in other nations throughout the globe to produce components of an end-product or finished good. While the definition of globalization of supply chains is straight forward and simple, the reality of globalized supply chains is quite complex and contains many layers beyond what will be addressed in this paper. At the root of that complexity is supply chain visibility.

Supply chain visibility on the surface seems like something any manufacturer or procurement officer should have. After all, the component produced in support of an end-product had to be procured, so it would seem inherent that the original equipment manufacturer (OEM) would have eyes on the downstream procurement chain. To understand the OEM's position in the supply chain, think of the OEM as the manufacturer at the top of a pyramid, where the ultimate product or service stems from or is contracted with. Below the OEM are the prime-tier suppliers, which are suppliers that an OEM conducts direct business with. With supply chains

²⁷ "The History and Evolution of the Global Supply Chain," Blume Global, accessed March 25, 2022, <https://www.blumeglobal.com/learning/history-of-supply-chain/>.

²⁸ Ngaire Woods, *The Political Economy of Globalization* (Houndmills England: Macmillan Press, 2000).

often running three sub-tiers and beyond²⁹, the reality is that many OEMs do not have visibility into their supply chain beyond the prime-tier supplier or first sub-tier supplier for a given product.



Case Studies

²⁹Parimal Kopardekar, “Aerospace Supply Chain and Manufacturing,” NASA Aeronautics Research Institute, February 4, 2020, <https://nari.arc.nasa.gov/sites/default/files/attachments/1-pk-feb4-5-SupplyChainManagement.pdf>.

³⁰ This pyramid portion of this graphic was created by the author of this study, Shannon Marsh. The background image in the graphic was sourced from “Throughout and beyond Covid-19: Building Fault-Tolerance into the Global Supply Chain,” Supply Chain Asia, April 26, 2020, <https://supplychainasia.org/throughout-beyond-covid-19-building-fault-tolerance-global-supply-chain/>. The information quoted from the Geodis study can be found at “2017 Supply Chain Worldwide - Geodis.com,” accessed March 25, 2022, https://geodis.com/in//sites/default/files/2019-03/170509_GEODIS_WHITE-PAPER.PDF.

The following case studies (Apple Incorporated, The James Webb Space Telescope, and the F-35 Fighter Jet and Buy-American Policies) were chosen to demonstrate the complexity and lack of visibility of supply chains from a supplier of product that touches many households, to the global reach of the supply chain of the James Webb Telescope, and the implications of domestic content restriction policies on the F-35 Fighter Jet. These examples are intended to help the reader conceptualize the existence of globalization of supply chains, and in some of the cases lack of visibility into the supply chain, as well as lack of understanding of limited source suppliers and impacts restrictive legislation could have on a project.

Apple Incorporated & Boeing Aircraft Supply Chain Examples

Globalization of supply chains adds to the complexity of supply chain risk management, in particular supply chain visibility. While this report explores aerospace supply chains, we will start our case study review examining a case study on a more micro-level that impacts nearly every individual's daily life in the United States to demonstrate the relationship of an OEM, prime-tier suppliers, globalization of the supply chain, and lack of supply chain visibility beyond the prime-tier supplier. That micro-level case study considers the supply chain of personal electronic devices such as cell phones, laptops, and smart watches.

Apple Incorporated makes a list of suppliers publicly available, though they do not list which suppliers produce which parts of which products.³¹ The list shows suppliers in locations including China, France, Malaysia, South Korea, Vietnam, Mexico and the United States, among others. Apple states that this list represents 98 percent of their direct spend, indicating these suppliers are prime-tier suppliers and not inclusive of sub-tier suppliers. This list demonstrates

³¹ "2021 Apple Supplier List," accessed March 27, 2022, <https://www.apple.com/supplier-responsibility/pdf/Apple-Supplier-List.pdf>.

the globalization of the Apple supply chain even at the prime-tier supplier level. Beyond the prime-tier supplier, things start to get blurry with supply chains consisting of sub-tier suppliers many tiers deep.

The aforementioned example indicating Apple prime-tier suppliers span the globe demonstrates supply chain visibility into the first or prime-tier level of suppliers. The supply chain for Apple at second-tier, third-tier and beyond is not evident in the Apple documentation. This example illustrates the global supply chain touching the hands of the general population on products that can be found in many United States households – personal electronic devices. According to the United States census as of 2018, “smartphones were present in 84% of households, while 78% of households owned a desktop or laptop.”³² While this is just one example, this one example exhibits the ubiquitous nature of global supply chains.

If a prime-tier supplier list for hand-held electronics shows a global presence, what then could we expect a supply chain for complex systems that materialize in the aerospace industry? Highly complex, highly interdependent and interconnected global supply chains are seen throughout the aerospace industry. A 2017 Supply Chain Worldwide Survey conducted in 2016 by an independent research institute and published by Geodis, a global transportation company, collected 623 responses from 17 countries, with industry representation from chemical, pharmaceuticals, biotech, consumer goods, aerospace, defense, energy, utilities, high-tech, and electronics industries. According to that survey, the “aerospace industry is an illustrative example of [growing supply chain] complexity: with an average of 3 million parts by plane and

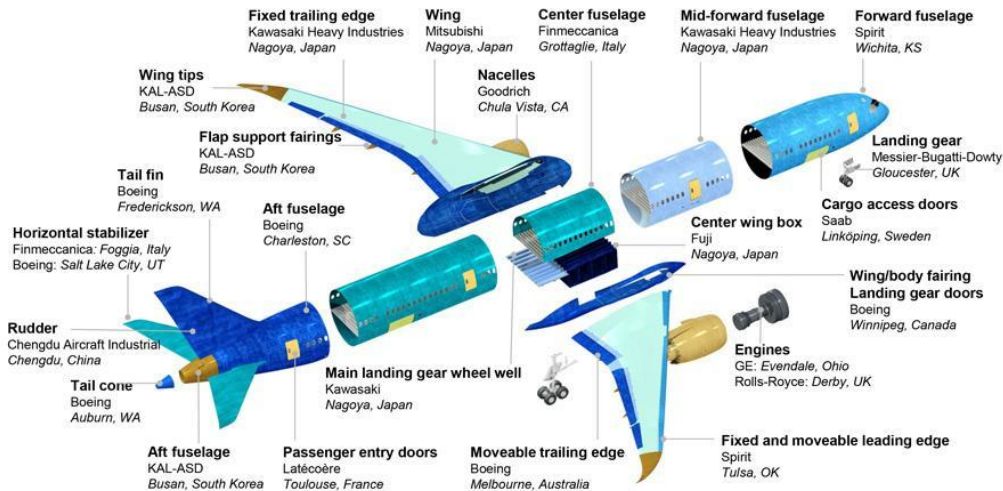
³² US Census Bureau, “Computer and Internet Use in the United States: 2018,” Census.gov, October 8, 2021, <https://www.census.gov/newsroom/press-releases/2021/computer-internet-use.html#:~:text=Smartphones%20were%20present%20in%2084,owned%20a%20desktop%20or%20laptop>.

four levels of suppliers ranging from raw materials to aircraft manufacturers”.³³ Figure 2 demonstrates the global supply chain of a Boeing commercial aircraft.

³³ “2017 Supply Chain Worldwide - Geodis.com,” accessed March 25, 2022, https://geodis.com/in/sites/default/files/2019-03/170509_GEODIS_WHITE-PAPER.PDF.

Figure 2. Example of a Boeing Aircraft Supply Chain³⁴

Global Supply Chains Explained ... In One Graphic



Copyright © 2015 Boeing. All rights reserved.

That same study queried its respondents about their perceived supply chain visibility. The response (across all industries represented) showed “77% of the firms asked have either no visibility or a restricted view. Only 6% have complete visibility”.³⁵ This lack of supply chain visibility shown in the Geodis study and also demonstrated in the earlier mentioned NASA / iceberg analogy is concerning when the aerospace industry and aerospace agencies are faced with the task of becoming compliant to domestic content regulations that dictate where a product is manufactured. Without visibility into the supply chain, this becomes a daunting task.

Scholars and journalists have examined the pros and cons of the global supply chain with fervor from the onset of the pandemic in early 2020. A search on Google Scholar for the term

³⁴ “Global Supply Chains Explained ... in One Graphic,” U.S. Chamber of Commerce, accessed April 6, 2022, <https://www.uschamber.com/security/supply-chain/global-supply-chains-explained-one-graphic-0>.

³⁵ “2017 Supply Chain Worldwide - Geodis.com”

“pandemic impact global supply chain” returned 18,600 scholarly works related to the topic authored between 2020-2022. Those written works paint a picture of initial concern and theory (early 2020) to predictions of failures and analysis of realized supply chain chokepoints (2021-present) as well as analysis of supply chain recovery plans and paths ahead for globalized supply chains. While the number of scholarly works on global supply chain over the last several years indicate a keen interest in this field of research with varying viewpoints on globalization of supply chains, the need for greater supply chain visibility and redundancies in supply chain are common themes amongst scholarly work on the topic. The need for both increased supply chain visibility and redundancy in supply chains are two points that suggest implementation of stricter domestic content regulations such as Executive Order 14005 may require more risk analysis prior to implementation to ensure the benefits of the policy to U.S. suppliers can outweigh the consequences.

On the heels of a globally devastating pandemic, and as global economies and supply chains work to recover, there is much to be considered when implementing a policy such as the Buy-American act executive. One item for consideration is whether the policy assumes certain factors for its implementation and success. Such factors include but are not limited to the following: redundancy in supply chains, adequate supply chain visibility, the existence of equivalent production capabilities or the ability to stand up those capabilities in a timely and cost-effective fashion, actual existence of raw materials and resources in the U.S., adequate investment in U.S. industry, intellectual capital contained within the U.S. and the ability for existing U.S. manufacturers to be able to adjust existing supply chains and trade agreements to comply with the policy. In fact, Executive Order 14005 may have been created without those answers as the E.O. required all agencies to submit a report to the Made in America director within 180 days of the executive order which outlined the agencies compliance with Made in

America laws, the agency's use of waivers, and recommendations for further "effectuating the policies" within the executive order. This mandate is discussed in more detail in the Summary of Potential Impacts of Executive Order 14005 on the Aerospace Industry section of this study.

This mandate is focused on compliance but also gave federal agencies the ability to share with the Made in America agency director proposed plans for compliance, essentially giving the agency the opportunity to review and answer some of the above points that may be applicable to them. While the executive order gave agencies this chance, there is no similar mandate to the private sector supplier supporting those agencies. An appropriate action from the agency would be to flow down a similar request to their prime-tier suppliers to garner an understanding of their compliance to the executive order requirements.

The focus and attention given to supply chains and global markets over the last two-plus years might lead the public to wonder if the issues seen in supply chains are new. Research indicates this is not likely the case, rather that the COVID pandemic was a tipping point for suppliers and supply chain nodes in the global network; this is a "survival of the fittest" type scenario that caused the issues to rise to the top. Specific to the aerospace industry, this assessment was highlighted in a November 2021 journalism article published by SpaceNews.com titled "Space Industry Feels Varying Effects of Supply Chain Disruptions".³⁶ In that article, author Jeff Foust focuses on the issue that the pandemic brought existing issues in aerospace supply chains to the surface: "Panelists during a session of the ASCEND conference by the American Institute of Aeronautics and Astronautics Nov. 10 said that the shocks to the global supply chain caused by the pandemic highlighted existing weaknesses in traditional space industry supply chains." Foust goes on to highlight that some of the issues revolved around

³⁶ Jeff Foust , "Space Industry Feels Varying Effects of Supply Chain Disruptions," SpaceNews, November 14, 2021, <https://spacenews.com/space-industry-feels-varying-effects-of-supply-chain-disruptions/>.

underinvestment in the [aerospace] supply chain relative to other industries creating a situation where supply chain shocks hit even harder.

Globalization of supply chains has been the norm for at least the last 20-30 years with the term “supply chain management” officially coined during that time as well. While globalization of supply chains was truly cemented in the last 20-30 years, the reality is that globalization, or at least international supply chain networks, has existed for much longer and can be traced back to at least the early 20th century.

The James Webb Space Telescope

For aerospace contractors and manufacturers that support agencies such as NASA with long-term missions, where contracts are already in place and international manufacturer relationships are established with the prime-contractor which may be relied on for future work on such projects, the waiver scrutiny and implementation could lead to significant impacts. It is not

unusual for the complete mission lifecycle of a NASA mission to span ten, twenty, or more

years. The

development of a

project and the

relationships built

during the early

mission phases of

Concept Studies,

Concept and

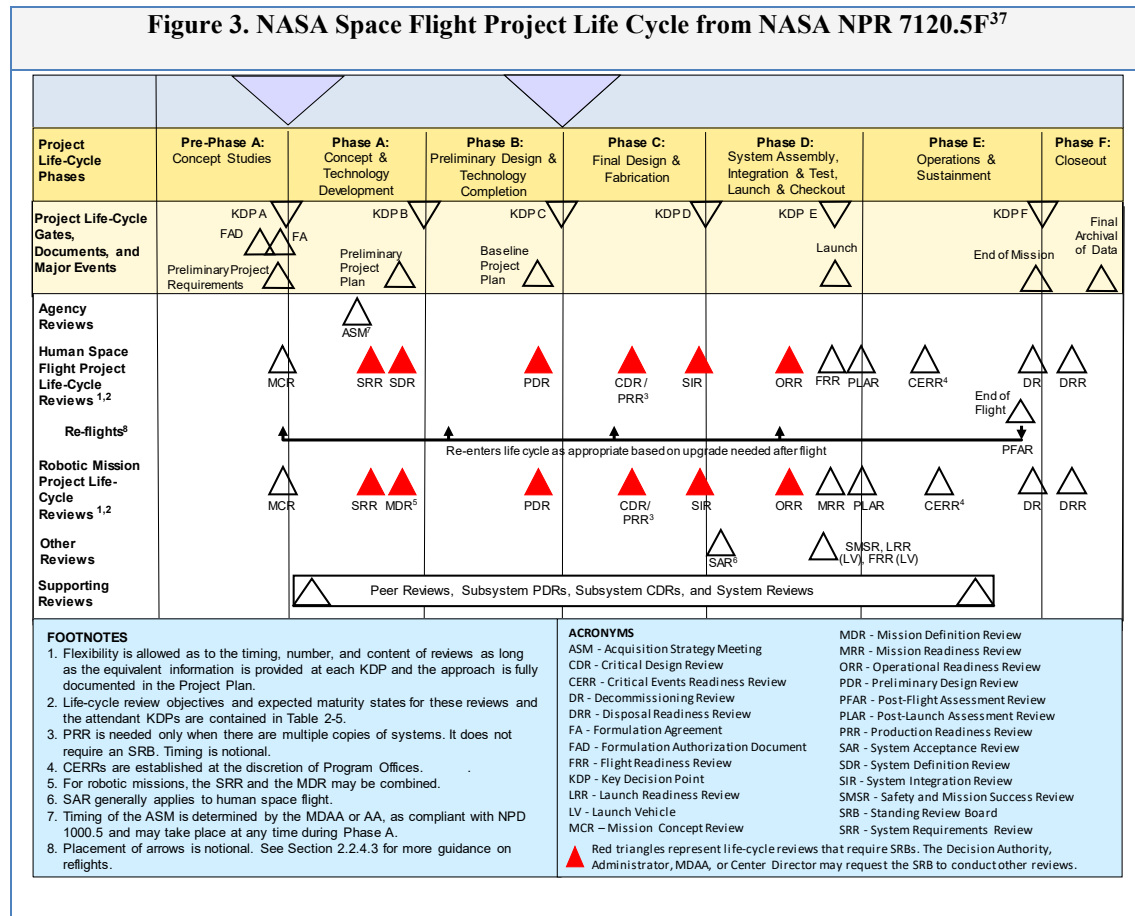
Technology

Development, and

Preliminary Design

and Technology

Completion, may be



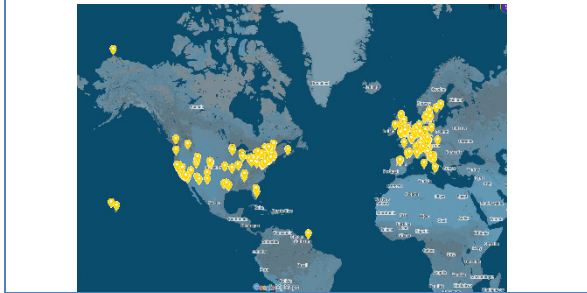
reliant on technology development and expertise which may exist outside of the United States.

This lifecycle can be seen in Figure 3.

³⁷ “NPR 7120.5F,” NASA (NASA, August 3, 2021), <https://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPR&c=7120&s=5E,17>.

The James Webb Telescope project is a prime example of a long-term space project which utilized extensive international collaboration. Serious planning for the James Webb telescope

Figure 4. Map of Contributors to the James Webb Telescope Project³⁸



began in the 1990s and launched on December 25, 2021. According to the James Webb project website, contributors to the project included “thousands of scientists, engineers, and technicians from 14 countries, 29 U.S. states, and Washington, D.C. contributed to design, build,

test, integrate, launch, and operate Webb”.³⁹

The F-35 Fighter Jet and Buy-American Policies

In April 2021, The Heritage Foundation published a journal entry which highlighted the dangers of knee-jerk type reactions to long-standing complex supply chain issues. The journal discussed the issue of the F-35 fighter jet, an issue that would have been realized had Buy-American rules been implemented.⁴⁰ The issue of the F-35 fighter jet came to light when former president Donald Trump banned Turkey from contributing to the F-35 program because of Turkey’s ties to Russia. The Department of Defense realized that the F-35 program was reliant on sole-source providers in Turkey. This realization resulted in the Department of Defense continuing to purchase F-35 components from Turkey into 2022. Had the DoD banned Turkey from participating the F-35 program, the report estimates the move would have cost the F-35 program \$1 billion. The F-35 case study is an example of a policy set in place with the intention

³⁸ “Institutional Partners Webb/NASA,” NASA (NASA), accessed April 6, 2022, <https://webb.nasa.gov/content/meetTheTeam/team.html#interactiveZoomableMapOfContributors>.

³⁹ “Institutional Partners Webb/NASA,” NASA (NASA), accessed April 6, 2022, <https://webb.nasa.gov/content/meetTheTeam/team.html>.

⁴⁰ Maiya Clark, “Understanding and Protecting Vital U.S. Defense Supply Chains,” *Heritage Foundation Backgrounder* 3598 (April 1, 2021), <https://www.heritage.org/sites/default/files/2021-04/BG3598.pdf>.

of securing the supply chain on an aerospace project and protecting U.S. interests but clearly without a study into the potential impacts of such a decision.

Literature Review: A Study of Perspectives on Buy-American Policies

A review of existing scholarly literature as well as media and blog-style publications indicate varying perceptions and viewpoints on the benefits and impacts of the “Buy America” act. While perceptions vary, some common threads include delays in production time and increased manufacturing costs, product pricing, concerns over lack of redundancy in supply chain and impacts on existing trade agreements as well as national security. Among existing literature, studies include historical research pieces, current opinion pieces, and even empirical quantitative and qualitative analysis.

The first sampling of literature titled “Literature Review Sample A. Risk/Consequence Focused Viewpoints” is focused on viewpoints indicating risk and consequence of Buy-American policies. The second sampling of literature titled “Literature Review Sample B. Beneficial Impacts Focused Viewpoints” is focused on viewpoints indicating beneficial impacts of Buy-American policies.

Literature Review Sample A. Risk/Consequence Focused Viewpoints

The following examples exhibit a sampling of viewpoints and potential impacts (risk/consequence) of the “Buy America” Act on supply chains, U.S. manufacturing and international relations:

- Increased Cost to the U.S. Government - Research suggests Buy-American policies are counter-productive. One example suggests that Buy-American policies increase cost to the U.S. government.⁴¹
- Lack of Evidence of Benefits of Buy-American Policies, Increased Project Costs, Project Delays - A 2015 Congressional Research Service report states: “*Empirical evidence on the economic benefits or costs of domestic preference laws is largely lacking*”. The report continues to state that Buy-American policies could increase costs of projects when imported components may be less costly. The same report cites delays in project completion because of the difficulty in complying with Buy-American rules, as well as delays in product transportation when U.S. carriers are required for transport.⁴²
- Increased Product Cost, Impact on Global Competitiveness of U.S. Suppliers - A January 2021 article for the Center for Strategic and International Studies cites the potential for increased cost to businesses which would not only impact the cost of the end-product but would undermine global competitiveness of U.S. companies since domestically produced components would be more expensive than foreign components. The report also cites an issue common to the aerospace industry. Aerospace projects are not generally high-volume buys. Suppliers supporting low-volume aerospace projects may be reluctant to alter supply chains to comply with

⁴¹ Peter B. Dixon & Maureen T. Rimmer & Robert G. Waschik, 2017. "Macro, industry and regional effects of eliminating Buy America(n) programs: USAGE simulations," Centre of Policy Studies/IMPACT Centre Working Papers g-271, Victoria University, Centre of Policy Studies/IMPACT Centre.

⁴² Michaela D. Platzer and William J. Mallett, “Effects of Buy America on Transportation Infrastructure ...,” National Agricultural Law Center (Congressional Research Service, November 10, 2015), <https://nationalaglawcenter.org/wp-content/uploads/assets/crs/R44266.pdf>, Summary.

Buy-American rules because it may simply not be viewed as a beneficial business decision, causing the business to prioritize non-government customers.⁴³

- International and Trade Relations, Loss of U.S Government Income - A November 2021 article published by Defense News warned of the impact of President Biden’s executive order on international relations, particularly trade relations.⁴⁴ The article paints President Biden’s version of Buy-American as protectionist in nature, a move that could cost the U.S. government big money. The article states that “foreign military sales fuel a \$40.6 billion trade surplus for the sector and help Washington gain interoperability with allied militaries, and they warn those benefits could decline”.⁴⁵ Put simply, if the U.S. refuses to purchase from those allied nations, those nations are not likely to in-turn purchase from the U.S.
- Availability and Volatility of Domestic Suppliers - In a 2018 report prepared for then-president Donald Trump⁴⁶, the DoD highlighted concerns with availability and volatility of domestic suppliers, particularly limited or sole-source suppliers should an economic downturn occur. This report certainly foreshadowed events and impacts to come just two years after its publication – impacts similar to those discussed in the aforementioned SpaceNews.com article. The report titled, “Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain

⁴³ “Buy American, Again,” Buy American, Again | Center for Strategic and International Studies, accessed February 23, 2022, <https://www.csis.org/analysis/buy-american-again>.

⁴⁴ Joe Gould, “Buy American: Biden Sees Industry Pushback as Allies Warn of Trade Consequences,” Defense News (Defense News, November 1, 2021), <https://www.defensenews.com/global/the-americas/2021/11/01/buy-american-biden-sees-industry-pushback-as-allies-warn-of-trade-consequences/>.

⁴⁵ Joe Gould, “Buy American: Biden Sees Industry Pushback as Allies Warn of Trade Consequences,” Defense News (Defense News, November 1, 2021).

⁴⁶ “Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States,” September 2018, <https://media.defense.gov/2018/Oct/05/2002048904/-1/-1/1/ASSESSING-AND-STRENGTHENING-THE-MANUFACTURING-AND-DEFENSE-INDUSTRIAL-BASE-AND-SUPPLY-CHAIN-RESILIENCY.PDF>.

Resiliency of the United States” details the DoD assessment of domestic suppliers in the Defense Industrial Base:

“...risk archetypes with discrete impacts on America’s manufacturing and defense industrial base....include the rise of single and sole source suppliers which create individual points of failure within the industrial base, as well as fragile suppliers near bankruptcy and entire industries near domestic extinction. Due to erosion that has already occurred, some manufacturing capabilities can only be procured from foreign suppliers, many of which are not domiciled in allied and partner nations. The concomitant gaps in U.S.-based human capital and erosion of domestic infrastructure further exacerbates the challenge. Ultimately, these negative impacts have the potential to result in limited capabilities, insecurity of supply, lack of R and D, program delays, and an inability to surge in times of crisis.”⁴⁷

Literature Review Sample B. Beneficial Impacts Focused Viewpoints

This section of the literature review is focused on viewpoints indicating beneficial impacts of Buy-American policies. While researching for scholarly work and journalism on beneficial impacts of Buy-American policies, research yielded very few results, particularly in recent years (2018 – present). Due to the limited amount of recent research indicating beneficial impacts of Buy-American policies, a study from 1998 is included in the following sample. The following sample of literature indicate potential beneficial impacts to include maintaining the U.S. industrial base, benefits to national security, job growth, assistance for suppliers with limited resources, increase U.S. purchasing power and growth of U.S. industries.

- Maintains U.S. Industrial Base, National Security – In a Naval Post-Graduate School thesis published in 1998 titled “The Costs and Benefits of Maintaining the Buy

⁴⁷ “Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States,” September 2018, <https://media.defense.gov/2018/Oct/05/2002048904/-1/-1/1/ASSESSING-AND-STRENGTHENING-THE-MANUFACTURING-AND-DEFENSE-INDUSTRIAL-BASE-AND-SUPPLY-CHAIN-RESILIENCY.PDF>.

American Act”, author Keith Hirschman discussed the benefit of a strong U.S. industrial base, in particular when it comes to wartime procurements.⁴⁸ Hirschman also states that at the time of his research France has heavily subsidized its aerospace industry putting the U.S. at a disadvantage when competing with France on contracts.⁴⁹ Hirschman also discussed the benefit of a strong U.S. industrial base for national security. He discussed that heavy reliance on foreign suppliers could make the U.S. vulnerable to nations who choose to withhold procurements as a policy tool. Even still, Hirschman advised that Buy-American act restrictions should have a very narrow focus to minimize consequence and risk of the policies.

Interestingly, despite Hirschman’s research being over 20 years old, he also discusses issues with Buy-American policies which are very similar to those discussed throughout this research paper. Hirschman concludes that while there may be benefits from Buy-American policies, the policies should be reworked, primarily narrowed in scope to avoid problems such increased cost, burden of determining foreign suppliers in the supply chain, negative impact to international relations, increased lead times, and straining an already weak U.S. industrial base with additional orders.⁵⁰ This analysis is significant in that current research shows similar concerns, indicating that while Buy-American policies have a long history and continue to have additions with new administrations, the policies continue to grow

⁴⁸ Keith A Hirschman, “THE COSTS AND BENEFITS OF MAINTAINING THE BUY AMERICAN ACT,” Defense Technical Information Center (Naval Post Graduate School, June 1998), <https://apps.dtic.mil/sti/pdfs/ADA350159.pdf>, 68.

⁴⁹ Keith A Hirschman, “THE COSTS AND BENEFITS OF MAINTAINING THE BUY AMERICAN ACT,” Defense Technical Information Center (Naval Post Graduate School, June 1998).

⁵⁰ Keith A Hirschman, “THE COSTS AND BENEFITS OF MAINTAINING THE BUY AMERICAN ACT,” Defense Technical Information Center (Naval Post Graduate School, June 1998), <https://apps.dtic.mil/sti/pdfs/ADA350159.pdf>, 99.

with little obvious cost-benefit analysis or mitigation of risk associated with the policies.

- Assist Sole-Source or Limited Source-Suppliers with Resources, Help Protect Jobs in the United States. U.S. Senator Chris Murphy and U.S. Representative David Cicilline proposed further Buy-American policy in May 2021. Their press release indicated that increasing Buy-American legislation with a focus on eliminating loopholes (waivers) U.S. government procurement of American-made goods would increase and this would lead to 100,000 jobs in the United States.⁵¹ The press release also stated that Buy-American policies could assist limited or sole-source suppliers who may be struggling with resources by providing those suppliers with resources.⁵²
- Increase U.S. Purchasing Power and Grow Industries - A U.S. White House fact sheet on the Biden-Harris administration Made-in-America commitments sites states that Executive Order 14005 is “consistent with international trade laws and will bring the U.S. in line with the domestic procurement practices of peer countries”.⁵³ The fact sheet continues on to state that the executive order will “allow the U.S. to use its purchasing power to seed and grow new and strategic industries, while continuing our work with allies and partners to diversify and strengthen international supply chains

⁵¹ “Murphy, Cicilline Introduce 'Buy American' Legislation to Ensure U.S. Government Prioritizes American-Made Goods and American Manufacturers: U.S. Senator Chris Murphy of Connecticut,” Chris Murphy Senator (<https://www.murphy.senate.gov/>, May 21, 2021), <https://www.murphy.senate.gov/newsroom/press-releases/murphy-cicilline-introduce-buy-american-legislation-to-ensure-us-government-prioritizes-american-made-goods-and-american-manufacturers>.

⁵² “Murphy, Cicilline Introduce 'Buy American' Legislation to Ensure U.S. Government Prioritizes American-Made Goods and American Manufacturers: U.S. Senator Chris Murphy of Connecticut,” Chris Murphy Senator.

⁵³ “Fact Sheet: Biden-Harris Administration Delivers on Made in America Commitments,” The White House (The United States Government, March 4, 2022), <https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/04/fact-sheet-biden-harris-administration-delivers-on-made-in-america-commitments/>.

to mitigate the global disruptions we've seen from COVID-19, climate change, and geopolitical conflict".⁵⁴

Summary of Potential Impacts of Executive Order 14005 on the Aerospace Industry, and PEST / SWOT Analysis

Executive Order 14005 required all agencies to submit a report to the Made in America director within 180 days of the executive order which outlined the agencies compliance with Made in America laws, the agency's use of waivers, and recommendations for further "effectuating the policies" within the executive order.

In July 2021, in response to Executive Order 14005, NASA, along with the Department of Defense (DoD) and the General Services Administration (GSA) published a proposed rule "to strengthen the impact of Federal procurement preferences in the Buy American statute for products and construction materials that are domestically manufactured from substantially all domestic content" (86 FR 40980).⁵⁵ The changes to the rule proposed the following as stated in "Federal Acquisition Regulation: Amendments to the FAR Buy American Act Requirements":

- "A near-term increase to the domestic content threshold following a short grace period during which contractors and the workforce prepare for the increase and a schedule for future increases".
- "A fallback threshold that would allow for products meeting a specific lower domestic content threshold to qualify as domestic products under certain circumstances"; and

⁵⁴ "Fact Sheet: Biden-Harris Administration Delivers on Made in America Commitments," The White House (The United States Government, March 4, 2022).

⁵⁵ ⁵⁵ "Federal Acquisition Regulation: Amendments to the FAR Buy American Act Requirements, 87 FR 12780," March 7, 2022, <https://www.govinfo.gov/content/pkg/FR-2022-03-07/pdf/2022-04173.pdf>.

- “A framework for application of an enhanced evaluation factor (price preference) for a domestic product that is considered a critical item or made up of critical components.”⁵⁶

At the beginning of this study, we explored the complexity of supply chains, the lack of visibility into those complex global supply chains, and the reliance on established supply chains. Current literature showed us examples of concerns for potential impacts that are consequential in nature with limited literature on known benefits of Buy-American policies. The literature review indicated perceptions of Executive Order 14005, which included localized effects such as business impacts on individual suppliers, larger scale impacts such as increased costs to the U.S. government, and grander scale impacts such as destruction of existing trade relations and obligations with allied nations.

Figure 5 outlines the prevailing concerns of impacts of Buy-American policies with recommendations for policy options or mitigation strategies as appropriate. The focus of the PEST and SWOT tests in this study are on policy recommendations and next steps. Each impact/consideration is numbered starting with the prefix I/C and an Arabic number and has a letter P,E,S and/or T assigned to it indicating if it has potential for a political, economic, social and/or technological impact on the aerospace sector and aerospace agencies. Next to that letter is a plus or minus indicating whether that impact may be positive or negative or both. These results have been assessed based on the research presented in this study to include the case studies and literature review provided, as well as industry knowledge and experience in the aerospace SCRM arena. Following the table, there is a brief explanation of the PEST results on the recommendation / next steps only as that is the focus of the test for this study. Regarding

⁵⁶ “Federal Acquisition Regulation: Amendments to the FAR Buy American Act Requirements, 87 FR 12780,” March 7, 2022, <https://www.govinfo.gov/content/pkg/FR-2022-03-07/pdf/2022-04173.pdf>.

categories, impacts can cross into multiple categories of PEST analysis. In particular, the Political and Social categories often cross over each other. For the purposes of this study, Political impacts primarily look at international relations while social impacts look at the greater implications of the impacts on international relations as well as constituent response. More detailed explanations are available in the summaries of each recommendation provided below Figure 5.

The explanation also provides a SWOT summary. The same process is implemented for the Policy Recommendations and Next Steps. The numbering process for the recommendations and next steps is PR/NS and an Arabic number. In areas where a recommendation or next step has both positive and negative impacts, a ++ or -- will be present to indicate whether positive or negative impacts have greater impact. If there is not enough data to make that distinction, the indicators will remain +- indicating that research shows potential for both positive and negative impacts but that it is not clear which outweighs the other at this time. In all cases further investigation and research would be required prior to implementing steps to the policy suggestions or next steps, and in particular those where it is not clear from research if the suggestion's positive impact outweighs the negative impact.

Policy makers and decision authorities are encouraged to utilize this test process with factors specific to their requirements or agency circumstances. The same test process can be flowed down to prime-tier and sub-tier suppliers.

A note about subjectivity – the PEST and SWOT tests have an element of subjectivity as do all test methods which introduce the human element. It is unavoidable. It is advisable to include a bias statement with PEST and SWOT results. Test results that stem from qualitative methods are subject to greater scrutiny and examination of bias than quantitative methods as the reasoning

is often questionable and evidence considered less reliable to policy and makers and decision authorities than empirical data. However, for the analysis of potential impacts, where many impacts have not yet been realized and empirical data largely does not exist, this method is appropriate to foster new thinking, consideration for proactive mitigation strategies, and alternative analysis. Because the purpose of the PEST and SWOT analysis is to encourage new thinking on the policy issue, it can also be beneficial to run multiple rounds of both PEST and SWOT and utilize subject matter expert meetings to assess those findings and summarize results to take action on. For the purposes of this research paper, I ran the tests one time each.

As such the following bias statement is provided to remain in alignment with the above suggestion: I am an experienced aerospace SCRM professional. This provides a level of knowledge beyond what is gleaned in research. However, I have based my analysis on research and utilized my experienced based knowledge to confirm my analysis.

Figure 5. PEST Analysis: Potential Impacts and Considerations of Executive Order 14005 and Policy Recommendations / Next Steps

Potential Impacts / Considerations	Policy Recommendations/ Next Steps
<ul style="list-style-type: none"> • I/C 1 - Increased Cost to the U.S. Government (E -, S -) • I/C 2 - Lack of Evidence of Benefits of Buy-American Policies, Increased Project Costs, Project Delays (P+-, E+-, S+-, T+-) • I/C 3 - Increased Product Cost Leading to Risk to Global Competitiveness of U.S. Suppliers (P-, E-, S-, T-) • I/C 4 - International & Trade Relations, Loss of U.S Government Income (P-, E-, S-, T-) • I/C 5 - Supplier Inability to Efficiently Implement Requirements of Buy-American Rules (P-, E-, S-, T-) • I/C 6 - Lack of Supply Chain Visibility Can Make Compliance with Buy-American Rules Difficult for agencies, prime and sub-tier suppliers. (P-, E-, S-) 	<ul style="list-style-type: none"> • PR/NS 1 - Pause implementation of Executive Order 14005 and related rules. Commission an all-of-government study which reviews implementation of Buy-American rules over the last twenty years to better understand actual benefits of such acts. (P++-, E++-, S+-, T+-) • PR/NS 2 - Consider a revised approach to critical supply chain resiliency and reviving U.S. based capabilities. Rather than a “lock-out” approach which can be viewed as protectionist and alienating, develop a policy to strength supply chain ties with allies, grow allies in supply chains, and utilize profits from those enhanced relationships to invest in building up resiliency in supply chains by developing U.S. aerospace suppliers over time. (P+, E+, S+, T+) • PR/NS 3 - Rather than requiring suppliers to revamp existing supply chains, develop programs to evaluate risk in existing supply chains and implement mitigations where appropriate rather than a blanket policy. (P+-, E+-, S+-, T+) • PR/NS 4 - Invest in Supply Chain Mapping strategies to better understand supply chains and increase supply chain visibility (P+, E++-, S+, T+)

Compounding factors to be considered in the implementation of expanding Buy-American requirements include globalization of supply chains, existing contracts and international commitments, political impacts to include international relations, availability of skilled labor and manufacturing capabilities in the United States, supply chain visibility, resources and materials factors. For a global economy lifting itself out of unprecedented devastation resulting from the COVID 19 pandemic, it is critical to consider compounding factors in policy decisions that affect the global supply chain.

Analysis of PEST Results and SWOT Analysis

The following provides an analysis of the above Policy Recommendation and Next Steps PEST results and correlating SWOT analysis:

- PR/NS 1 - Pause implementation of Executive Order 14005 and related rules. Commission an all-of-government study which reviews implementation of Buy-American rules over the last twenty years to better understand actual benefits of such acts. (P++-, E++-, S+-, T+-)
- Note – this recommendation assumes that such a study has not been previously conducted, particularly in the last 20-30 years. This assumption was made based on research results which indicated such a study has not been conducted.
 - Political - The pause of any government policy or rule has the potential to have both positive and negative impacts on political factors, both domestically and internationally. However, in the case of Executive Order 14005, research has indicated that the policy as status quo has the potential to impact existing international trade agreements and upset correlated international relations. As such, it is assessed that the benefit of the pause would outweigh the risk associated with the pause with respect to political impacts.

- Economic – The cost of the pause may not directly cause a negative impact economically; however, the commissioning of an all-of-government study would have costs associated with it, hence the negative impact for economic. However, the benefits of this study could have last and rippling benefits, so the benefit is assessed to outweigh the risk.
- Social – Social impacts include the response from political constituents and the international community. Research shows that elements of the international community are nervous about the policy as is, however as this is a highly politically charged topic, any pause to policy may be viewed negatively by constituents who prefer a more protectionist or isolationist approach to policy. Additionally, constituents may have strong feelings on globalized supply chains due to supply chain shortages experienced from the pandemic. Evidence is not sufficient to assess whether the positive impacts outweigh the negative, at least in the immediate period of time after a pause would be implemented.
- Technological – Technological development stands to benefit from a pause and evaluation of the implementation of Buy-America rules over the last twenty years. This is because this pause can provide empirical data of which suppliers can utilize to create technology advancement strategies. However, some technology advancement may suffer at least in the short term if there are suppliers who are relying on this policy to drive customer bases to them and ultimately drive research and development efforts. There is not enough evidence at this time to assess whether positive or negative impacts carry greater weight from this solution. Further research is required.
- SWOT – Strengths of this recommendation include potential for improved international relations and increased understanding of the long-standing Buy-

American act and subsequent executive orders and rules. Weaknesses of this option include the time and resources it takes to implement and monitor an all-of-government approach. Opportunities of this suggestion include a chance to create policy that is based on actual metrics of successes and failures of previous Buy-American policies and the creation of policy that can enhance both the U.S. supplier base and international relations. Threats of this suggestion include push-back politically due to the highly charged nature of this topic.

- PR/NS 2 - Consider a revised approach to critical supply chain resiliency and reviving U.S. based capabilities. Rather than a “lock-out” approach which can be viewed as protectionist and alienating, develop a policy to strengthen supply chain ties with allies, grow allies in supply chains, and utilize profits from those enhanced relationships to invest in building up resiliency in supply chains by developing U.S. aerospace suppliers over time. (P+, E+, S+, T+)
 - Political – This revised approach fosters the strengthening and growth of allied relationships. Because research indicates elements of the international community have trepidations about the policy as is, a revised approach would likely primarily yield positive impacts on international relations.
 - Economic – While there will be cost in creating a revised approach, this cost would likely quickly be balanced out by improved international relations and continuation or growth of existing and formation of new global supply chains. The positive impact on supply chains would likely quickly equal increased revenues, particularly in the U.S. and global supply base.

- Social – As with PR/NS 1, social impacts include the response from political constituents and the international community. Research shows that elements of the international community are nervous about the policy as is, however as this is a highly politically charged topic, any revision to policy may be viewed negatively by constituents who prefer a more protectionist or isolationist approach to policy. Additionally, constituents may have strong feelings on globalized supply chains due to supply chain shortages experienced from the pandemic. Evidence is not sufficient to assess whether the positive impacts outweigh the negative. Further research is needed.
- Technological – The aerospace industry, particularly that of the space sector has historically been reliant on international relationships to grow technology and advance missions. This was demonstrated throughout this study and was seen in the development and launch of the James Webb Space Telescope. As such, technology is assessed to benefit from this restructure.
- SWOT – Strengths of this option include the bolstering of allied relationships, a move that stands to have lasting positive impacts on international relations. Weaknesses of this suggestion include the fact that this is much more strategic in nature and may not appeal to those wishing for quick fixes. Opportunities from this suggestion include the possibility of benefits to existing U.S. suppliers and development of new U.S. suppliers by creating a larger customer base internationally willing to purchase from them. Threats to this suggestion come from those preferring a more protectionist or isolationist policy.

- PR/NS 3 - Rather than requiring suppliers to revamp existing supply chains, develop programs to evaluate risk in existing supply chains and implement mitigations where appropriate rather than a blanket policy. (P+-, E+-, S+-, T+)
 - Political – This revised approach allows for change which can bolster the U.S. supplier base with minimal disruption to existing supply chains, with the intent of actually improving security in supply chains. This move has many positive benefits both near-term and long-term and can be seen as an international relations win.
 - Economic –Creating a standardized risk approach supported by the federal government will have costs associated with it, but compared to the policy status quo, the economic benefits of this risk and mitigation evaluation stands to improve product effectiveness and compliance with standards, safety, decrease costs of product and ultimately projects, as well as improve adherence to production and mission schedules.
 - Social – As with PR/NS 1 and 2, social impacts include the response from political constituents and the international community. Research shows that elements of the international community are nervous about the policy as is, however as this is a highly politically charged topic, any revision to policy may be viewed negatively by constituents who prefer a more protectionist or isolationist approach to policy. Additionally, constituents may have strong feelings on globalized supply chains due to supply chain shortages experienced from the pandemic. Evidence is not sufficient to assess whether the positive impacts outweigh the negative. Further research is needed.

- Technological – The aerospace industry requires risk mitigation and safety in all parts of the supply chain and production. The impact of a standardized supply chain risk assessment and mitigation strategy will likely propel advancement of technology.
 - SWOT – Strengths of this recommendation include risk mitigation and a development of standardized proactive approach to SCRM. Weaknesses of this suggestion include ensuring the effort implemented is effective in risk detection and that it is maintained in an effort to remain effective. Opportunities from this suggestion include the chance to increase security in supply chains and reduce the possibility of counterfeit parts as well as identify weaknesses in the supply chain. This may also open the door for the establishment of new suppliers to fill in those weak point. Threats to this suggestion include the possibility of implementing a strategy or method that is not well researched and ultimately not effective.
- PR/NS 4 - Invest in Supply Chain Mapping strategies to better understand supply chains and increase supply chain visibility (P+, E++-, S+, T+)
 - Political – Supply chain visibility is a requirement in sustaining any supply chain and ensuring increased risk mitigation, improved safety, and improved adherence to production and timelines, particularly in the aerospace sector. From a political standpoint, this can be utilized to bolster trade agreements and international relations.
 - Economic – Robust supply chain mapping efforts cost money however the benefits would quickly outweigh the cost as visibility drives down cost, improves production time, helps to remove counterfeit parts from the supply chain, and improves safety

overall. Essentially, supply chain visibility offers assistance to a do it right the first-time approach.

- Social – In this instance, the social impact would likely be primarily or only positive. Supply chain visibility can increase product quality and safety, ultimately creating a sense of confidence in both the constituent community and the international community.
- Technological – The aerospace industry and related technology stands to benefit greatly from increased supply chain visibility. This effort can help assess identify weak points in the supply chain, therefore opening doors to advance technology.
- SWOT – Strengths of this suggestion include increased awareness of strengths and weaknesses in the supply chain ultimately improving production times, mission timeline adherence, safety, technological advancement, and security. Weaknesses of this suggestion include implementing a program or method that is not well research and therefore not effective. Opportunity of this suggestion includes the chance to truly understand supply chains and experience the benefits noted in the strengths. Additionally, this increased knowledge provides opportunity to buy down costs by understanding the existence of suppliers in other networks if supply chain visibility efforts become shared product. Threats to this suggestion come from a lack of understanding by policy makers as to the importance of this. This may also face push back due to agency or corporate culture which is resistant to change and may not embrace such an undertaking. The mapping is only as good as the input.

Gaps and Limiting Factors

Research indicates limited knowledge on actual benefits or realized impacts of Buy-American policies. The majority of literature available focuses on hypothesizing about potential risk of negative consequences. Additional limiting factors when considering actual impacts and factors such as supply chain visibility is availability of information and lack of reporting. Any agency or supplier reporting their lack of insight into their supply chain visibility automatically exposes vulnerabilities, an act that is counter-intuitive in both government and commercial sectors.

Opportunities for Future Research

There are many gaps in understanding the complexities of global supply chains in general, and much of the aerospace industry is cloaked behind sensitive projects and the need to protect itself from vulnerabilities. The industry could benefit from future research that includes large scale studies on supply chain mapping and supply chain visibility statuses, studies on actual impacts of Buy-American policies over the last 20-30 years, and follow-on studies to determine actual impacts from Executive Order 14005 in a determined time in the future, perhaps in 5 years and 10 years from its implementation.

Conclusion

Buy-American policies have a long history and Executive Order 14005 is just the latest mark on history the Buy-American act is creating. It is important to avoid polarizing perspectives on the policy and associated rules as polarizing thoughts tend to pull the policy maker and decision makers away from the spirit of the legislation and down a path of political bias.

However, on the same token, it is important to pause, evaluate, and investigate the actual drivers behind the issue the policy is attempting to repair.

While the policy did provide for a 180-day timeframe for agencies to respond to the Executive Order with recommendations, research indicates a greater pause and review of existing supply chain networks, as well as supply chain visibility would offer a better basis for implementation of the executive order. During this pause and review of supply chains, we can explore and consider potential impacts to the aerospace sector and aerospace agencies such as NASA. If Executive Order 14005 was a knee-jerk reaction to a giant looming black cloud that is the brokenness of global supply chains and lack of resiliency and security of U.S. based supply chains, then consideration for taking a step back and understanding the actual root causes of the problems may be a very prudent step in preventing some of the potential impacts highlighted in this study.

The United States and the world experienced screeching halts in supply chains and delivery of goods. Those halts exposed problems already on the brink of failure. One thing is certain - United States cannot put itself in a position to rely on a limited number of suppliers in one geographic locale. We don't need to go backwards as a reaction to the devastation of the pandemic. We need to seriously consider building out alliances in the global supply chain in an effort to protect and enhance our critical supply chains, such as aerospace. Building out alliances in the supply chain can be viewed as a near-term goal with building out domestic capabilities as a long-term fix incorporated into alliance networks, rather than alienating those networks.

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CV / Biography

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