

April 8, 2022

TO: Applied Science & Technology Research
Organization of America (ASTRO America)
6701 Democracy Blvd., Suite 300
Bethesda, Maryland 20817

RE: AM Forward

Raytheon Technologies is pleased to join ASTRO America and the Biden-Harris Administration in implementing AM Forward— a voluntary compact aimed at strengthening U.S. supply chains by supporting U.S.-based suppliers' adoption and deployment of additive manufacturing (AM), or industrial 3D printing capabilities.

Additive manufacturing is a leading-edge production technology that is foundational to U.S. global competitiveness; it has several benefits, including the ability to form lightweight geometries that are unattainable through conventional manufacturing means. Aerospace and defense companies use additive manufacturing to reduce part-counts and create high-performing components across many platform-types, ranging from hypersonic systems to aircraft engines. In addition, additive manufacturing provides a unique capability that supports continued sustainment of warfighter readiness throughout the entire life cycle of our military products, that frequently outlive conventional supply chains.

Additive Manufacturing practices can often accelerate resource- and time-intensive traditional processes, such as forgings and castings, that are constrained by a small number of domestic suppliers. Additive manufacturing affords the opportunity to produce input materials at the machining or assembly source, enabling broader democratization of the supply chain across a wider range of potential suppliers. If appropriately qualified and applied, we believe additive manufacturing can result in shrinking the lead times of parts, even under current supply chain conditions. To achieve this outcome, our suppliers—including small and medium sized enterprises as well as large suppliers—need considerable support.

Through AM Forward, Raytheon Technologies will establish a goal for U.S.-based suppliers to increase their ability to additively produce parts, enhancing their competitiveness, agility, and productivity, within the next 12 months. Such an initiative will demonstrate clear, consistent, and growing demand for additively produced parts, provide training to suppliers' workers to support broad additive capabilities, potentially engage or support standards development, and offer technical assistance. We appreciate the Biden Administration's support of these efforts through U.S. Government financing programs, capacity building, and workforce development initiatives.

Raytheon Technologies has been an industry leader in the development and use of additive manufacturing technologies throughout our development, product, and production value chain for over three decades. From extensive work with AM equipment manufacturers as early as 1989, our involvement as early contributors to collaborations and initiatives like Manufacturing USA/America Makes and other academic institutions, to qualification and development of new materials and standards, our investment has continued to grow consistently during this time. Raytheon Technologies has made over 250,000 non-metallic details, tooling, and components and thousands of metallic components internally across all Raytheon Technologies businesses and with domestic suppliers. For example, Pratt & Whitney utilizes additive manufacturing technologies to support their production facilities, engine development of commercial and military products such as the F135, certification of the PurePower® Geared Turbofan™ engine, and certification of production and repair hardware. The High Energy Laser (HEL) product line within Raytheon Intelligence & Space is developing plastic and metal AM on multiple programs for deliverable components built by domestic suppliers focused on decreasing part count, air flow movement and light deflection. Collins Aerospace has utilized additive manufacturing to produce a number of products across its portfolio including components for space applications such as the International Space Station and is currently developing additive parts for the Orion capsule. Raytheon Missiles and Defense is using AM in its hypersonic air-breathing and boost glide programs.

We see increasing potential for additive manufacturing to be applied across our value chain. We have gathered extensive experience in several applications and working with several suppliers and customers. We are now at a tipping point for a rapid expansion of additive manufacturing across many more applications. We see opportunity in new product development, current product manufacturing, and sustainment for components that are no longer in production. To address these opportunities, we need a strong domestic supply chain to enable this future growth. To support the development of a strong domestic supply chain, we continue to support regulatory bodies, standards development organizations, and various academic, government and industry groups. These efforts support the transition of additive manufacturing processes from the laboratory to production.

Raytheon Technologies will support AM Forward goals by committing to:

- Work with small/medium sized domestic suppliers to compete on over 50% of the requests for quotes that are sent out on products identified to be manufactured using additive manufacturing technologies
- Work with other AM Forward OEMs and U.S. Government agencies to:
 - Explore establishing an AM material consortium or leveraging existing materials data groups such as the Metallic Materials Properties Development and Standardization (MMPDS) to develop and share AM material properties.
 - Develop the framework to establish an AM Approved Supplier List (ASL) to simplify and accelerate the procurement process of AM parts
 - Supporting the qualification for small/medium sized suppliers and training to meet Raytheon Technologies qualification requirements
- Participate in university and technical college programs for additive workforce development
 - Where feasible, share existing Raytheon Technologies AM learning resources with a network of suppliers
 - Continue our work with America Makes and other academic and industry partners on additive manufacturing curriculum development

- Work with other AM Forward OEMs and other external agencies (e.g., AIA, NADCAP) to facilitate geographic-driven supplier consortia to collaborate with national networks to activate access to AM training and technology solutions
- Continue to drive critical AM standards development through leadership of and participation in Standard Development Organizations (SDOs) including SAE AMS, ASTM F42, ANSI, and AWS.

We look forward to delivering on these commitments in partnership with the federal government to support AM Forward in the achievement of its ambitious objectives.

Raytheon Technologies will also support efforts by suppliers within our sourcing network to take part in key U.S. government programs associated with AM Forward. For example, we believe various federal agencies can play an important role in accelerating AM supplier access to necessary capital, workforce training, technical assistance, and technology transition support. For this reason, we will work with relevant federal government agencies as well as nonprofit organizer ASTRO America to encourage participation in AM Forward workshops and, as appropriate, support proposals for assistance associated with government programs, such as those described in the White House fact sheet on AM Forward dated TBD.

Additionally, Raytheon Technologies is committed to collaborating with other AM Forward participants, as well as U.S. Government agencies, to improve the capability, agility, and competitiveness of our supply base. This activity will require engagement at both a working-level and a senior executive-level along with government officials and other industry peers to support a range of activities by industry, government, and non-profits. We understand as an AM Forward participant, we will receive support from 501(c)(3) nonprofit organization staff, including the Applied Science & Technology Research Organization of America (ASTRO America) and Gettysburg College's Eisenhower Institute.

We know the competitiveness of the U.S. industrial base, including Raytheon Technologies, relies on the capability of a wide spectrum of suppliers producing and post-processing critical aerospace parts. We also recognize that over the last few years many suppliers have lacked access to resources to upgrade technologies that catalyze productivity gains, and the supply chain has become challenged. With additive manufacturing capability catalyzed through AM Forward, we are confident we can collaboratively accelerate AM adoption at scale; thereby democratizing the supply-base while empowering small and medium sized businesses to increase capacity and resiliency of U.S. manufacturing, while supporting and expanding good-paying jobs across the United States.

Thank you for your leadership on this important initiative.

Respectfully,



Paolo Dal Cin

RTX Senior Vice President, Operations, Supply Chain, Quality, EH&S