



CONGRESSIONAL LEGISLATIVE STRATEGIES TO SUPPORT COLORADO AEROSPACE

DECEMBER 2021

OVERVIEW

The national and global aerospace industry landscape continues to evolve rapidly. Space transportation and habitation development, advancements in on-orbit service technologies, growth in the remote sensing sector, and continued expansion of small satellite capabilities are all driving job growth and stimulating economic opportunities in the private space sector. At the same time, as space becomes increasingly congested and contested, uncertainty looms on the horizon for operators due to the lack of space traffic coordination and management, and space environment management. Space is also swiftly becoming the most critical domain for national security. Competition among the major aerospace states for aerospace and defense programs and business is fierce, as well as international competition with heavily subsidized aerospace companies backed by their governments, and there is greater emphasis on leveraging opportunities for private-sector growth within the industry.

We must respond to these competitive opportunities and challenges by continuing commercial growth, improving efficiencies, creating enabling regulations for businesses, strengthening our workforce, and advancing small business and education opportunities, while also enhancing the ability of Colorado-based programs and technologies to compete here in the United States and around the world.

Continued investment in Colorado's commercial, military, and academic space infrastructure is vital to maintaining our state as a center of excellence for space. The Colorado Space Coalition (CSC) appreciates the support of the Colorado delegation for priorities that support our space economy, and requests continued collaboration among the Colorado delegation to support the expansion of Colorado's aerospace industry and jobs through the following strategies and priorities for action, authorization, and appropriations for fiscal year 2022 and beyond.

2022 CONGRESSIONAL REQUESTS

EXECUTIVE SUMMARY

ADVOCATE FOR PERMANENT BASING OF U.S. SPACE COMMAND TO REMAIN IN COLORADO.

The CSC requests continued strong Congressional advocacy to the Administration and Department of Defense (DoD) to support permanent basing of U.S. Space Command at Peterson Space Force Base in Colorado Springs, based on the location's merits and cost benefits in Mission Readiness, Communication Infrastructure and Workforce.

CONTINUE COMMITMENT FOR DEVELOPMENT OF UNITED LAUNCH ALLIANCE (ULA) VULCAN CENTAUR LAUNCH VEHICLE.

The CSC requests continued Congressional commitment to support development of the Vulcan Centaur launch system to ensure ULA is a certified and competitive launch provider for national security payloads.

CONTINUE STRONG SUPPORT FOR THE NEXT GENERATION GLOBAL POSITIONING SYSTEM (GPS) III/IIIF SATELLITE AND OPERATIONAL CONTROL (OCX) SEGMENT PROGRAMS.

The CSC requests continued Congressional commitment to the funding of the DoD GPS III/IIIF Satellite program, including advocacy for utilizing Navigation Message Authentication (NMA) to counter civil spoofing threats, and accelerating the fielding and launch of the modernized GPS III and IIIF satellites. The CSC also recommends the continued evolution of GPS IIIF for capability and resilience, and advocating for allied nations to build a geosynchronous Positioning Navigation & Timing constellation that both augments GPS and reinforces our international alliances.

CONGRESSIONAL SUPPORT FOR THE NEXT GENERATION OVERHEAD PERSISTENT INFRARED (OPIR) PROGRAM.

The CSC requests continued strong Congressional support for the Next Gen OPIR program, the Space Force's next-generation, advanced space-based missile warning system that incorporates more capable warning sensors, enhanced resiliency and cyber hardening, and better mission analysis capability into our nation's missile warning mission. The CSC also requests commitment to funding Block 0 architecture development, deployment, and expansion.

POLICY AND FUNDING SUPPORT FOR HYPERSONIC STRIKE AND DEFENSE WEAPONS CAPABILITIES.

The CSC requests Congressional support for continued emphasis and funding on research and development of hypersonic strike weapons, including continued budget commitment for the hypersonic defense (HD) capabilities to support evolution of holistic joint kill chain HD technologies and requirements. The CSC also requests continued budget commitment to fund a competitive Glide Phase Interceptor program through Final Design Review to ensure the right technical interceptor solution is delivered to our Warfighter to address a new, unique and complex threat.

PROTECT CAPABILITIES TO DEFEND THE UNITED STATES FROM LONG-RANGE BALLISTIC MISSILE DEFENSE ATTACKS, AND COMMIT TO REPLACING THE NATION’S STRATEGIC DETERRENT CAPABILITIES.

The CSC requests continued budget commitment to fund the Ground Based Midcourse Defense (GMD) System in order to maintain the viability of the current fleet of interceptors, and continue budget commitment to fund the Next Generation Interceptor as the follow-on system to replace the aging Ground Based Interceptors within the GMD System. The CSC also requests continued Congressional support for the Ground Based Strategic Deterrent (GBSD).

ENCOURAGE THE DEPARTMENT OF DEFENSE TO LEVERAGE COMMERCIAL GEOSPATIAL INTELLIGENCE CAPABILITIES TO THE FULLEST EXTENT POSSIBLE.

The CSC recommends continued strong support from Congress to direct the Intelligence Community and Department of Defense to continue to leverage the commercial remote sensing industry, and ensure funding levels for Commercial GEOINT are commensurate with user community requirements.

COMMIT TO RETURN OF U.S. HUMAN SPACEFLIGHT CAPABILITIES AND SUPPORT COLORADO’S LEADING ROLE IN THE NATION’S SPACE EXPLORATION AND SCIENCE MISSIONS.

The CSC requests strong congressional support for the Artemis program, and ensuring the Orion spacecraft, Gateway, and Space Launch System programs remain fully funded. The CSC also recommends ensuring commercial launch providers make human safety their number one priority by following best practices developed over decades by NASA and other space agencies. The CSC requests continued funding support for NASA’s Discovery Programs VERITAS and DAVINCI+, and the Nancy Grace Roman Space Telescope; and support for programs that enable future Mars missions. The CSC also requests robust funding for NASA’s Science Mission Directorate, including continued support in utilizing the National Academies’ Decadal Survey process to provide the scientific roadmap designed to advance NASA’s science objectives.

SUPPORT INDUSTRY COLLABORATION AND PUBLIC PRIVATE PARTNERSHIPS TO ADVANCE CIVIL AND NATIONAL SECURITY SPACE PROGRAMS AND GROW THE COMMERCIAL SPACE SECTOR.

The CSC requests continued funding for Commercial Cargo Resupply contracts, and Commercial Crew Transportation Capabilities contracts. The CSC recommends supporting the continued operation of the International Space Station through at least 2030, while expanding partnerships with the private sector to develop next generation orbital space habitats as destinations for orbital research and commercial enterprise. The CSC requests continued funding support for NASA’s NextSTEP and Commercial Lunar Payload Services programs, and also for satellite servicing missions including On Orbit Servicing Assembly and Manufacturing technologies. The CSC requests continued congressional support for the Space Resources Institute Act, and advocacy for the Office of Space Commerce to enhance its Colorado presence to support economic growth and technological advancement of the U.S. commercial space industry.

ENHANCE NATIONAL CAPABILITIES IN SPACE AND EARTH WEATHER PREDICTION, EARTH SCIENCE, EARLY WARNING SYSTEMS, AND ENVIRONMENTAL INTELLIGENCE.

The CSC requests support for increased funding and full deployment of JPSS, GOES, Weather System Follow-on Microwave, and Space Weather Follow-on programs. The CSC recommends building upon the momentum that came with passage of the PROSWIFT Act to ensure Colorado's retains and expands its leadership in space weather research. The CSC also recommends establishing a space weather program in NOAA's Oceanic and Atmospheric Research line office to improve research-to-operations transitions from the academic and commercial space weather communities.

SUPPORT ACQUISITION POLICIES AND REGULATORY FRAMEWORKS THAT PROMOTE CONTINUED GROWTH OF COLORADO'S SPACE INDUSTRY.

The CSC requests Congress ensure factors enabling continued growth of the space industry are appropriately considered in all phases of space acquisition and operations for the U.S. government. The CSC requests that acquisition policies and the regulatory environment reflect the speed at which commercial innovation and technology development is occurring, enabling ways for the U.S. to better partner with the private sector to stay a leader in space.

ENSURE SUPPORT FOR THE SMALL SATELLITE ECONOMY AS IT FITS INTO THE LARGER ARCHITECTURE OF SATELLITE ACQUISITION BY THE FEDERAL GOVERNMENT.

The CSC requests continued support and funding for the research, development, and fielding of small satellite technology across a wide range of Federal Government agencies (DOD, NASA, and NOAA) and through Small Business Innovation Research and Small Business Technology Transfer grant funding. The CSC also requests support for the development of Rapid Response Launch Capability to address future needs for Federal Agencies.

MAKE SPACE SUSTAINABILITY A PRIORITY IN POLICY AND PROGRAMS.

The CSC requests Congressional support for enabling Mission Authorization and resolving international legal issues for commercial activities that currently do not have certainty in licensing and liability. The CSC also requests support for ensuring commercial partnerships are considered for On-Orbit Servicing for U.S. Government missions, and funding for activities in support of debris mitigation and active remediation of the orbital environment. The CSC requests Congressional support for adequately resourcing and authorizing the Department of Commerce, NASA, FCC, Department of Transportation, Department of State, and DoD in activities related to ensuring the long-term sustainability of space.

SUPPORT GROWTH OF COLORADO'S COMMERCIAL SPACE SECTOR BY CONTINUING THE EFFORT TO REDUCE UNNECESSARY LICENSING AND EXPORT RESTRICTIONS.

The CSC recommends supporting and encouraging the continuance of administrative changes to International Traffic in Arms Regulations (ITAR) and Export Administration Regulations (EAR) to increase U.S. security and competitiveness, including the export control reform legislation for commercial satellites enacted in the FY2013 Defense Authorization bill. The CSC requests Congressional support for a regulatory environment for remote sensing satellites that fosters both domestic and international competition by ensuring US companies are not hindered by onerous, outdated, and heavy-handed regulations. Additionally, the CSC recommends working with the U.S. Department of State to pursue a statutory exemption for exports of space related items to U.S. allies, and working with the U.S. Department of Commerce to promote export sales of U.S. space components, products, and services.

ADVOCATE FOR COLORADO NATIONAL GUARD F-16Cs CONVERSION TO F-35A AIRCRAFT.

The CSC requests Congressional support to convert the Buckley Space Force Base 140th Wing from F-16C to F-35A aircraft and retain the air defense mission at Buckley SFB. The 140th Wing, Colorado Air National Guard at Buckley Space Force Base operates the oldest F-16s in the Air Force and if not awarded new F-35 fighter jets, the base risks losing its flying mission, operational runway capability, and Air National Guard unit.

SUPPORT STRATEGIES TO DEVELOP A 21ST-CENTURY AEROSPACE WORKFORCE.

The CSC requests Congressional support for P-20 education programs and initiatives that increase engagement, retention, and success levels of Colorado students in science, technology, engineering, and mathematics (STEM) education. The CSC recommends support for policy such as the Traineeships for American Leaders to Excel in National Technology and Science (TALENTS) program that enhances and streamlines clearance processing for undergraduate and graduate students. Additionally, the CSC requests support for federal grant requests benefiting STEM programs in Colorado, such as the state-wide Colorado Space Grant Consortium. The CSC recommends Congressional support for expanding education and research opportunities for underrepresented communities and at Minority Serving Institutions in order to enhance and diversify the nation’s STEM talent pipeline.

PROMOTE AND ADVANCE COLORADO AEROSPACE THROUGH PARTICIPATION IN THE FOLLOWING CONGRESSIONAL COMMITTEES AND CAUCUSES, WITH PRIORITY GIVEN TO APPROPRIATIONS COMMITTEES.

Participation in these forums helps promote and advance support for aerospace and gain visibility for Colorado’s leadership in this industry. Colorado aerospace represents a uniquely integrative view of the civil, commercial and defense space sectors, and our congressional delegation is ideally situated to champion the national space ecosystem’s many assets and opportunities. We thank Colorado’s delegation members for their current participation in a number of these committees and caucuses, and request consideration of those which do not have representation from Colorado.

Senate:

- Senate Appropriations Committee
 - Subcommittee on Defense
 - Subcommittee on Commerce, Justice and Science and Related Agencies
- Senate Committee on Armed Services
- Senate Select Committee on Intelligence
- Senate Committee on Commerce, Science & Transportation
 - Subcommittee on Science and Space
 - Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard
 - Subcommittee on Communications, Media and Broadband
 - Subcommittee on Aviation Safety, Operations, and Innovation
- Senate Aerospace Caucus
- Senate Unmanned Aerial Systems (UAS) Caucus

House:

- House Appropriations Committee
 - Subcommittee on Commerce, Justice and Science and Related Agencies
 - Subcommittee on Defense
- House Committee on Armed Services
- House Permanent Select Committee on Intelligence
- House Committee on Science, Space and Technology
- House Aerospace Caucus
- House Space Power Caucus
- House Research and Development Caucus
- House Science and National Laboratories Caucus
- House Space Force Caucus
- House Defense Communities Caucus
- The Congressional Unmanned Systems Caucus

2022 CONGRESSIONAL REQUESTS

RECOMMENDATIONS AND BACKGROUND

ADVOCATE FOR PERMANENT BASING OF U.S. SPACE COMMAND TO REMAIN IN COLORADO.

Recommendation:

- Continue strong Congressional advocacy to the Administration and Department of Defense to support permanent basing of U.S. Space Command at Peterson Space Force Base in Colorado Springs, based on the location's merits and cost benefits in Mission Readiness, Communication Infrastructure and Workforce.

Background:

- As a combatant command, U.S. Space Command (USSPACECOM) is responsible to establish unity of command for operational space forces, develop space doctrine, concepts of operation, and integrate national space capability across all military operations. In the initial search for a permanent location for USSPACECOM headquarters, six finalists were announced, four of which were located in Colorado: Alabama's Redstone Arsenal, California's Vandenberg Air Force Base, and Colorado's Peterson Space Force Base, Buckley Space Force Base, Cheyenne Mountain Space Force Station, and Schriever Space Force Base.
- Stated in a letter to the Defense Department dated August 29th signed by the entire Colorado Congressional delegation and Governor Polis: "As the epicenter of national security space, Colorado is the prime location to house national efforts to ensure continued U.S. technological superiority, global leadership, and capabilities in space. As home to Air Force Space Command, Schriever Air Force Base (AFB), Buckley AFB, Peterson AFB, the National Space Defense Center, U.S. Northern Command, and North American Aerospace Defense Command (NORAD), Colorado provides the existing command structure, infrastructure, and communications platforms necessary to host additional national security space initiatives and ensure coordination of efforts. Additionally, our state ranks first in the nation in its concentration of aerospace jobs and has the nation's largest aerospace economy on a per capita basis."
- Colorado has deep ties to the Department of Defense and immense patriotic commitment to providing for the nation's security. In 2020, Governor Polis signed into law legislation that further supported military families in Colorado by providing military spouse licensure reciprocity in the state. The State significantly values the many defense installations in Colorado and recognizes that Department of Defense generates 8% of the State's totally economy in terms of employment, earnings, and state tax revenues. The annual defense economic impact to Colorado is \$36.6 billion, and the state is home to more than 170,000 military and defense-related civilian personnel, or 5.2 percent of the state's workforce.
- In May 2020, the Air Force announced a new basing decision process with a "revised approach" that enabled communities across the US to self-nominate based on their ties to the military

space mission, existing infrastructure capacity, community support, and cost to the Air Force. In November 2020, the Air Force also announced Peterson Space Force base was one of six finalists. In January 2021, President Trump selected Huntsville, Alabama as the permanent location of USSPACECOM. As President Trump himself stated, he single-handedly made the decision to relocate the headquarters of USSPACECOM to Alabama, resulting in serious concerns that the decision was made for political reasons and not based on operational, national security, or budgetary considerations in such critical areas as Mission Readiness, Communication Infrastructure and Workforce

- Both the U.S. Government Accountability Office and the Department of Defense Inspector General are currently investigating the decision to move the home of U.S. Space Command from Colorado Springs to Huntsville, with the findings expected in 2022. We commend Colorado’s congressional delegation for continuing to urge the Administration to fully consider the budgetary and national security implications of relocating USSPACECOM: from the \$1B in additional infrastructure costs required to establish the necessary capabilities in Alabama, to the potential detrimental impacts on Intelligence Community dependencies and missions (currently supported by Peterson SFB’s proximity to the National Space Defense Center, The Aerospace Corporation, and Buckley SFB’s Aerospace Data Facility) and the nation’s superiority in space.

CONTINUE COMMITMENT FOR DEVELOPMENT OF UNITED LAUNCH ALLIANCE (ULA) VULCAN CENTAUR LAUNCH VEHICLE.

Recommendation:

- Continue Congressional commitment to support development of the Vulcan Centaur launch system to ensure ULA is a certified and competitive launch provider for national security payloads.

Background:

- With more than a century of combined heritage, ULA is the world’s most experienced and reliable launch service provider, maintaining a track record of 100% mission success with more than 145 successful consecutive launches. In 2020, ULA and SpaceX won military launch contracts to launch national security payloads over the next five years, with ULA receiving 60% of the satellite launch contracts and SpaceX receiving 40%.
- By law the Air Force is only allowed to buy ULA Atlas 5 launches through 2022. The Atlas 5 main engine is the Russian RD-180. Congress passed legislation in 2015 that requires the DoD to end its reliance on Russian rocket engines.
- ULA’s next generation vehicle for DoD launch services is the Vulcan Centaur. The Vulcan Centaur is currently under development and will surpass current ULA rocket capabilities and launch services at significantly lower costs, while still meeting the requirements of ULA’s cooperative research and development agreement with the U.S. Air Force to certify the Vulcan Centaur for national security space missions and assured access to space.
- The Vulcan Centaur is making strong progress in development and leverages the proven success of the Delta IV and Atlas V launch vehicles while introducing advanced technologies and innovative features. The new rocket will be superior in reliability, cost and capability, and provide a single system for all launch missions.

- ULA expects Vulcan to be certified for most national security missions in 2023 after the vehicle completes two successful flights.
- Vulcan Centaur will bolster U.S. manufacturing by adding to the more than 22,000 direct and indirect American jobs in 46 states supported by ULA programs.

CONTINUE STRONG SUPPORT FOR THE NEXT GENERATION GLOBAL POSITIONING SYSTEM (GPS) III/IIIF SATELLITE AND OPERATIONAL CONTROL (OCX) SEGMENT PROGRAMS.

Recommendations:

- Continue Congressional commitment to the funding of the DoD GPS III/IIIF Satellite program.
- Advocate for the utilization of Navigation Message Authentication (NMA) to counter civil spoofing threats. GPS civil signals underpin U.S. critical national infrastructure – GPS delivers approximately \$1B/day in U.S. economic benefit (2019 NIST Report).
- Accelerate the fielding and launch of the modernized GPS III and IIIF satellites to remain the global “Gold Standard,” especially in the face that China has launched their third generation Global Navigation Satellite System (GNSS) at a rate six times faster than the U.S.
- Continue to evolve GPS IIIF for capability and resilience, including implementing on-orbit signal re-programmability and GPS crosslinks to proactively counter adversary jamming/spoofing of signals. GPS military signals underpin U.S. security, enabling precision weapons, troop maneuvers, logistics, and more – GPS is a force multiplier adversaries seek to deny.
- Make GPS more resilient utilizing a Coalition Architecture approach. Advocate for allied nations to build a geosynchronous Positioning Navigation & Timing (PNT) constellation that both augments GPS and reinforces our international alliances.
- Continue support for OCX, the enhanced ground control segment of the GPS modernization effort.

Background:

- Designed and built by Lockheed Martin here in Colorado, GPS III – and its follow program GPS IIIF – are the most powerful GPS satellites ever launched into orbit for the U.S. Space Force.
- GPS III satellites will have three times better accuracy and up to eight times improved anti-jamming capabilities. Spacecraft life will extend to 15 years, 25 percent longer than the newest GPS satellites on-orbit today. GPS III’s new civil signal will also make it the first GPS satellite to broadcast a compatible signal with other international global navigation satellite systems, like Galileo, improving connectivity for civilian users.
- GPS IIIF satellites will bring even more capabilities to the GPS constellation, including Regional Military Protection (RMP); an upgraded Nuclear Detection Detonation System (NDS) payload; a safety-improving Search and Rescue payload; and an accuracy-enhancing Laser Retroreflector Array. The RMP capability further reinforces GPS III/IIIF as a warfighting system, providing up to 60x greater anti-jamming for our warfighters operating in contested environments. GPS IIIF SV13 and beyond will incorporate the company’s LM2100 Combat Bus™, an enhanced space vehicle that provides even greater resiliency and cyber-hardening against growing threats, as well as improved spacecraft power, propulsion and electronics. LM2100 Combat Bus vehicles

are also capable of hosting Lockheed Martin's Augmentation System Port Interface (ASPIN), which would allow for future on-orbit servicing and upgrade opportunities.

- To date, five GPS III satellites have successfully launched. Lockheed Martin's sixth, seventh, and eighth GPS III satellites already complete, have been declared "available for launch" by the Space Force and are in storage waiting to be called up. The ninth and tenth GPS III satellites are now fully assembled and going into final testing before delivery. The Space Force has exercised contract options to begin production on the first seven GPS IIIF satellites (GPS IIIF space vehicles 11-17).
- GPS underpins our economy and national security. There are more than two billion GPS receivers in use around the world, a number that Europe's satellite navigation agency estimates will hit seven billion by 2022. The telecommunications industry, banks, airlines, electric utilities, cloud computing businesses, and TV broadcasters require constantly precise GPS timing. The U.S. Department of Homeland Security has designated 16 sectors of infrastructure as "critical," and 14 of them depend on GPS.

CONGRESSIONAL SUPPORT FOR THE NEXT GENERATION OVERHEAD PERSISTENT INFRARED PROGRAM (OPIR).

Recommendation:

- Continue strong Congressional support for the Next Gen OPIR program, including commitment to funding Block 0 development, deployment, and expansion.

Background:

- Next Gen OPIR Block 0 is the Space Force's next-generation, advanced space-based missile warning system that incorporates more capable warning sensors, enhanced resiliency and cyber hardening, and better mission analysis capability into our nation's missile warning mission. Dubbed by the U.S. Department of Defense as a "Go Fast" acquisition program, Next Gen OPIR will provide core missile warning for the defensive "kill chain" that protects our nation and armed forces from missile threats. The new system responds to challenges from adversaries who increasingly seek to erode space advantages held by the United States. Next Gen OPIR is the next generation following the current Space Based Infrared System (SBIRS), and provides a more capable, resilient, and defensible space-based global missile warning capability against emerging threats. In recent years, SBIRS has detected more than 1,000 missile launches as ballistic missile technology continues to proliferate around the world.
- The Next Gen OPIR constellation currently includes five satellites, three of which will be in geosynchronous orbit and two will be in polar orbit. Lockheed Martin will be responsible for the three geosynchronous earth orbit (GEO) satellites and Northrop Grumman for the two Polar orbit satellites.
- Lockheed Martin is developing and building three GEO satellites that provide improved missile warning capabilities and are more survivable against emerging threats. The first satellite is scheduled to be available for launch in 2025.
- The Next Gen OPIR GEO program's system level Critical Design Review (CDR) in October 2021, maintained the program's accelerated pace. The CDR specifically addressed the integration

between the space and ground segments, in addition to the integration of the Next Generation Interim Operations Ground System with the legacy missile warning system enabling the enhanced missile warning capabilities following launch.

- The system level CDR is the latest milestone the Next Gen OPIR GEO program has met since the 2018 contract award. Earlier this year, under Lockheed Martin’s prime contractor leadership, subcontractors Raytheon and a Northrop Grumman/Ball completed payload CDRs. One of the two mission payloads will each fly on the first two Next Gen OPIR space vehicles. The Lockheed Martin team also completed a separate space vehicle CDR, which aggregated 34 subsystem and payload reviews, and locked in the satellite’s technical baseline and a systems level CDR.
- The Space Force plans to have all five Block 0 satellites in orbit by 2030.
- Further expansion of Next Gen OPIR beyond the Block 0 Architecture (three satellites in GEO orbit, two in Polar orbit) is key to future stability and strengthened deterrence for the nation. Future evolution of Block 0 program is currently in development.

POLICY AND FUNDING SUPPORT FOR HYPERSONIC STRIKE AND DEFENSE WEAPONS CAPABILITIES.

Recommendations:

- Congressional support for continued emphasis and funding on research and development of hypersonic strike weapons.
- Continue budget commitment for the hypersonic defense (HD) capabilities to support evolution of holistic joint kill chain HD technologies and requirements.
- Continue budget commitment to fund a competitive Glide Phase Interceptor (GPI) program through Final Design Review (FDR) to ensure the right technical interceptor solution is delivered to our Warfighter to address a new, unique and complex threat.

Background:

- Developing next-generation hypersonic strike weapons and hypersonic defense capabilities are key priorities of the United States Department of Defense’s National Defense Strategy and Missile Defense Review. China and Russia’s growing commitment and technological progress in developing these technologies are key factors in the need to accelerate research and development of U.S. hypersonic strike and defense technology capabilities.
- To address growing concerns with adversarial hypersonic threats and their ability to exploit existing Missile Defense System (MDS) architectures, the Missile Defense Agency (MDA) will initiate its Glide Phase prototype program in late 2021 as part of MDA’s 3 phase-HD strategy. The strategy also supports mutual priorities such as INDOPACIFIC joint-emerging operational needs, Defense System Guam, and the Pacific-Deterrence initiative. This prototype program seeks the development of a GPI All-Up-Round (AUR) initially integrated into the Aegis Mk-41 Vertical Launching Station (VLS). The GPI program will execute flight-intercept test campaign in the latter of the decade and seeks delivery of 10 prototype rounds.
- Addressing hypersonic technology threats requires harnessing a mix of talent and technologies in fields in which multiple Colorado companies excel, including operationalizing hypersonic

capabilities, systems and engineering, remote sensing, cyber, and command, control and communications.

- Lockheed Martin partners with the MDA, Army, Air Force, and Navy on the technology development and demonstration for multiple capabilities that span all hypersonic flight disciplines, with work on multiple, cutting-edge hypersonic projects in support of national security taking place in Colorado.

PROTECT CAPABILITIES TO DEFEND THE UNITED STATES FROM LONG-RANGE BALLISTIC MISSILE DEFENSE ATTACKS, AND COMMIT TO REPLACING THE NATION’S STRATEGIC DETERRENT CAPABILITIES.

Recommendations:

- Continue budget commitment to fund the Ground Based Midcourse Defense (GMD) System in order to maintain the viability of the current fleet of interceptors.
- Continue budget commitment to fund the Next Generation Interceptor as the follow-on system to replace the aging Ground Based Interceptors within the GMD System.
- Support the Ground Based Strategic Deterrent (GBSD).

Background:

GMD & NGI

- The Ground-based Midcourse Defense (GMD) element of the Ballistic Missile Defense System provides the capability to engage and destroy intermediate- and long-range ballistic missile threats in space to protect the United States. Beginning in 2014, the DoD initiated efforts to increase the reliability and maintainability of the GMD weapon system and the anti-ballistic Ground Based Interceptor (GBI) component. FY16 NDAA (Section 1682) requires replacement of older kill vehicles by the end of FY22. FY18 NDAA (Section 1686) supports 20 additional interceptors (for a total of 64) to be fielded “as soon as technically feasible.” The 2017 National Defense Strategy and 2019 Missile Defense Review also highlighted the need to prioritize defense of the U.S. homeland and to remain ahead of the advancing missile threat facing the U.S. homeland.
- The Missile Defense Agency extended the Boeing Development and Sustainment Contract team contract in January 2018 due to National Military threat mitigation requirements. The contract is to develop, procure, test, and install 20 additional GBIs to meet the growing threat from ballistic missile attack on the homeland from global threats.
- In 2019, in the face of a growing threat and schedule pressures on the GBI system, the United States initiated the Next Generation Interceptor (NGI) – an All-Up Round ballistic missile defense interceptor capable of meeting the rapidly growing threat. The United States intends to deploy the new fleet of interceptors no later than 2028.

GBSD

- In September 2020, the United States Air Force awarded Northrop Grumman the contract to develop a new nuclear missile, Ground Based Strategic Deterrent (GBSD), intended to replace the 50-year-old Minuteman III (MMIII) Intercontinental Ballistic Missile which has been deployed as the ground-based leg of the U.S. nuclear forces structure since 1970.

- GBSD employs a modular design and open architecture, allowing for the replacement of aging and outdated components. According to the Air Force, this modular approach would reduce the lifecycle cost of GBSD and provide flexibility for improvements throughout the life of the weapon system, as complex threats evolve.
- The Air Force expects GBSD to begin replacing MMIII in 2029. As the missile moves toward production and deployment, we request Congressional support for this program.
- GBSD was initiated by the Obama Administration after extensive analysis of threats and cost analysis. It was determined to be the most cost-effective way to ensure a credible Intercontinental Ballistic Missile (ICBM) capability through at least 2075. GBSD has been underway for 10 years, with development activities underway and fielding of the system beginning a few years from now. These plans have been validated by two presidential administrations – Democrat and Republican – six congresses and six secretaries of defense.
- Our allies rely on the protection provided by the U.S. nuclear umbrella, which reduces the incentive for those nations to pursue nuclear programs of their own. Extending the nuclear guarantee underwrites the security of over thirty formal treaty allies, including NATO, Japan, Australia, and South Korea. The current ICBMs have been extended decades beyond their original service life, and both the Air Force and GAO have noted that the system cannot be reliably sustained beyond 2030, without significant loss of assets and deterrence capability.
- In addition to work on the GBSD program statewide, a number of the ICBM silos attached to F.E. Warren Air Force Base in Wyoming are actually located throughout Colorado.

ENCOURAGE THE DEPARTMENT OF DEFENSE TO LEVERAGE COMMERCIAL GEOSPATIAL INTELLIGENCE CAPABILITIES TO THE FULLEST EXTENT POSSIBLE.

Recommendation:

- Continue strong support from Congress to direct the Intelligence Community and Department of Defense to continue to leverage the commercial remote sensing industry and ensure funding levels for Commercial GEOINT are commensurate with user community requirements.

Background:

- Commercial remote sensing capabilities serve a critical national security function for the DoD, Intelligence Community (IC), and combatant commands (CCMDs). These products are used daily to support user communities in map making, global monitoring of security developments, pattern of life analysis, and can support the targeting mission. Timely, accurate imagery is integral to the actions of our nation's warfighters.
- Commercial imagery is used by over 500,000 government users at the tactical edge and is available within tens of minutes after collection. Satellite data requirements are drastically increasing, and with peer adversaries like China who continue to advance technology and grow capabilities, it is ever more important the U.S. continue to invest in overhead capabilities.
- Commercial industry continues to invest in expanding their capabilities and the IC and DoD should leverage these capabilities in order to spread the cost of systems among 100s of customers, reduce the risks of building their systems, and increase overall capability to the user community. The USG should leverage the innovation and investments of private industry.

- Additionally, commercial imagery is unclassified and can be shared among all U.S. Government stakeholders and coalition forces, providing validation to support shared situational understanding and strengthen critical partnerships with our allies.
- Given the international competition U.S. commercial space companies are facing against foreign competition who are heavily subsidized, it is ever more important for the U.S. to invest in and leverage U.S. industry.

COMMIT TO RETURN OF U.S. HUMAN SPACEFLIGHT CAPABILITIES AND SUPPORT COLORADO'S LEADING ROLE IN THE NATION'S SPACE EXPLORATION AND SCIENCE MISSIONS.

Recommendations:

- Advance the nation's cislunar and human deep-space exploration capabilities by providing congressional support for the Artemis program, and ensuring the Orion spacecraft, Gateway, and Space Launch System (SLS) programs remain fully funded.
- Support the launching of U.S. astronauts aboard U.S. launch vehicles and spacecraft, and ensure commercial providers make human safety their number one priority by following best practices developed over decades by NASA and other space agencies.
- Continue funding support for NASA's Discovery Programs VERITAS and DAVINCI+, and the Nancy Grace Roman Space Telescope.
- Support continued space exploration efforts through the expansion of existing flight projects and research and analysis programs.
- Support programs that enable future Mars missions including additional lunar surface and orbital habitations and power elements, lunar surface power, and scientific missions on the lunar surface and orbit.
- Ensure robust funding for NASA's Science Mission Directorate (SMD), which allows us to better understand Earth and beyond, while presenting key opportunities for Colorado's research institutions and fueling the talent and workforce pipeline in the state. This includes continued support in utilizing the National Academies' Decadal Survey process to provide the scientific roadmap designed to advance NASA's science objectives.

Background

- Sustained focus, process, and funding is required to ensure the U.S. regains human spaceflight capabilities and retains its leadership in space. Colorado's aerospace industry competes for work across all of NASA's portfolio, is at the forefront of future spaceflight development and launch capabilities, and plays a leading role in many of NASA's most ambitious space science endeavors. Such missions and programs are critical for advancing and maturing valuable technology. NASA's work with commercial and international partners on a program of human exploration efforts to the moon and beyond also advances access to cislunar space (the orbital area near the moon) as a future economic resource, with enormous potential to enable science, manufacturing and mining activities beyond Earth.
- Colorado companies are at the center of NASA's Artemis program, which will land the first woman and first person of color on the Moon and use what we learn to take the next giant leap

to Mars. Components include the Orion Spacecraft by Lockheed Martin and Commercial Lunar Payload Delivery Services by Deep Space Systems, Lockheed Martin, and Sierra Space. NASA selected Maxar Technologies to build the power and propulsion element for NASA's Gateway. Orion is launched by Boeing's Space Launch System (SLS) Rocket, and more than 184 Colorado companies support the Artemis supply chain.

- United launch Alliance has launched more than 145 consecutive and successful, science, exploration and national security missions. Through its existing launch fleet, and forthcoming Vulcan Centaur, ULA is supporting NASA and its partners in developing capabilities to deliver American astronauts to low Earth orbit, the moon and beyond.
- To be designed, built, and operated by Lockheed Martin, VERITAS (Venus Emissivity, Radio Science, InSAR, Topography, and Spectroscopy) and DAVINCI+ (Deep Atmosphere Venus Investigation of Noble gases, Chemistry, and Imaging) will launch 2028-2030 to study Venus' dense atmosphere, topography, and geologic processes. These programs represent NASA's return to Venus after more than three decades.
- Ball Aerospace will design and develop NASA's Wide Field Instrument (WFI) Opto-Mechanical Assembly for the Nancy Grace Roman Space Telescope. The Roman mission will advance our understanding of the nature of dark energy and dark matter and provide unparalleled views of the outer solar system, planets around other stars, and the stellar populations of nearby and distant galaxies.
- Given the need for sustained, long-term, technology and budget planning for a human mission to Mars, "Mars 2033" is a goal of launching humans to Mars in 2033 to take advantage of a low energy launch window for a year-and-a-half round trip instead of the normal two or three-year journey. The likelihood of mission success is much improved with a shorter mission, with the added advantage of less exposure to radiation, solar flares and the effects of zero gravity for astronauts. Investments in lunar missions that have clear applications to future Mars missions should remain a priority of NASA. We commend Congressman Ed Perlmutter for being a long-standing champion of the Mars 2033 goal.
- NASA's solicitation of the National Academies' Decadal Surveys provides a critical roadmap for mission planning and scientific areas of emphasis to address the agency's science objectives. By providing robust funding for NASA SMD's divisions – Earth Science, Heliophysics, Astrophysics, and Planetary Science – allows for Colorado's academic and commercial aerospace sectors to maintain global scientific competitiveness and to develop strong STEM pipelines by enabling students and early-career professionals to develop skill sets more rapidly.

SUPPORT INDUSTRY COLLABORATION AND PUBLIC PRIVATE PARTNERSHIPS TO ADVANCE CIVIL AND NATIONAL SECURITY SPACE PROGRAMS AND GROW THE COMMERCIAL SPACE SECTOR.

Recommendations:

- Continue funding for Commercial Cargo Resupply contracts, and Commercial Crew Transportation Capabilities contracts.
- Support the continued operation of the International Space Station through at least 2030, while expanding partnerships with the private sector through its Commercial Low Earth Orbit

Destination (CLD) strategy to develop next generation orbital space habitats as destinations for orbital research and commercial enterprise.

- Continue funding support for NASA's NextSTEP and Commercial Lunar Payload Services programs.
- Continue funding satellite servicing missions including On Orbit Servicing Assembly and Manufacturing (OSAM) technologies that will lead to better resilience, further abilities to assemble and manufacture on orbit, and boost the commercial role for sustainable space.
- Continue congressional support for the Space Resources Institute Act.
- Advocate for the Office of Space Commerce to enhance its Colorado presence to support its goal of fostering the conditions for the economic growth and technological advancement of the U.S. commercial space industry.

Background:

- Expanding market opportunities for the commercial space sector is key for ensuring future space industry growth. NASA's strategy includes stimulating the commercial space industry to help the agency achieve its goals and objectives for expanding the frontiers of knowledge, capability, and opportunities in space. The benefits of this approach include leveraging private investment, advancing the nation's space capabilities, and paving the way for new economic markets.
- NASA's Commercial Crew Development (CCDev) program has succeeded in stimulating an exceptional renaissance of space launch, spacecraft, space operations, and space commerce capabilities – at a lower cost than historical programs. In 2016 NASA awarded Sierra Space a Commercial Resupply Services 2 contract to deliver cargo and scientific research to the International Space Station (ISS), as well return and disposal services for at least six missions through 2024, using Sierra Space's Dream Chaser spacecraft.
- Boeing's Crew Space Transportation (CST)-100 Starliner spacecraft is currently being developed in collaboration with NASA's Commercial Crew Program for travel to and from low Earth orbit destinations like the International Space Station. The first uncrewed mission is expected to be launched by United Launch Alliance in 2022.
- The International Space Station is one of the most ambitious and successful international collaborations in history. As a designated U.S. National Laboratory, the ISS provides access to the space environment and is a critical microgravity research platform for U.S. space companies, researchers, and students. BioServe Space Technologies is a Center within the Aerospace Engineering and Sciences Department at the University of Colorado Boulder and has had a permanent research presence on the ISS since 2002. Colorado company Oakman Aerospace partnered on the Multi-User System for Earth Sensing (MUSES) which is currently operating aboard the ISS and is the first commercially operated remote sensing hosted payload platform. Also aboard the ISS is the Nano-Star Tracker built by Blue Canyon Technologies, which is on the Air Force STP-H5 test pallet and is providing precision attitude information to the various scientific instruments.
- The International Space Station's upcoming retirement at the end of the decade presents an exceptional opportunity for NASA to partner with the private sector to develop next generation orbital space habitats as destinations for orbital research and commercial enterprise, saving the agency money while stimulating economic opportunity. Sierra Space is developing its LIFE™

Habitat (Large Integrated Flexible Environment) and has partnered with Blue Origin to create a commercial space station, Orbital Reef, capable of functioning as orbiting business park to support and accelerate the technological benefits of in-space manufacturing. Lockheed Martin Space and Voyager Space Holdings are partnering to establish Starlab, an inflatable commercial space station, by 2027.

- NASA's Next Space Technologies Exploration Partnership (NextSTEP) is a public-private partnership model that seeks commercial development of deep space exploration capabilities to support more extensive human spaceflight missions around and beyond cislunar space. The NextSTEP partnership model provides an opportunity for NASA and industry to partner to develop capabilities that meet NASA human space exploration objectives while also supporting industry commercialization plans. Lockheed Martin Space is among five companies to develop lunar lander design concepts as part of the NextSTEP-2 program.
- NASA's On Orbit Servicing, Assembly, and Manufacturing (OSAM-1) mission will be a technology demonstration to robotically refuel and build an antenna on a LEO satellite, serving as a proving ground for on orbit technologies that will lead to a more sustainable space for commercial endeavors. Maxar is working closely with NASA to develop technologies that will further sustainability, resiliency, and agility allowing for modifications and technology upgrades to be made to spacecraft post-launch.
- Colorado is a global leader in research into In-Situ Resource Utilization (ISRU) - using materials found or manufactured in space to replace materials that would otherwise have been brought from Earth. ISRU is critical for developing successful and economically viable human spaceflight missions to the moon, Mars and beyond. The Colorado School of Mines' Space Resources Program is the world's first multi-disciplinary graduate program in the field of space resources and a leader in ISRU research. We commend Representatives Ed Perlmutter and Doug Lamborn for introducing H.R. 4719, the Space Resources Institute Act, directing NASA to submit a report on the merits of, and options for, establishing an institute related to space resources to advance NASA's objectives for maintaining U.S. preeminence in space.
- The Office of Space Commerce is tasked with fostering the conditions that enable the economic growth and technological advancement of the U.S. commercial space industry. Enhanced collaboration among DoD, NOAA, NASA, academia and commercial sector regarding weather data sharing and future satellite architecture development is vital for meeting that goal. With its unique concentration of space assets in this arena, Colorado is the perfect hub for this connectivity, and can leverage the existing David Skaggs Research Center on the U. S. Department of Commerce campus in Boulder.

ENHANCE NATIONAL CAPABILITIES IN SPACE AND EARTH WEATHER PREDICTION, EARTH SCIENCE, EARLY WARNING SYSTEMS, AND ENVIRONMENTAL INTELLIGENCE.

Recommendations:

- Support increased funding and full deployment of JPSS, GOES, Weather System Follow-on Microwave, and Space Weather Follow-on programs.
- Build upon the momentum that came with passage of the PROSWIFT Act to ensure Colorado's retains and expands its leadership in space weather research.

- Establish a space weather program in NOAA's OAR line office to improve research-to-operations transitions from the academic and commercial space weather communities.

Background:

- Strong investment by NASA and NOAA in atmospheric research and weather prediction is important to both the nation and Colorado. Fully funding NOAA's future geostationary and low Earth orbit weather satellite formulation efforts helps ensure the lowest risk and the highest potential for success. Earth science programs heavily utilize the type of small mission capabilities, including launch and support functions, at which Colorado's aerospace industry excels. Additionally, NASA's small-scale Earth Venture programs are critical to the development of the scientific discovery that leads to breakthroughs in operational weather.
- NOAA's Joint Polar Satellite System (JPSS) and Polar Follow On (PFO) will replace current polar-orbiting satellites and operate through 2038. The U.S. experiences more severe weather events than any other nation on Earth (due to our population density and developed infrastructure), and JPSS provides critical input to advance forecasts of the most dangerous and damaging weather. Ball Aerospace designed, built, and tested the JPSS-1 satellite, successfully launched in 2017, and is under contract to provide the Ozone Mapping and Profiler Suite-Nadir (OMPS) instruments on NOAA's follow-on JPSS-2, JPSS-3 and JPSS-4 satellites.
- The Geostationary Operational Environmental Satellite system (GOES) is operated by NOAA's National Environmental Satellite, Data, and Information Service division, and supports weather forecasting, severe storm tracking, and meteorology research. The GOES-R series of next-generation weather satellites are being built by Lockheed Martin and will operate through 2036. Two are successfully on orbit, and the remaining two (GOES-T and GOES-U) will also be built by Lockheed Martin. GOES-T is expected to launch in March of 2022. With significantly enhanced capabilities, and together with JPSS, these satellites will greatly improve the accuracy and extend the warning times for thunderstorms and tornados across the country, saving lives and protecting commerce.
- Weather System Follow-on Microwave (WSF-M) is a DoD program to address critical space-based environmental monitoring (SBEM) requirements, providing the warfighter with environmental intelligence to address three critical SBEM gaps: ocean surface vector winds, tropical cyclone intensity, and LEO energetic charged particle characterization (a space weather gap). Ball Aerospace is the prime contractor for the WSF-M mission and will deliver the payload, spacecraft, and a fully integrated space vehicle to launch.
- The Space Weather Follow-on (SWFO) mission is a program in the newly created NOAA/NESDIS space weather office that will replace the aging ESA/NASA SOHO, NASA/ACE, and NOAA/DSCOVR satellites, incorporating their capabilities into a single advanced satellite system with backup systems on the GOES-U satellite. SWFO will orbit at the L1 Lagrangian point, 1.5 million km between the Earth and the Sun, to provide critical early warning of approaching solar storms that cause the most severe space weather events including radiation storms and geomagnetic storms that can impact GPS reception, satellites in orbit, airline operations, and the electric power transmission grid. Ball Aerospace will deliver the spacecraft and perform observatory integration and test prior to launch.
- The Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow (PROSWIFT) Act coordinates the development and implementation of federal government activities to improve the nation's ability to prepare, avoid, mitigate, respond to, and

recover from potentially devastating impacts of space weather events. The ability to understand and predict space weather events is also critical to the success of future Moon and Mars missions because of the risks they pose to spacecraft crew during transit. We commend Representative Ed Perlmutter and Senator Cory Gardner for their leadership in implementing this legislation, and request continued support for opportunities to build upon the momentum from passage of the PROSWIFT Act to further leverage Colorado’s leadership in space weather research, and to ensure the Research to Operations (R2O) and Operations to Research (O2R) loop remains intact and further enhanced.

- NOAA has established space weather programs in the NESDIS and NWS line offices, but lacks a dedicated space weather research program in the OAR line office. This contrasts with NOAA’s terrestrial weather program which enjoys synergistic support in all three line offices. The lack of an OAR space weather program has led to challenges in establishing a robust space weather Research to Operations (R2O) and Operations to Research (O2R) loop, particularly with the academic and commercial space weather research communities. Establishing an OAR space weather program will allow the NWS Space Weather Prediction Center to better focus on its core mission of issuing space weather forecasts while establishing an able partner for the academic and commercial space weather research communities to develop advanced physics-based models, artificial intelligence systems, and data science tools to improve space weather forecasting.

SUPPORT ACQUISITION POLICIES AND REGULATORY FRAMEWORKS THAT PROMOTE CONTINUED GROWTH OF COLORADO’S SPACE INDUSTRY.

Recommendations:

- Ensure factors enabling continued growth of the space industry are appropriately considered in all phases of space acquisition and operations for the U.S. government.
- Support efforts to update government procurement to better leverage the speed of commercial innovation and technology development.

Background:

- Colorado’s space economy includes a number of companies that manufacture and operate satellites which are used for a wide range of economic activities as well as for national security and civil space needs of the Federal Government. Continued support of the satellite industry will help the U.S. meet mission requirements and stay at the forefront of technological development and data gathering. As the Federal Government relies more heavily on the commercial sector for solutions, Colorado’s satellite industry will continue to provide cutting-edge solutions.
- The commercial space sector is innovating at a pace that should be leveraged by the Federal Government to better meet mission needs. The space economy in Colorado is investing in developments to stay ahead of global competition and acquisition policies and the regulatory environment should reflect the speed at which this innovation is occurring, looking for ways to better partner with the private sector to stay a leader in space. The Colorado space industry is diverse and robust, and with updated acquisition policies and a regulatory framework that

understands this, the U.S. can continue to lead on space issues and not lose ground to adversaries.

ENSURE SUPPORT FOR THE SMALL SATELLITE ECONOMY AS IT FITS INTO THE LARGER ARCHITECTURE OF SATELLITE ACQUISITION BY THE FEDERAL GOVERNMENT.

Recommendations:

- Continue support and funding for the research, development, and fielding of small satellite technology across a wide range of Federal Government agencies (DOD, NASA, and NOAA) and through Small Business Innovation Research and Small Business Technology Transfer grant funding.
- Support the development of Rapid Response Launch Capability to address future needs for Federal Agencies.

Background:

- Satellite-based operations and manufacturing combined are one of the fastest growing sectors of Colorado's space economy. Development and use of small satellites (generally weighing less than 1,100lbs) continues to grow to meet military, civilian and commercial remote sensing needs. Multiple Air Force, DARPA, and NASA missions over the last decade have demonstrated the operational success of smallsats for both national security and civil missions. While there are limitations to small satellite capabilities, their benefits include lower costs, responsiveness and flexibility, speed to orbit, enhanced resiliency of space capabilities to ensure the performance of critical missions, new opportunities for space mission performance, and potential for broader and more continuous coverage from space. Colorado companies and research institutions are at the forefront of small satellite research, development, manufacturing, and technology commercialization.
- Funding and policy support for smallsats across a wide range of Federal Government agencies is important to Colorado's space industry. Numerous smallsat companies, universities, and other research and development agencies in Colorado are developing cutting edge technology through direct federal funded (DOD, NASA, NOAA) programs and Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grant funding. The Defense Advanced Research Projects Agency's (DARPA) Blackjack program and the Space Development Agency (SDA) will be developing and operationalizing (respectively) proliferated LEO constellations, and Colorado small satellite companies such as Blue Canyon Technologies and York Space Systems will be major providers for these systems.
- Colorado is also developing the next generation of disruptive technologies using cubesats and 50-100 kg spacecraft, enabling missions to be addressed at orders of magnitude less cost than legacy systems. Continued support of NASA and NSF research funding for these developments will enable Colorado to remain at the forefront of the next generation of space assets for academic, commercial, and operational systems.
- Rapid Responsive Launch Capability involves setting up a framework to shorten the integration process required to launch a spacecraft, and developing a responsive space model that offers rapid, repeatable access to orbit. Currently, typical mission integration campaigns can take many months of developing and verifying requirements, in addition to the time required for regulatory

approvals. Creating a standard launch integration product that has pre-established compatibility with the satellite product can significantly reduce mission integration time, and time to launch. Rapid Responsive Launch Capability supports and encourages further commercial space growth by making small satellite launches and remote sensing activities more affordable, accessible, and open to adoption by adjacent industries (e.g. oil and gas, agriculture).

MAKE SPACE SUSTAINABILITY A PRIORITY IN POLICY AND PROGRAMS.

Recommendations:

- Enable Mission Authorization and resolve international legal issues for commercial activities that currently do not have certainty in licensing and liability.
- Ensure On-Orbit Servicing is considered in the trade space for U.S. Government missions and that commercial partnerships are developed and utilized to service U.S. Government spacecraft.
- Fund research and development, demonstrations of technologies, and economic studies that support debris mitigation and active remediation of the orbital environment, ensuring small business and academic innovation is included.
- Adequately resource and authorize the Department of Commerce, NASA, FCC, Department of Transportation, Department of State, and DoD in activities related to ensuring the long-term sustainability of space.
- Support cross-agency collaboration and research between NASA, NOAA, FAA, DOD and other relevant agencies to better understand the changing dynamics that are influencing Low-Earth Orbit (LEO) spacecraft operations, potentially impacting satellite and debris tracking, collision analysis, and de-orbit/re-entry window calculations.

Background:

- As orbital space becomes more congested, both challenges and opportunities exist for space businesses. The U. S. Space Force currently tracks more than 24,000 pieces of space debris, with hundreds of thousands of more pieces going untracked, that threaten the safety of astronauts and the billions of dollars in commercial, military, and scientific satellites that are vital to both national security and the global economy. Even tiny pieces can inflict severe damage, or destroy, a spacecraft. With close to 8,000 satellites currently in orbit, and thousands more scheduled to launch in the next few years, collision threats are growing exponentially.
- Three key elements to achieve space sustainability are: space situational awareness (SSA), space traffic coordination and management (STCM), and space environment management (SEM). SEM encompasses the active measures to holistically manage and shape the space environment.
- Modern society is reliant on the resilience and continuity of space systems, even as today's spacecraft are designed to be discarded at end-of-mission and not utilized for long-term persistent operations. Further, this "throwaway" culture of space generates orbital debris and heightens the risk of collisions in space.
- Space Sustainability efforts require interagency collaboration and coordination in addition to industry input. We recommend this cross-functional topic should be a priority for the National Space Council and the Users Advisory Group.

- Low Earth Orbit is becoming increasingly crowded with the approval and initial deployment of commercial “mega-constellations” for global broadband internet access. Space Policy Directive 3 of 2018 mandated that the NOAA Office of Space Commerce assume responsibility for all civil Space Traffic Management (STM) from the DOD. Successfully replicating current DOD conjunction analysis and warning capabilities will require a dedicated multi-agency effort to better understand the dynamic environment in LEO characterized by space weather, debris field generation and evolution, and operational considerations, as well as to design advanced tracking, conjunction analysis, orbital catalog maintenance, and publicly accessible dissemination systems for civil STM.
- Colorado is home to numerous companies, academic institutions, non-government organizations, and government entities who are directly or indirectly involved with ensuring space is a safe and sustainable environment for all users. This ecosystem, when looked at as a whole, is defining Colorado as the hub of space sustainability, something Coloradans can be especially proud of alongside its robust aerospace industry.
- On-orbit servicing, assembly, manufacturing, (OSAM) and orbital debris removal are essential – and growing – space industry sectors in which Colorado companies are increasingly playing a leading role. Maxar is developing advanced robotic arms that will semi-automatically assemble and reconfigure spacecraft components while on orbit. Astroscale U.S. provides satellite life extension, end-of-life, active debris removal, and in-situ inspection services. OrbitFab is designing the first gas stations in space to support on-orbit servicing, and Altius Space Machines is supporting LEO satellite servicing and cooperative servicing interfaces.
- National policy, current missions, and programs in support of technology demonstration projects and a global regulatory environment for orbital operations will create a safer and more sustainable environment for space operations, while maintaining U.S. leadership in this rapidly growing sector of the global space economy.
- On-orbit Servicing (OOS) technologies extend the efficiency, resiliency, and operational lifetime of client satellites while also facilitating the mitigation of orbital debris through a range of services, including in-situ space domain awareness, refuel, repair, relocation, end-of-life disposal, and upgrade of space assets that may otherwise be difficult and costly to replace expeditiously. OOS can support both civil and military missions, providing flexibility in operations. Commercialized OOS services have recently demonstrated success, but the U.S. Government has yet to establish preparations to leverage these services across all missions.
- National policy and programs in support of technology demonstration projects and a global regulatory environment that enables OOS will create a safer and more sustainable environment for space operations, while maintaining U.S. leadership in this rapidly growing sector of the global space economy.

SUPPORT GROWTH OF COLORADO’S COMMERCIAL SPACE SECTOR BY CONTINUING THE EFFORT TO REDUCE UNNECESSARY LICENSING AND EXPORT RESTRICTIONS.

Recommendations:

- Support and encourage continued administrative changes to International Traffic in Arms Regulations (ITAR) and Export Administration Regulations (EAR) to increase U.S. security and

competitiveness, including the export control reform legislation for commercial satellites enacted in the FY2013 Defense Authorization bill.

- Remove noncritical areas where ITAR control is not necessary in order to focus security protections without creating barriers to commerce and research.
- Work with the U.S. Department of State to pursue a statutory exemption for exports of space related items to U.S. allies, such as North Atlantic Treaty Organization (NATO) countries.
- Support a regulatory environment for remote sensing satellites that fosters both domestic and international competition by ensuring US companies are not hindered by onerous, outdated, and heavy-handed regulations.
- Work with the U.S. Department of Commerce to promote export sales of U.S. space components, products, and services.

Background:

- Export controls create unintended consequences due to the broad and vague nature of the ITAR and EAR regulations and the lengthy processing time. We applaud the efforts of Colorado delegation members in advancing satellite export control reform through the FY 2013 National Defense Authorization Act, and request the delegation continue to work on meaningful changes/reforms of the ITAR, including transfers of items from the United States Munitions List to the Commerce Control List, to ensure U.S. companies are globally competitive.
- International interest in purchasing U.S.-produced space components suffers due to the unpredictable licensing process, which hampers U.S. competitiveness. In turn, it forces international governments and companies to purchase or develop foreign-produced technology, thereby reducing U.S. security, rather than enhancing it.
- U.S. universities are unable to attract top international graduate students to work on research that is covered by ITAR restrictions, limiting their ability to develop the next generation of technology. Current policy also prevents the United States from retaining the talent of such science and engineering professionals, and the restrictions also limit the ability of U.S. students to gain the cutting-edge space-research experience that their counterparts in Europe and Asia benefit from, undermining the global competitiveness of U.S. companies.
- The United States commercial remote sensing industry is important not only for national security and civil government missions, but also for key private sector industries and natural disaster response. It should not be hindered by heavy-handed government regulations that disadvantage Colorado companies' ability to compete globally. Regulations should foster innovation and growth across the commercial sector that ensure the U.S. remains a leader in technology and ahead of international competitors.
- Restrictive limitations on international participation in human spaceflight need to be addressed in the ongoing reform efforts. As the United States regains its status as a provider and innovator in human spaceflight, continued attention to export reform regulations will ensure projects can secure partnerships with like-minded nations around the globe to advance the technological growth and economic security of the U.S. industrial base.
- Ongoing industry input on Export Control Reforms is vital for capturing valuable insight into what technologies are already available throughout rest of world.

ADVOCATE FOR COLORADO NATIONAL GUARD F-16Cs CONVERSION TO F-35A AIRCRAFT.

Recommendation:

- Congressional support to convert the Buckley Space Force Base 140th Wing from F-16C to F-35A aircraft and retain the air defense mission at Buckley SFB.

Background:

- The 140th Wing, Colorado Air National Guard (COANG) at Buckley Space Force Base operates the oldest F-16s in the Air Force and if not awarded new F-35 fighter jets, the base risks losing its flying mission, operational runway capability, and Air National Guard unit.
- The F-35 is the next generation of fighter jets for the Air Force. To sustain the air defense mission and viability of a flying mission for the COANG and Buckley SFB, the COANG will need to convert to this next generation of aircraft.
- The Colorado Air National Guard at Buckley is the only air defense base in the central United States to carry out the Aerospace Control Alert mission, which consists of a national network of fully loaded aircraft ready to protect the country on a moment's notice.
- \$16.25 million has been invested in Buckley's facilities over the past 15 years and little new construction would be required to house the new F-35 aircraft.

SUPPORT STRATEGIES TO DEVELOP A 21ST-CENTURY AEROSPACE WORKFORCE

Recommendations:

- Promote and support P-20 education programs and initiatives that increase engagement, retention, and success levels of Colorado students in science, technology, engineering, and mathematics (STEM) education.
- Support policy such as the Traineeships for American Leaders to Excel in National Technology and Science (TALENTS) program that enhances and streamlines clearance processing for undergraduate and graduate students.
- Support federal grant requests benefiting STEM programs in Colorado, such as the state-wide Colorado Space Grant Consortium.
- Strengthen Colorado's unique aerospace ecosystem by fostering and supporting critical government/industry/university partnerships in workforce development through advanced research and technologies.
- Support expanding education and research opportunities for underrepresented communities and at Minority Serving Institutions in order to enhance and diversify the STEM talent pipeline across the country and across Colorado.

Background:

- Aerospace companies in Colorado and nationwide are deeply concerned about the skills shortages facing the industrial base and the need to replenish the workforce with engineers in the very near future. To keep Colorado competitive and innovative, our P-20 students require a rigorous STEM education if they are to have the opportunity for a career in aerospace or other high-tech industries.
- The public and private sectors must work together on educational efforts that address workforce shortages and maintain and replenish engineers and scientists needed to keep Colorado competitive. Aerospace companies provide significant support in this effort by engaging and supporting our students through their many education outreach programs.
- One barrier to filling critical jobs quickly is that recent graduate entering the aerospace workforce are often delayed in being able to work on certain programs while they await security clearance. Programs such as the Traineeships for American Leaders to Excel in National Technology and Science (TALENTS) program (enacted in the FY2021 NDAA) can enhance and streamline the clearance processing for undergraduate and graduate students, enabling them to hit the ground running upon graduation for jobs that require security clearance.
- CU-Boulder hosts the Colorado Space Grant Consortium, a state-wide NASA-funded program that provides Colorado students access to space through innovative courses, real-world hands-on satellite programs, and interactive outreach programs. With funding from NASA, the Colorado Space Grant Consortium was able to increase its partnerships with community colleges across the state. Given Colorado's unique and unmatched civil, commercial, and national security aerospace ecosystem, it is important for the state to play a leading role in bringing together key partners – government, industry and universities – to effectively train and equip the future workforce needed to address the critical space-based jobs now and into the future.

By taking a coordinated approach, industry and government should work closely with colleges and universities to develop the academic and research programming needed to train the state's – and nation's – critical space workforce through a variety of disciplines. We commend and applaud the Colorado congressional delegation's support of funding federal programs that support this type of endeavor, including the recent support for the University Consortium for Space Technology Development within the FY22 Defense appropriations bill and call on the delegation to support similar efforts in FY23.

PROMOTE AND ADVANCE COLORADO AEROSPACE THROUGH PARTICIPATION IN THE FOLLOWING CONGRESSIONAL COMMITTEES AND CAUCUSES, WITH PRIORITY GIVEN TO APPROPRIATIONS COMMITTEES.

Participation in these forums helps promote and advance support for aerospace and gain visibility for Colorado's leadership in this industry. Colorado aerospace represents a uniquely integrative view of the civil, commercial and defense space sectors, and our congressional delegation is ideally situated to champion the national space ecosystem's many assets and opportunities. We thank Colorado's delegation members for their current participation in a number of these caucuses and committees, and request consideration of those which do not have representation from Colorado.

Senate:

Senate Appropriations Committee

- Subcommittee on Defense
- Subcommittee on Commerce, Justice and Science and Related Agencies

Senate Committee on Armed Services

Senate Select Committee on Intelligence

Senate Committee on Commerce, Science & Transportation

- Subcommittee on Science and Space
- Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard
- Subcommittee on Communications, Media and Broadband
- Subcommittee on Aviation Safety, Operations, and Innovation

Senate Aerospace Caucus

Senate Unmanned Aerial Systems (UAS) Caucus

House:

House Appropriations Committee

- Subcommittee on Commerce, Justice and Science and Related Agencies
- Subcommittee on Defense

House Committee on Armed Services

House Permanent Select Committee on Intelligence

House Committee on Science, Space and Technology

House Aerospace Caucus

House Space Power Caucus

House Research and Development Caucus

House Science and National Laboratories Caucus

House Space Force Caucus

House Defense Communities Caucus

The Congressional Unmanned Systems Caucus

Background:

- **The Senate Appropriations Committee Subcommittee on Commerce, Justice and Science** and Related Agencies and **House Appropriations Committee Subcommittee on Commerce, Justice, Science** and Related Agencies make ultimate funding decisions for agencies that are key to Colorado space programs, such as NASA, NOAA, and NSF.
- The **Senate Committee on Armed Services'** jurisdiction includes aeronautical and space activities peculiar to or primarily associated with the development of weapons systems or military operations.
- The **Senate Select Committee on Intelligence** and the **House Select Committee on Intelligence** oversee and make continuing studies of the intelligence activities and programs of the United States Government, submit to their respective chambers appropriate proposals for legislation, and report to the Senate and to the House respectively concerning such intelligence activities and programs. We commend **Senator Michael Bennet** for his membership of this Senate Select Committee on Intelligence.

- The **Senate Committee on Commerce, Science & Transportation Subcommittee on Science and Space** has responsibility for science, engineering, and technology research and development and policy; calibration and measurement standards; and civilian aeronautical and space science and policy. We commend **Senator John Hickenlooper** for his role as Chair of this Subcommittee, which conducts oversight on the National Science Foundation, the National Aeronautics and Space Administration, the National Institute of Standards and Technology, and the Office of Science and Technology Policy.
- The **Senate Committee on Commerce, Science & Transportation Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard** has oversight for the National Oceanic and Atmospheric Administration (NOAA), which is a key contributor to Colorado's space industry.
- The **Senate Committee on Commerce, Science & Transportation Subcommittee on Communications, Media, and Broadband** has oversight for matters relating to communications, including commercial and noncommercial satellite broadcast and satellite communications. We commend **Senator John Hickenlooper** for his membership of this Subcommittee.
- The **Senate Committee on Commerce, Science & Transportation Subcommittee on Aviation Safety, Operations, and Innovation** has jurisdiction over civil aviation, with specific oversight responsibility for the Federal Aviation Administration (FAA), and controls the authorization levels for all FAA programs, including those related to Unmanned Aircraft Systems and commercial Spaceport activity. We commend **Senator John Hickenlooper** for his membership of this Subcommittee.
- The **Senate Aerospace Caucus** was formed in late 2009 to provide critical oversight of United States Government aerospace acquisition programs, ensure a competitive industrial base, and promote education and workforce development programs that prepare American students for careers in aerospace. We commend **Senator Michael Bennet** for his membership of this Caucus.
- The **Senate Unmanned Systems (UAS) Caucus** was formed in 2012 with a mission to educate senators and staffers on the capabilities of unmanned systems and work closely together to best shape the unmanned systems policymaking process.
- The **House Appropriations Defense Subcommittee's** jurisdiction includes: departments of Army, Navy (including Marine Corps), Air Force, Office of Secretary of Defense, Defense Agencies (except Department of Defense-related accounts and programs under the Subcommittee on Military Construction and Veterans Affairs; and the Office of the Assistant Secretary of the Army (Civil Works), Central Intelligence Agency, and Intelligence Community Staff.
- The **House Committee on Armed Services** retains exclusive jurisdiction for defense policy generally, ongoing military operations, the organization and reform of the Department of Defense and Department of Energy, counter-drug programs, acquisition and industrial base policy, technology transfer and export controls, joint interoperability, the Cooperative Threat Reduction program, Department of Energy nonproliferation programs, and detainee affairs and policy. We commend **Representatives Doug Lamborn** and **Jason Crow** for their membership of this Committee and the Subcommittee on Readiness. Additionally, we commend **Congressman Lamborn** for his role as Ranking Member of the Subcommittee on Readiness, and membership of the Subcommittee on Strategic Forces; and **Congressman Crow** for his membership of the Subcommittee on Cyber, Innovative Technologies, and Information Systems.
- The **House Committee on Science, Space and Technology's** jurisdiction includes all nondefense federal scientific research and development (R&D) at a number of federal agencies, including: NASA, the Department of Energy, the National Science Foundation, the Federal Aviation Administration, the National Oceanic and Atmospheric Administration, and the National Institute of Standards and

Technology. We commend **Representative Ed Perlmutter** for his membership on this Committee and for serving on the Subcommittee for Investigations and Oversight and Subcommittee on Space and Aeronautics.

- The **House Aerospace Caucus** is a bipartisan organization comprised of members of the House of Representatives who have a strong interest in public policy issues that affect the aerospace community. The Caucus serves as a forum for industry briefings to members of Congress and their staffs on the major issues that impact growth and innovation in the nation's space, civil aviation, and defense sectors. We commend **Representative Ed Perlmutter** for his role as Caucus Co-Chair, and **Representative Doug Lamborn** for membership of this Caucus.
- The **House Research and Development Caucus** informs Congress and the public on the important national and global issues regarding research and development affecting the United States. We commend **Congresswoman Diana DeGette** for her membership of the Caucus.
- The **House Science and National Laboratories Caucus** is focused on reinforcing federal investment in research and the national laboratories, in addition to raising awareness in and out of Congress about the role they play in long-term economic growth. We commend **Congressman Ed Perlmutter** for his membership of the Caucus.
- The **House Space Force Caucus** works closely with the Department of the Air Force and the Space Force to provide opportunities for members and their staff to learn about the vital role the U.S. Space Force plays in maintaining American space power. We commend **Congressman Jason Crow and Congressman Doug Lamborn** for establishing and serving as co-chairs of this bipartisan Caucus.
- The **House Defense Communities Caucus** is a bipartisan group of House lawmakers, representing communities that host active and closed installations, who support those communities in their efforts to assist service members and their families, and raise awareness of the unique issues and challenges facing defense communities. The Caucus promotes dialogue on defense community issues, serves as a liaison between Congress, DoD and the private sector, and advances legislation to strengthen defense communities.
- The **Congressional Unmanned Systems Caucus** is a bipartisan group of House members, and its mission is to educate members of Congress and the public on the strategic, tactical, and scientific value of unmanned systems; actively support further development and acquisition of more systems, and more effectively engage the civilian aviation community on unmanned system use and safety. We commend **Congressman Doug Lamborn** for his membership.

ABOUT THE COLORADO SPACE COALITION

The Colorado Space Coalition (CSC) is a partnership among members of the private sector, the state of Colorado, the Denver Metro Chamber of Commerce/Metro Denver Economic Development Corporation, several economic development agencies, the Colorado Space Business Roundtable, higher education institutions, and other stakeholders. The Coalition is led by Lieutenant Governor Dianne Primavera, Michael Gass, retired President and CEO of United Launch Alliance; and Dr. Ron Sega, Director and Woodward Professor of Systems Engineering at Colorado State University.

The goal of the Colorado Space Coalition is to build upon the state's diverse company base in order to maintain and enhance Colorado's position as a center of excellence for space, and to expand the state's recognition as the best place for aerospace companies to locate and thrive.

The CSC spans the entire state and represents varied backgrounds, but united goals. The Coalition meets regularly to assess opportunities for Colorado's growth and to promote Colorado's space assets nationally and internationally. The Colorado Space Coalition values the Colorado Congressional Delegation's interest in and commitment to our shared vision of Colorado as a center of excellence for space now, and in the future.



Colorado Space Coalition
1445 Market St.
Denver, Colo. 80202

PHONE: 303.620.8083
EMAIL: vicky.lea@metrodenver.org
www.spacecolorado.org