

# **Report On the Comprehensive Military Value and Economic Impact of Department of Defense Activities in Colorado**



*Prepared by the Department of Military and Veterans Affairs*

April 2015

# STATE OF COLORADO

## OFFICE OF THE GOVERNOR

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John W. Hickenlooper  
Governor

Distinguished Coloradans,

I am pleased to share the *Report on the Comprehensive Military Value and Economic Impact of Department of Defense Activities in Colorado*: Colorado's first in-depth analysis into the roles and missions of the Department of Defense within Colorado. In the pages of this document, you will find a holistic look at the role of our state in the necessary and vital work of national security. By quantifying and defining the many ways in which the people who make up these critical missions weave into the complex tapestry of our diverse state, we can better understand how to continue our legacy of success in our shared goal of a safe and prepared United States.

The Centennial State has grown with the nation from the time of post-Civil War rebuilding to an era of global importance in an increasingly interconnected world. Our state's leadership in emerging technologies, particularly in the aerospace industry, is a sign of the value created by anchoring this industry within a highly educated population of achievers.

This mutual benefit is highlighted in the economic data contained within this report. I urge Coloradans from every corner of the state to read this report to see the jobs and economic factors that are driven by research, small business contracts, and a host of other areas that are not always associated with the Department of Defense.

Whether it is toward the farthest reaches of space or here on the ground, Colorado has a long, proud history of providing what is needed, when it is needed to our nation's leaders. I look forward to carrying on this tradition and supporting our servicemembers and their families.

Sincerely,

  
John W. Hickenlooper  
Governor of Colorado

# STATE OF COLORADO

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John W. Hickenlooper  
Governor

Major General  
H. Michael Edwards  
The Adjutant General

April 15, 2015

Fellow Coloradans,

Service takes on many forms but is not always easy to quantify. As we serve our State and Nation, those of us in uniform often look ahead, but seldom look back. We strive to prepare for the challenges that await us, be it on a foreign field or as we battle the natural disasters that appear.

This report provides a unique insight into many of the aspects of the Department of Defense that reside in Colorado. This report quantifies service, not only in terms of the service members, civilians, and contractors who work to advance our national security, but also in terms of what Colorado has done to provide the infrastructure and transportation necessary for mutual success.

The pages of this report touch on the history that has brought us to the present, but more importantly there are insights into the ways in which we can improve our efforts going forward. Our Western history and heritage are alive in the pioneering work that is taking place across the Centennial State. Our partnerships span the globe and result in real progress in the constantly changing national security domain. Whether in North America or across the Globe, the missions and commands that thrive in Colorado are always on the forefront of the challenges that lie ahead.

I hope that you will take the time to review the information that has been compiled here. Use it as a reference and a roadmap for improving the ways in which we protect those we hold dear.

Respectfully,

H. Michael Edwards  
Major General, COANG  
The Adjutant General of Colorado

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## **1. Summary of Key Data**

In the 2015 National Security Strategy and the 2014 Quadrennial Defense Review, the President and the Secretary of Defense provide a strategic context for the Department's national defense objectives. DOD must begin transitioning from today's wars to prepare for future challenges, protect the broad range of US national security interests, advance DOD's initiatives to rebalance and reform, and support deficit reduction through a lower level of defense spending. This broad strategic context has been decomposed into ten non-prioritized strategic mission areas for which DOD must organize, train and equip. They represent the strategic objectives that govern all DOD investments at a macro level, and are value benchmarks for the four military services' personnel, missions, and installations at the micro level. The degree to which Colorado military personnel, missions and installations facilitate the success of these ten mission areas is one vital measure of the State's collective value to supporting national defense. The ten mission areas are:

- Counter terrorism and irregular warfare
- Deter and defeat aggression
- Project power despite anti-access/area denial challenges
- Counter weapons of mass destruction
- Operate effectively in cyberspace and space
- Maintain a safe, secure, and effective nuclear deterrent
- Defend the homeland and provide support to civil authorities
- Provide a stabilizing presence
- Conduct stability and counterinsurgency operations
- Conduct humanitarian, disaster relief, and other operations

This Report confirms that Colorado Active and Reserve Component forces, DOD civilians and installations contribute significantly to all these mission areas. The Study also examined the degree of that contribution by analyzing the extent to which the following nine Colorado attributes serve as strengths, vulnerabilities or opportunities at the State and regional level:

- Transportation infrastructure
- Technological capacities
- Primary, secondary and post-secondary education assets
- Intellectual capabilities criteria to include military academic and technical organizations
- Quality of life benchmarks for service members and their families
- Training opportunities
- Geography
- Defense and aerospace industry
- The proximity and colocation of other military installations, commands, missions and capabilities

These nine attributes extend beyond strictly DOD areas of interest, providing a platform to describe the complexion of economic benefits and relationships associated with the military personnel,

missions and installations resident in the State. A later portion of this Report explains these benefits and relationships in detail. In this section, the intent is to use the nine attributes as a lens showing the degree of Colorado's strengths, vulnerabilities or opportunities in support of DOD strategic objectives.

The Study used the following definitions for the terms strengths, vulnerabilities and opportunities:

- **Strength**: A good or beneficial quality, asset, or attribute of Colorado military installations or economic activity that is real and accruing an advantage to DOD or the State of Colorado. Also, tangible assets or attributes or some combination of these that translate into power for resisting negative forces (trends, plans, programs, policies, etc.)
- **Vulnerability**: A difficult-to-defend asset, attribute, trend, or characterization of a military installation or an economic activity which is or may be harmful to DOD or the State of Colorado. Also, any asset, attribute, trend, or characterization of a military installation or economic activity which is open to attack or criticism.
- **Opportunity**: An identified set of circumstances or a suitable occasion that highlights or reinforces a strength or mitigates a vulnerability. Successful strategies for taking advantage of an opportunity should tie three elements together: the desired ends to be achieved, the ways one might pursue the opportunity, and the means or resources needed.

### **Summary of Colorado Strengths**

The State of Colorado offers an impressive number of strengths in support of all nine DOD attributes. The Study's conclusions on strengths are summarized below.

#### **Providing a Robust Transportation Infrastructure**

All Colorado military installations enjoy access to robust transportation networks and infrastructure, supporting the movement of personnel for training, operations and which are responsive to current mobilization requirements. The multitude of commercial and military airports serving the greater metropolitan Denver region provides diverse hubs for departing and arriving personnel. The Front Range roads and highways system allows year-round traffic for DOD mission-related vehicles, and have historically proven responsive to surge requirements when extraordinarily large numbers of people or equipment sets have needed to be quickly moved. While there may be minor locality encroachment issues affecting existing or proposed transportation infrastructure, this Study did not uncover any major transportation-related encroachment developments adversely impacting military operations and training in Colorado.

#### **Offering Innovative and Open Technological Capabilities**

The State of Colorado fosters a tremendous variety of high technology capabilities that are "engines" for enhancing the State's military value to DOD. The broad diversity and locational stability of Colorado's technology-based industries provide DOD with a high level of stability during the peaks and valleys of product and technology lifecycles. Innovation springs from an



environment where available funding meets a technology opportunity, and the State is a magnet for attracting both. The local military and civilian population living on and around military installations is well-educated, technically proficient, satisfied with a positive quality of life in their work and recreational pursuits, and possesses the selective security classification clearances needed for many DOD jobs. This characterization is equally true for DOD retirees who are establishing second careers in major Colorado defense industries or, again, within DOD. There is a cross-flow from DOD into industry and vice versa that nurtures strong bonds between those two major employers and is a self-reinforcing relationship that concentrates talent, productive capacity, and innovation. As explained in the economic impact discussion below, strength is reflected in the pooling of talent and generation of spin-off industries or ventures through agglomeration.<sup>1</sup> Advanced industries in areas such as information technology, electronics, bioscience, energy and aerospace capabilities are propelling Colorado growth in leading technology enterprises that support national defense objectives. For example, the Metro Denver Economic Development Corporation's January 2015 Cluster Profile on the aerospace industry affirmed that "the state's wealth of talent, research assets, and synergy between industry, commercialization, research, and workforce development supports its position as a space industry leader."

### **Demonstrating Depth in Primary, Secondary and post-Secondary Education Assets**

The Study Team visiting Colorado military installations repeatedly heard highly approving evaluations of the servicing primary, secondary and post-secondary education systems. DOD benefits from a highly educated military workforce sourced in part from Colorado's 89 colleges, universities and training programs that accept the post 9/11 GI Bill. These educational institutions offer service members and their families a broad range of higher learning and technical skills opportunities where these benefits may be used. The 2015 Guide to Military Friendly Schools rankings recognize eight of Colorado's community colleges in the top tier. Colorado is a "choice" state, meaning once a year parents of school-aged children can apply for admission to a school other than in their neighborhood or traditional zone of attendance. At Schriever AFB alone, the Base Education Office reported that service members and DOD civilians with school-aged children are serviced by 90 public elementary schools, 27 middle schools and 19 high schools. This is typical of the diversity available for other State military installation families. Colorado School Grades, a coalition of 18 non-profit community organizations, used data from the Colorado Department of Education to rate every public school in the State. In assessing 345 secondary or high schools in Colorado, the coalition's list of top ten schools placed every single one within the larger Denver metropolitan region.

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<sup>1</sup> Economic agglomeration is a cumulative, self-reinforcing process that concentrates talent, productive capacity and innovation creating spin-off industries and organizations that attract funding from the other firms in the same industry (DOD in this case) as well as non-DOD entities such as other federal agencies and public and private organizations from around the world. Agglomeration effects typically begin with the localization economies of scale which then attract organizations seeking the specialized workforce and economic infrastructure that develops to support the sector. As the agglomeration process reinforces itself and accumulates over time, it supports economic urbanization forces resulting in urban growth of industries, organizations and personnel that attract funding from the other firms in the same industry (DOD in this case) as well as non-DOD entities such as other federal agencies and public and private organizations.

## **Having Depth and Scope of Intellectual Capabilities, including Military, Academic and Technical Organizations and Institutions**

One of the singular representative benchmarks for demonstrating the depth and scope of Colorado intellectual capabilities is the synergy that prevails among educational institutions, industry and laboratories conducting cutting-edge research. According to the Colorado Department of Higher Education, the State hosts over 470 institutions educating approximately 400,000 students. These reflect several types of institutions including publicly supported (made up of research universities, four-year state colleges, community colleges and local district colleges), private accredited (which includes for-profit, non-profit, and seminary), area technical, and private occupational institutions. Colorado's aerospace industry sector – ranked third out of 50 states in total private-sector employment – embraces widespread collaborations with out-of-state industry partners as well as in-state and out-of-state universities and colleges. The US Air Force Academy alone boasts sponsorship of 20 Research Centers that partner with a number of industries and research and development arms of other universities, fostering a \$65M enterprise in 2014. Another unique resource that reflects depth and scope of intellectual capabilities is the deep wellspring of DOD retirees with advanced degrees, technical experience, and desirable security clearances. Over a lifetime, many of these individuals flow between DOD and industry and research and development careers, contributing an unheralded but significant synergy that fuels military, academic and technical institutions.

## **Demonstrating the Capacity to Meet or Exceed Quality of Life Benchmarks for Service Members and their Families**

Military service members and their families consistently rate their Colorado quality of life in a positive manner. Whether the metric is the availability of standard family services and benefits like access to discounted deals through installation Morale, Welfare and Recreation offices, the availability of commissaries and base exchanges, or the off-base attractions afforded by the metropolitan Denver economy and the great outdoors experience of the Front Range and beyond, military service members rarely criticize their quality of life. The Study Team found through surveys and conversations that Colorado service members also equate quality of life with an affordable cost of living. Anecdotal evidence from interviews combined with empirical surveys conducted by Sperling's and CLRSearch confirm that Front Range Coloradans consistently rate their cost of living better than the national average, and their quality of life also better than the national average across indices such as access to amusement opportunities, cultural events, housing, restaurants and education.<sup>2</sup>

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<sup>2</sup> Sperling's and CLRSearch ratings on Colorado quality of life are publicly available on the internet.

## **Possessing the Depth and Scope of Resources to Meet Service and Joint Training Opportunities**

There is diversity and depth in the institutional or operational “presence” of DOD tenants on military installations with critically important and well-funded national defense missions. Significant military installation construction and refurbishment is funded by major command and defense organization tenants. The space missile warning and defense enterprise hosted at Buckley AFB, Peterson AFB, Schriever AFB, Cheyenne Mountain Air Force Station, and Greeley Air National Guard Station creates a vast joint footprint for air and space training requirements. The Study Team found no evidence that current joint training opportunities were at significant risk for lack of current funding or for misalignments in required personnel stationed at installations. Tenant organizations like the Missile Defense Agency at Schriever AFB and the Aerospace Data Facility at Buckley AFB are funding significant infrastructure improvements in part to enhance the operational training effectiveness of assigned personnel and mission sets. The Piñon Canyon Maneuver Site consisting of 238,000 acres provides world-class training environments for Fort Carson units, out-of-state US Army units, and units from joint organizations and allied partners. In all these examples, the cooperative agreements between Front Range military installations for scheduled, shared access to land, air and space training ranges and opportunities enhance Service and Joint training requirements. Local communities possess the additional lodging, restaurant, transportation and other capabilities needed when installation personnel and facilities are surging with training and exercise activities that exceed organic capacity. Installations are sensitive to community concerns about noise associated with certain training activities. Buckley AFB, the US Air Force Academy and Fort Carson have modified airspace usage and ground training operations to mitigate a variety of community noise complaints without significantly detracting from required joint training schedules.

## **Having Geography that Best Supports the National Security and National Military Strategies and Defense Strategic Guidance**

Operational training of land, air and space forces assigned to Colorado are largely unaffected by climate and geography which often are interrelated. In the opening segment of this Report there is an elaboration of missions assigned to the Armed Forces which are independent of geography. But the reality is that Colorado military installations and their associated mission sets are successful in part because geography promotes rather than prohibits vital training activities that ensure mission readiness. The unique combination of the flat plains landscape that quickly rises to meet the Rocky Mountain range allows a rich mix of geographical environments for land and air training. For example, the Colorado Army National Guard hosts a unique High Altitude Army National Guard Training Site near Vail, providing a training environment particularly useful for the Armed Forces recent overseas engagements in the high altitude regions of Afghanistan. And the vast and varied environment afforded by the Piñon Canyon Maneuver Site is similarly supportive of the mission requirements established in national military strategy documents.

## **Providing Resources that Support and Sustain the Defense and Aerospace Industry**

The strategic importance of aerospace missions within DOD, combined with the congruence of well-funded space-oriented tenants at several Colorado military installations, ensure sustained DOD expenditures and investments that will support and sustain Colorado's defense and aerospace industry. Colorado's acculturated DOD contractor workforce provides better returns on investment, higher levels of productivity, and promotes industry-level economies of scale that make existing military installations attractive to DOD investment. The aggregation of space-oriented installation facilities, and the reliable tenant-provided funding to modernize facilities, serves as a magnet for defense and aerospace industries looking to participate in this strategically significant mission area as well as enabler areas like research and development, communications and cyber. The current balance of Active Duty, Reserve Component and civilian personnel assigned to Colorado military installations, and the flexibility individuals demonstrate in transitioning from one career area to another, promote a level of "human capital" resiliency that fosters the defense and aerospace industry's success. Within Colorado there are entities like the Colorado Space Grant Consortium, the Colorado Space Coalition, the Colorado Springs Defense Mission Task Force, the Aurora Chamber of Commerce Defense Council, and the Colorado Space Business Roundtable that foster interaction in the community, sponsor research and education activities for the aerospace industry, and advance legislation for industry growth. Little things matter, like the number and location of commercial airports and joint-use military-civilian airfields that satisfy the transportation needs of major military commands, businesses and visitors. Because of all these factors, Colorado employs more than 7% of the nation's aerospace workforce.

## **Optimizing the Proximity and Co-location of other Military Installations, Commands, Missions, and Capabilities for Operating in a Joint Environment**

The congruence of military installations in the metropolitan Denver area with integrated missile warning and space-oriented mission responsibilities promotes an unrivaled degree of operational jointness. In Colorado, the six major military installations that share some levels of responsibility for these mission sets (excluding the US Air Force Academy) are within 90 miles of one another. Movement of tasked personnel and the operational execution of missions are optimized by this condition of proximity. Installations with short-notice or unusual mobilization challenges have memos of agreement with nearby installations to obtain assistance.

## **Summary of Colorado Vulnerabilities**

Despite the impressive number of strengths elaborated above, Colorado may be perceived as suffering select vulnerabilities across some – but not all – of the nine attributes. An important and compelling exposition on encroachment as a vulnerability can be found in the 2014 Colorado Front Range Regional Encroachment Management Action Plan (REMAP) Report. The REMAP Report distinguishes encroachment challenge areas as water, airspace restrictions, energy compatibility and availability, natural factors/climate effects, urban growth, and spectrum encroachment. The Study

Team collected commentary and survey results from Colorado installation personnel that reflect concerns with some of these challenge areas. The Team believes the REMAP Report is a comprehensive examination that does not need to be repeated here but warrants continued attention, particularly with the suite of “Proposed Management Actions” offered to mitigate Front Range encroachment challenges. The Study Team’s conclusions on vulnerabilities are summarized below.

### **Providing a Robust Transportation Infrastructure**

The Study Team found selected shortcomings or deficiencies in the transportation infrastructure that connect some installations with two completely different locations: the bedroom communities where the off-base workforce resides, and the training areas that installation units most frequently utilize. In rare instances these shortcomings relate to encroachment concerns originating with nearby landowners. More commonly the problems trace to State and federal highway projects which have been identified and, in many cases, are ready to execute when funding becomes available. A vulnerability that affects access to training areas is more severe and of greater consequence to DOD than road improvements that facilitate quicker access to installation entry gates. But the latter can become a quality of life issue, which makes it important in a different way.

### **Offering Innovative and Open Technological Capabilities**

In a period of reduced DOD investments into technological research and development activities, the conditions that attract and retain high-tech talent and supporting industry are undermined. Colorado’s leadership in hosting an impressive array of industry, laboratories and institutions of higher learning might be jeopardized by a persistent reduction in high-tech funding. Continued reductions in defense spending will further erode research and development, impacting technologically-based industry clusters that are located along Colorado’s Front Range.

### **Having Depth and Scope of Intellectual Capabilities, including Military, Academic and Technical Organizations and Institutions**

The Study Team’s assessment of vulnerability in this DOD strategic objective is aligned with the assessment of vulnerability in Offering Innovative and Open Technological Capabilities elaborated above. Potential budget cuts affecting the DOD industry within Colorado might include force structure reductions that jeopardize the depth of the “pool” of highly skilled military, DOD civilian and industry contractor personnel. Loss of high wage-earning jobs can introduce a variety of second and third-order negative consequences for quality of life considerations which are currently magnets for attracting top-tier talent to the State. A companion concern in this DOD strategic objective of depth and scope is one raised in an April 2014 report issued by the Colorado Springs Regional Business Alliance on The Pikes Peak Defense and Aerospace Sector economy where 48% of defense non-aerospace and 65% of aerospace firms identified challenges matching job requirements with qualified applicants. Budget cuts affecting the DOD industry in Colorado may exacerbate this vulnerability in attracting a qualified skilled workforce.

## **Having Geography that Best Supports the National Security and National Military Strategies and Defense Strategic Guidance**

This Report has already affirmed the advantages that Colorado's Front Range geography provides land, air and space forces that train year-round to meet national security and military strategies. The fact that Colorado is a land-locked state without access to coastal waters means it will likely never be a major locale for maritime training or for exercising major sea-based employment concepts. The 2012 Defense Strategic Guidance touts development of warfighting capabilities that support a "pivot" to the Asia-Pacific region, to address the security concerns the nation may face there. While the "pivot" of national military interest to Asia variously affects force structure and mission training requirements for all four Military Services, the operational concepts include significant maritime and littoral concepts of employment. Colorado's land-locked geography is a vulnerability in the sense that the State will likely not be a recipient of DOD exercise or training funds targeting the development of maritime and littoral forces and capabilities.

Additionally, selective community expressions of concern about Fort Carson's Piñon Canyon Maneuver Site require continued attention from DOD, regional and State leaders, to prevent any loss of access to Army and joint training there. While the Piñon Canyon Maneuver Site is the visible training area in this regard, all training areas within the State merit attention and observation as the State's population increases and federal decision makers seek to expand lands associated with national forests and other desirable but often incompatible designations.

## **Providing Resources that Support and Sustain the Defense and Aerospace Industry**

Earlier this Report highlighted the strength derived from the synergy of military personnel, DOD civilians, and DOD retirees all of whom are in the "pool" of the available high-tech workforce. The Report suggests that there's a positive level of dynamic balancing among these three members of the "pool." But if resources that sustain Colorado's defense and aerospace industry are threatened – if the DOD contribution to Colorado's employment revenue declines because of force structure reductions – then that dynamic balancing of three "pool" constituencies could be upset. And that might trigger a cascading migration of industry and jobs out of the State.

## **Summary of Colorado Opportunities**

The Study identified a number of opportunities which Colorado may pursue to protect and build upon the State's military installations and defense industry. Some opportunities require resources; some require attention and monitoring; some require active engagement via meeting attendance or review and comment on draft work products; some might be advanced with legislative assistance. Most of the opportunities cited below reappear as Recommendations in Section 2.

- There are countless opportunities for Colorado to advocate a positive message about the strengths by which it supports the nine DOD attributes cited above. Speeches, press releases, proactive attendance at numerous community and regional boards and alliances,

widespread distribution of the Abridged Report version of this lengthier Unabridged Report – there is a compelling and positive story to be told, over and over again.

- The Front Range center-of-gravity for defense-related research and development activities is an opportunity all by itself. Numerous reports and studies affirm the Study Team’s conclusion that the current synergies resident in the collaboration between DOD, private industry and educational institutions are dynamically designed for growth, not contraction. Only the introduction of negative forces like mandated DOD budget or force structure reductions will adversely affect this growth dynamic.
- Informed observers of DOD expect budget turbulence, force structure changes, and mission realignments at the installation and command level this decade. With or without sequestration all four Military Services will be impacted. All four Services are conducting sensitive alternatives planning, imagining various budget and force structure scenarios in which they will attempt to satisfy strategic military guidance at acceptable risk. The Reserve Component, consisting of the Reserves and National Guard, are sometimes viewed as a “shock absorber” in times of turbulence. There are two sides to the coin of shock absorption – on one side, the Reserve Component assumes missions abandoned by the Active Duty Component; on the other side, the Reserve Component becomes the targeted “bill payer” to preserve active duty force structure and /or mission capability. In Washington it works both ways. Colorado’s opportunity is to proactively lobby to favorably influence this coin toss, to ensure Reserve Component presence and missions at most Front Range military installations are protected or even enhanced.
- Cyber is the newest DOD mission area receiving significant funding and strategic attention. A similar DOD growth area is in the development of unmanned aerial systems. Colorado has an established military-industry-laboratory research and development foundation for elevating these two mission areas to the same level that it has for aerospace defense.

### **Overview of Installation Data**

Colorado installations exhibit great strengths and minimal vulnerabilities. This assessment establishes a favorable position for Colorado in a future Base Realignment and Closure (BRAC) effort. The Study Team assessed seven Colorado installations using 11 military value criteria. Three of the criteria were focused on assessing the economic impact of an installation to Colorado. Where an installation hosted one or more major tenant commands, and data was obtained from these commands, the assessment took into account tenant-specific information relevant to the military value criteria. A more detailed explanation of these 11 military value criteria is provided in Section 5 of this Report.

The Study Team weighted each military value criterion, the results of which are shown in Figure 1. The weighting assumed that the Study Team subject matter experts comprised a representative sample of decision makers from a normal distribution of informed DOD/BRAC analysts.

Consequently, their input is representative of the population of future BRAC decision makers. The weights are universal and, thus, not specific to just Colorado.

| Objectives                                    | All Participants |
|---|------------------|
| Military Capabilities                         | 19.51 %          |
| Cost of Operations                            | 15.88 %          |
| Future Total Force Requirements               | 12.96 %          |
| Availability and Condition of Land            | 10.44 %          |
| Availability and Condition of Airspace        | 9.98 %           |
| Facilities / Infrastructure                   | 9.00 %           |
| Contingency Mobilization                      | 5.74 %           |
| Manpower Implication / Personnel Availability | 5.29 %           |
| Surge Capability / Capacity                   | 4.41 %           |
| Economic Contribution                         | 3.63 %           |
| Community Interaction                         | 3.16 %           |

**Figure 1: Weights of Military Value Criteria**

The horizontal bars in Figure 1 are arranged from top (most weight) to bottom (least weight) for each military value criterion. The percentages recorded vertically down the middle of the bars indicate a criterion’s contribution out of the total available weight (100%).

The Study Team scored each installation using the 11 military value criteria. By applying the universal weights to the scores, each installation was characterized in terms of its strengths and vulnerabilities.<sup>3</sup> A large criterion weight (i.e., weight  $\geq 9\%$ ) combined with a high installation score (i.e., score  $\geq 60\%$ ) indicates strength. Similarly, a large weight (i.e., weight  $\geq 9\%$ ) and low installation score (i.e.,  $\leq 40\%$ ) indicates vulnerability. Subject matter expertise added fidelity to the segmenting and also allowed the team to synthesize some aggregate insights in terms of strengths, vulnerabilities, and opportunities.<sup>4</sup> The added fidelity was necessary since installations do not share the exact same roles, missions and functions. For example, if an installation is not intended to be a power projection platform, the significance of the military value criterion *Surge Capability and Capacity* must be placed into context. The assessments are the basis for the aggregate installation-level strengths, vulnerabilities and opportunities discussed below.

Areas where a weight-score combination was close to either of the stated thresholds (i.e., slightly above or below) were deemed to be additional areas assessed as strengths or vulnerabilities, as the case may be, and factored into the development of opportunities. Overall, Colorado military installations collectively reflect many strengths and only minor vulnerabilities. Figure 2 illustrates the results of the strengths and vulnerabilities analysis across the spectrum of the 11 military value criteria. The five main military value strengths nested within the green circle -- *Military Capabilities, Cost of Operations, Availability and Condition of Airspace, Availability and Condition*

<sup>3</sup> Contact DMVA for the analytical work products that are the source for these characterizations.

<sup>4</sup> Opportunities emanate from strengths and vulnerabilities.



of Land, and Total Future Force Requirements—indicate that Colorado military installations provide DOD significant military value through these characterizations. The Study Team assessed that only three of the six remaining military value criteria represented areas of vulnerability for Colorado. The cluster and relative relationships of the remaining three military value criteria in the upper left quadrant were statistically balanced, demonstrating neither noteworthy strength nor unwelcome vulnerability dimensions for Colorado military installations.

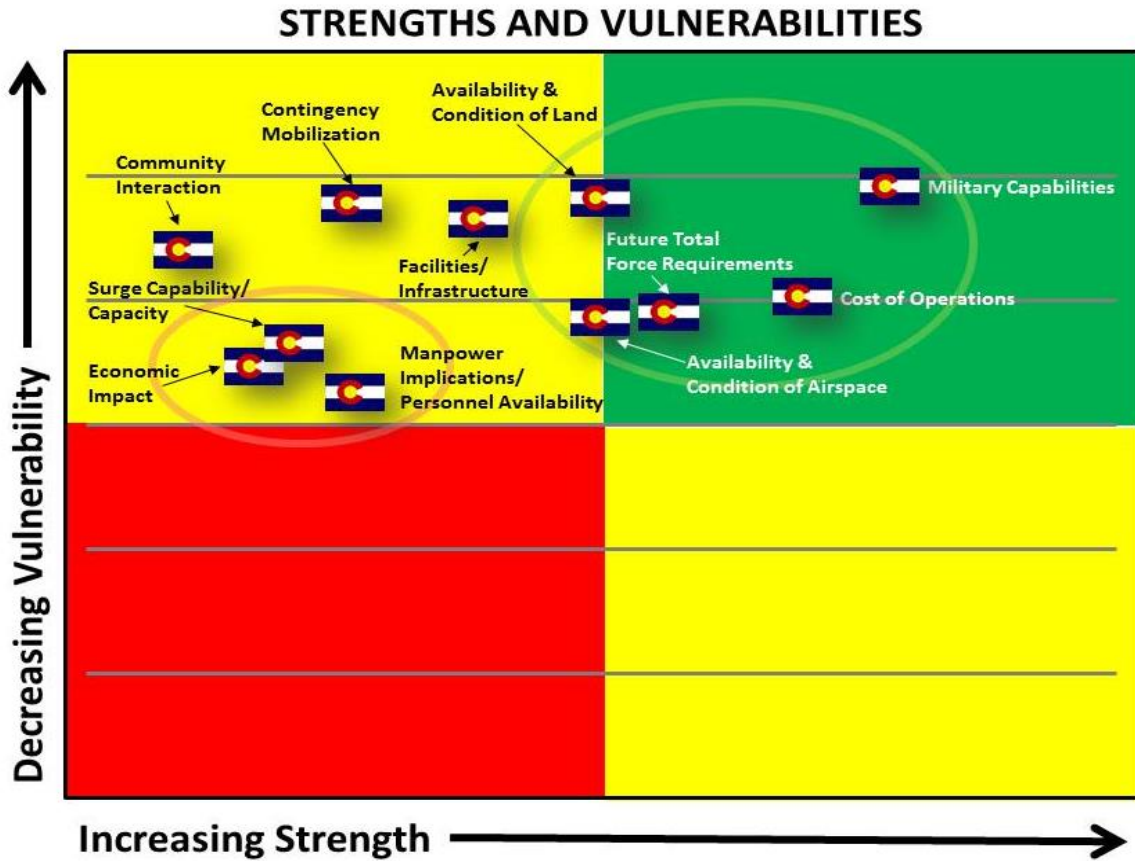


Figure 2: Strengths and Vulnerabilities by Military Value Criteria

The following analysis summarizes the installation-level aggregation assessments.

## Installation Strengths

Strengths are defined as good or beneficial qualities, existing assets, or attributes, or economic activity that is real and accruing advantages to DOD or the State of Colorado. These include tangible installation assets, attributes, or some combination of the two that translate into power for resisting negative forces such as trends, plans, programs, and policies.

The most significant Colorado installation-level strengths are grounded in *Military Capabilities*, *Future Total Force Requirements*, and *Cost of Operations*. *Availability and Condition of Land* and *Availability and Condition of Airspace* are additional strong areas for Colorado.

Military Capabilities: The analysis focused on the composition of the units on an installation, the degree to which unit mission sets support the major DOD national defense objectives, and the extent to which installations interacted in function and location. Table 1-1 summarizes the measures and metrics used to analyze the *Military Capabilities* of Colorado installations.

| Measure                  | Metric   |   |                               |
|--------------------------|--|---|-------------------------------|
| Tenant Missions/Commands | Mission(s) of tenants(s)                           | Command and staff level(s)                                  | Unit/organization composition |
| Proximity                | Nearness to other installations with like missions | Nearness to other installations with complementary missions |                               |
| Protection               | Resiliency against physical and cyber threats      |   |                               |
| Jointness                | Quantity of Service and Joint training ranges      |   |                               |

**Table 1-1: Components of the “Military Capabilities” Assessment**

The congruence of well-funded space and missile defense-oriented tenants at many installations such as Peterson Air Force Base (AFB), Cheyenne Mountain AFS, Schriever AFB, and Buckley AFB, underscores the strategic importance and uniqueness of Colorado’s DOD footprint. Colorado’s central location within the continental United States (CONUS) combined with excellent installation physical and cyber security protection are indicative of long-standing national and DOD levels of investment to critical national security and defense missions.

The very nature, resiliency, and “no-fail” character of the space and missile defense mission in Colorado have resulted in a high degree of in-state “top-tier” joint talent. Additionally, the diversity, accessibility, and in some cases the uniqueness of Service and joint training ranges along the Front Range are tremendous military capability enablers. Relocating, eliminating, or

transferring the associated people, missions and commands would require extraordinary effort, present a costly bill, and demand a significant amount of time to achieve a new steady state.

Future Total Force Requirements: The analysis focused on characterizing who is performing the missions on installations through a lens of future requirements. Table 1-2 summarizes the measures and metrics used to analyze the *Future Total Force Requirements* of Colorado installations.

| Measure                  | Metric  |
|--------------------------|---|
| Mission Assignment       | Active, Guard, Reserve and Civilian mix             |
| Unit/Mission Uniqueness  | Proximity to installations with like missions       |
| Total Force Demographics | Extent of any anticipated change in force structure |

**Table 1-2: Components of the “Future Total Force Requirements” Assessment**

Resiliency is the key strength emanating from Colorado’s robust mixture of Active, Guard, Reserve, civilian, and civilian-contractor workforce. The total military workforce in Colorado provides Joint, United States Air Force (USAF), United States Army (USA), and United States Navy (USN) personnel to fulfill Active and Reserve Component roles, missions and functions. The local retiree population is a tremendous source for non-DOD manpower to support, sustain and maintain significant portions of the national and DOD space and missile defense mission.

The current balance of Active Duty, Reserve Component and civilian personnel serving at Colorado installations, and the flexibility Colorado residents demonstrate in transitioning from one career area to another, contribute to the positive synergies among the aggregated installations, commands, missions and capabilities in the Front Range area.

Cost of Operations: The analysis focused on several personnel income-related quality of life measures (Military Personnel) and the costs of utilities to installations (Operations and Maintenance – O&M costs). These budget categories normally account for approximately 70% of the DOD budget. The selected income and installation utilities-related measures therefore provide a DOD cost-benefit perspective when compared to the same measures for the State of Colorado. Table 1-3 summarizes the measures and metrics used to analyze the *Cost of Operations* for Colorado installations.

| Measures                       | Metrics                            |
|--------------------------------|------------------------------------|
| Area Comparable Utility Costs  | Level compared to Colorado average |
| Installation Housing Allowance | Level compared to Colorado average |
| Average Weekly Wage            | Level compared to Colorado average |
| Area Relative Cost of Living   | Level compared to Colorado average |

**Table 1-3: Components of the “Cost of Operations” Assessment**

Overall, the quality of life services supported by DOD installations and the local communities around installations are excellent. They compare favorably with the Colorado averages, which are good on a national basis. Installations enjoy advantageous utility costs compared to the national average for large-scale industrial users. On and off-installation utilities are reliable. Off-installation utilities are provided at affordable rates for DOD personnel residing in the local communities.

Availability and Condition of Land: The analysis focused on characterizing the impacts that natural and man-made geography have on training and operations. Table 1-4 summarizes the measures and metrics used to analyze the *Availability and Condition of Land* of Colorado installations.

| Measures        | Metrics                            |                           |                     |
|-----------------|------------------------------------|---------------------------|---------------------|
| Encroachment    | Internal and external restrictions | Quantity of legal actions | Hazardous materials |
| Security/Access | Force Protection                   | Physical Security         |                     |
| Climate         | Training impact                    |                           |                     |
| Geography       | Training impact                    |                           |                     |

**Table 1-4: Components of the “Availability & Condition of Land” Assessment**

Operations and training are largely unaffected by climate, geography or encroachment issues. The Colorado climate along the Front Range normally permits training and operations year-around for most installations. Installations such as Peterson AFB, Schriever AFB, and Cheyenne Mountain AFS have tenant units that work almost exclusively inside fixed facilities. The United States Air Force Academy is similarly unaffected. On occasion, travel on and off these and all other installations is affected by adverse weather conditions. However, as with all DOD installations, provisions exist for mission essential personnel and functions to continue critical functions and operations. Other installations such as Fort Carson, Buckley AFB, and Greeley Air National Guard Station have tenant units whose mission requires outside training and operations. The impact of climate on these units’ training and operations is minimal since the units have the flexibility to adjust plans and still maintain overall readiness.

Similarly, the natural geography occupied or otherwise under the control of installations is sufficient to support tenant unit roles, missions and functions. Encroachment is not a significant concern from either the perspective of the installations or the communities surrounding them. Fort Carson, in particular, has a history of recurring issues with the local community surrounding the Piñon Canyon Maneuver Site. However, the installation has consistently implemented mitigation

measures where possible and practical. Training in the Piñon Canyon Maneuver Site remains an important and viable maneuver training area for Fort Carson. Although the potential exists for future encroachment issues from the local communities, these would likely not be of a nature to significantly impact readiness of Fort Carson’s tenant units.

Force Protection via security and access control are sufficient and commensurate with installation tenant units’ roles, missions and functions. Current and anticipated force protection resources are sufficient to mitigate current and potential future threats and vulnerabilities.

Availability and Condition of Airspace: The analysis focused on characterizing the impacts that airspace restrictions or an absence of restrictions have on training and operations. Table 1-5 summarizes the measures and metrics used to analyze the *Availability and Condition of Airspace* of Colorado installations.

| Measures        | Metrics                            |                           |                     |
|-----------------|------------------------------------|---------------------------|---------------------|
| Encroachment    | Internal and external restrictions | Quantity of legal actions | Hazardous materials |
| Security/Access | Force Protection                   | Physical Security         |                     |
| Climate         | Training impact                    |                           |                     |
| Geography       | Training impact                    |                           |                     |

**Table 1-5: Components of the “Availability & Condition of Airspace” Assessment**

Operations and training in the airspace around installations are largely unaffected by climate or encroachment issues. The Colorado climate along the Front Range normally permits training and operations year-around for the installations requiring local airspace. The US Air Force Academy and Buckley AFB are the main users of nearby protected airspace and neither have current or anticipated encroachment issues. Peterson AFB shares the city-owned, civilian-military Colorado Springs Municipal Airport. This sharing arrangement is free of intra-installation and civil-military issues. The airport’s location is an advantage in that it is central to five of Colorado’s seven DOD installations, including the US Air Force Academy, Cheyenne Mountain AFS, and Schriever AFB. The notoriety of Cheyenne Mountain AFS coupled with its geographic location bordering a State Park and National Forest attracts a variety of inquisitive people. While some take advantage of the lack of airspace restrictions around the facility, none significantly threaten the complex from the air.

The natural geography of the Western Slope provides an excellent aviation training environment. The High-Altitude Army National Guard Aviation Training Site located in the town of Gypsum, Colorado on Eagle County Airport offers a unique combination of training location and conditions with a high altitude training experience for rotary wing aircraft.

Achieving force protection via security and access control from the air are sufficient and commensurate with installation tenant units’ roles, missions and functions. Current and anticipated force protection resources are sufficient to mitigate current and potential future threats and vulnerabilities.

## **Installation Vulnerabilities**

Vulnerabilities are defined as existing assets, attributes, trends, or characterizations of Colorado military installations that are difficult to defend or are open to attack or criticism. These include economic activity which is or may be harmful to DOD or the State of Colorado.

The most significant Colorado installation-level vulnerabilities, from most significant to least significant, are grounded in *Economic Contribution*, *Surge Capability/Capacity*, and *Manpower Implications and Personnel Availability*. The emphasis on these three vulnerabilities is relative and should not be overstated. Overall, Colorado military installations enjoy a solid foundation and outlook if faced with the reduction or elimination aspects stemming from a BRAC study.

Economic Contribution: DOD installations provide significant economic benefit to Colorado. Although this perspective would likely be a factor in any future BRAC study, DOD would probably weight the opposite perspective, considering the fact that the BRAC study would be driven by the need for DOD to achieve cost savings. The economic vulnerability is a function of lost wages and revenue in the areas surrounding military installations. Reductions in DOD budgets or force structure or both would likely reduce an installation’s economic “engine” for on-base employment and off-base industrial development. A detailed examination of this concept of *Economic Contribution* is found below in the analysis on Economic Impact. Table 1-6 summarizes the measures and metrics used to analyze the *Economic Contribution* of Colorado military installations.

| <b>Measures &amp; Metrics</b>               |
|---|
| Direct Employment Rate                      |
| Average Compensation                        |
| Indirect Spin-offs and Agglomeration        |
| Sustainment Leadership                      |
| Construction Budget (MILCON)                |
| Construction Budget (Non-MILCON)            |
| Non-construction Services Related Contracts |

**Table 1-6: Components of the “*Economic Contribution*” Assessment**

Surge Capability/Capacity: The analysis focused on several enablers that are required for a successful surge. These include provided services, installation surge facilities, and the ability of local communities to accommodate overflow lodging and meal requirements.

| Measures            | Metrics   |
|---------------------|---|
| Enabling Services   | Extent of organic support services                      |
| Enabling Facilities | Extent of organic support infrastructure                |
| Community Capacity  | Organic capacity of the community to augment shortfalls |

**Table 1-7: Components of the “Surge Capability/Capacity” Assessment**

Table 1-7 summarizes the measures and metrics used to analyze the *Surge Capability/Capacity* of Colorado installations.

Overall, Colorado installations and local communities possess the required enablers (i.e., hotels and restaurants) to support surges in the mobilization or rapid deployment of assigned personnel. Most Colorado installations are home to tenant units and organizations that do not have the roles, missions, or functions demanding rapid surge operations. However, Fort Carson and Greeley Air National Guard Station are two exceptions. Fort Carson is home to a deployable Army division with 32,000 soldiers and significant organic power projection resources to deploy. Greeley Air National Guard Station is home to 305 airmen (one third of whom are full-time Guard) who receive mobilization augmentation assistance from their parent Space Group posted at a different geographical location. In view of these facts and considering Colorado’s central CONUS location, it is also unlikely that its installations would otherwise be used to support large surges of personnel and equipment. With the possible exception of a requirement to support a surge of civil-military resources needed to respond to natural disasters such as forest fires, little potential exists for large influxes of people and equipment onto the installations or into the local communities. Consequently, the extent this measure exists as an actual or potential vulnerability in the future depends on the likelihood of dramatic changes away from the status quo of Colorado unit and organization roles, missions and functions.

Manpower Implications and Personnel Availability: The analysis focused on the quality of the DOD workforce fulfilling DOD installation unit and organization requirements and their demonstrated flexibility in accommodating changes to roles and missions. Table 1-8 summarizes the measures and metrics used to analyze the *Manpower Implications and Personnel Availability* of Colorado installations.

| Measures                       | Metrics                                   |  |
|--------------------------------|---|--|
| Total Force Demographics       | Labor force skill level                   | Installation military to civilian ratio                      |
| Quality & Agility of Personnel | Education opportunities for the workforce | Extent that organizations have adapted to change in the past |

**Table 1-8: Components of the “Manpower Implications & Personnel Availability” Assessment**

Colorado’s DOD workforce historically adapts well to change, whether driven by geopolitical events or changes in strategy, or precipitated by DOD restructuring. Today, the workforce has a significant density of aerospace and missile defense roles, missions, and functions requiring personnel with technical skills and advanced degrees. If DOD wanted to reduce, consolidate units within the State, or relocate units out-of-state, Buckley AFB and Schriever AFB might be vulnerable to losing organizations or become subject to force structure reductions and mission realignments. Colorado could be adversely impacted if the affected, departing personnel were not replaced. Peterson AFB would likely be less affected considering the fact that it is home to a geographic Combatant Command headquarters, the AF Space Command headquarters, and has a unique tenant command authority with NORAD. The US Air Force Academy and Fort Carson would be less vulnerable since both lack similar densities of aerospace and missile defense roles, missions, functions, and the attendant skilled personnel. Greeley Air National Guard Station has technically trained personnel. However, it is unlikely that the 233<sup>rd</sup> Space Warning Group – the sole tenant on the installation – would be eliminated given its unique mission.

### **Installation Opportunities**

As noted earlier, opportunities arise from strengths and vulnerabilities. Opportunities are identified circumstance(s) or suitable occasion(s) that may serve to highlight and reinforce strengths or mitigate vulnerabilities. Installation opportunities are by definition installation centric and unique. That suggests that installation military commanders can play a significant role in taking advantage of installation opportunities. While that may be true in some cases, other local and regional leaders and groups can play effective roles in advocating initiatives that take advantage of installation opportunities. Even State and DOD leaders have roles to play. Much of this is outlined in greater detail in Section 3 below. The following list of installation opportunities represent the Study Team’s collective assessment based on both the data-driven analysis and numerous conversations and survey exchanges with installation personnel.

- Continue to pursue installation-specific proposals for improvements to roads and highways that service base entry and exit, or which facilitate the movement of personnel and equipment to and from training ranges and facilities. The Study Team learned of several specific road or interchange improvements desired or planned for the US Air Force Academy (Route 156/Powers interchange), Schriever AFB (safety enhancements for Route



94), and Peterson AFB (access road improvements leading to the gates) to name three. When advocates make the case that these and other transportation network improvements will add to the installation's military value to DOD, improve the quality of life of the workforce, and enhance unit training effectiveness, they have the elements of a compelling case in seeking funds or local zoning accommodations for these projects.

- Take creative advantage of the large and economically vibrant DOD retiree community that has settled in the Front Range area. They bring a sense of patriotism and a conviction in the value of Colorado's installations that makes them effective volunteers for a myriad of base-related activities and patrons of MWR services provided on base. In many cases these DOD retirees are in second careers, generating income that contributes to economic prosperity in the communities surrounding military installations. The variety of numerous off-base attractions like movie theaters and restaurants is making it more difficult to capture these retirees in a commercial sense. But there are other installation venues that routinely attract high usage – all ranks clubs, base exchanges and commissaries, golf courses – and installations should become keenly sensitive to what retirees will patronize as well as where they will perform volunteer service and craft programs that take advantage of that.
- Expand formal associations with local technical training institutes and universities to increase the options for higher education available for interested personnel, particularly in cyber and unmanned aerial systems. There is a tremendous intersection of education, industry, research and development and military enterprises in the metropolitan Denver area. There are a number of local and regional business alliances and organizations designed to cultivate this intersection. Installations might consider hosting meetings or conducting mission orientation tours to keep local business and education leaders informed on DOD trends as they are manifested at the installation level. Several Colorado installations reported engagements with high schools to cultivate opportunities for expanding the technical learning venues available to students. The Air Force recently announced a sabbatical program where selected personnel can temporarily disengage from formal AF roles and responsibilities to seek non-military experiences which, it is hoped, might serve as a sort of professional development excursion. When these individuals return to active duty, the expectation is that they will have matured or grown wiser during their time out of uniform. Colorado AF installations might want to view this sabbatical program as a quality of life enhancer and, if an assigned member is selected, exert special effort to assist the individual with pursuing his or her plan of action.
- Continue to pursue selective land acquisitions to promote mission flexibility and reduce the threat of encroachment impacts on installation missions and personnel movements. Some installations, like Cheyenne Mountain AFS, have no options for footprint expansion; others have modest opportunities, like some of the proposals within the Blueprint 2050 Plan for Peterson AFB. Land acquisitions are the most challenging installation-level actions because of local community equities that have to be accommodated, and because of the complexity in identifying a willing cohort of government “resource contributors” willing to pay the

costs involved. Even so, circumstances can change quickly sometimes and if there is a plan for a land acquisition, there is a greater chance of executing that plan successfully if the opportunity presents itself and funding is available.

## **Economic Impact of the Military on Colorado**

The economic impact analysis is based on a complex set of inputs from a variety of sources. The data represent the most recent complete set of inputs that can be found, generally for calendar years 2013 and 2014. The analysis addresses the economic activity that has taken place in Colorado that can be attributed to the Department of Defense (DOD). The analytical model is focused on two primary domains: 1) the activity that takes place on or in association with the seven assessed military installations in Colorado, and; 2) the contracts between the DOD and both private contractors and recipients of DOD assistance awards.

The model examines the direct, indirect and induced effects of having DOD activity located and performed in Colorado. The impacts come primarily from:

- The presence of a combination of active duty military and civilian workforces at the military installations
- The expenditures of those installations for construction and operations
- A large network of recipients of DOD contract and assistance award expenditures for work done in the State
- National Guard and Reserve forces located in the State

Not included are impacts from Veterans Administration (VA) expenditures in Colorado, DOD travel to the State originating from outside Colorado, and DOD education benefits paid to active duty military and federal civilian workers from budgets outside the State.<sup>5</sup>

## **Economic Impact Analysis**

The following series of tables present an outline of the analysis activities used to derive the total economic impact of the military on Colorado. Tables 1 through 5 and Figure 3 essentially present the findings at a statewide level.<sup>6</sup>

The tables that then follow are organized in a building block fashion, first showing the economic impacts of the military installations and DOD contracts by county level. The five military installations of Fort Carson, Peterson Air Force Base, Schriever Air Force Base, the United States Air Force Academy and the Cheyenne Mountain Air Force Station are grouped into one analysis for El Paso County. Buckley Air Force Base is shown in the Arapahoe County analysis, and the Greeley Air National Guard Station is shown as the Weld County analysis.

## **Statewide Analysis**

This section of the Report presents the final summation of the economic impact analyses based upon IMPLAN and Summit Economic models. It excludes other economic analyses found later in

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<sup>5</sup> If travel and education expenses are paid by Colorado military installations of DOD Colorado contracts, then the expenses are included.

<sup>6</sup> The impacts are derived from IMPLAN and Summit Economics modeling. See methodology explanation in Section 5 of this report.

the Report such as comparisons of DOD to other Colorado industries, economic diversity, agglomeration effects, and the long-term DOD budget outlook.

Table 1 presents findings in terms of the employment, earnings, and tax revenues to the State of Colorado that can be attributed to the presence of the DOD. Table 1 also presents an estimate of the proportion of Colorado's economy and of its State tax collections that are attributable to the DOD. In summary it can be said that the DOD is responsible for 5% to 7.5% of the State's total economy in terms of employment, earnings and State tax revenues.

| <b>Table 1 - Fiscal Impacts on the State of Colorado from DOD Related Employment, Earnings and Expenditures</b>    |                    |
|--|--------------------|
| Total State Employment (Implan)  | 3,235,493          |
| Total Employment from DoD Related Expenditures   | 169,153            |
| Ratio - DOD to Total Labor   | 5.2%               |
| Total State Labor Income (Implan)  | \$ 155,381,233,191 |
| Total Labor Income from DoD Related Earnings (Implan)  | \$ 11,683,241,677  |
| Ratio - DOD to Total Labor Income  | 7.5%               |
| Total Actual State Sales Tax Collections, 2013   | \$ 2,187,244,101   |
| Total State Sales, Use and Excise Tax Collections, 2013  | \$ 3,358,295,290   |
| Total State Sales Tax Collections from DOD Related Expenditures, 2014 (Implan)                                     | \$ 109,431,951     |
| Total State Sales, Use and Excise Tax Collections from DOD Related Expenditures                                    | \$ 168,021,852     |
| Ratio - Estimated Sales Tax from DOD Related Expenditures to Total Sales Tax                                       | 5.0%               |
| Total State Personal Income Tax Collections  | \$ 5,492,975,311   |
| Total State Personal Income Tax Collections from DOD Related Expenditures, 2014                                    | \$ 300,551,392     |
| Ratio - DOD to Total Income Tax  | 5.5%               |
| Total State Corporate Income Tax Collections   | \$ 652,180,000     |
| Total State Corporate Income Tax Collections from DOD Related Expenditures, 2014                                   | \$ 48,261,320      |
| Ratio - DOD to Total Labor   | 7.4%               |
| Total State License, Motor Vehicle, Regulatory & Business, and Other Tax Collections                               | \$ 608,220,356     |
| Total State "Other" Tax Collections from DOD Related Expenditures, 2014  | \$ 45,008,306      |
| Ratio - DOD to Total Labor   | 7.4%               |
| Total Revenue to the State of Colorado from Taxes Derived Directly or Indirectly from DOD Related Activities, 2014 | \$ 561,842,870     |
| Total State Revenues from All Sources, 2013  | \$ 10,285,452,173  |
| Share of Total State Tax Revenues from DOD Related Activities  | 5.5%               |
| Source: Summit Economics, LLC; Colorado Department of Revenue, 2013 Annual Report                                  |                    |

Total employment attributable to the DOD in Colorado is just under 170,000 or 5.2% of the total State employment. Total State employment includes both full time and part time jobs, as do all jobs attributable to the DOD. Labor income associated with that employment is more than \$11.6

billion, 7.5% of total labor income, primarily due to relatively high wages and benefits within the aerospace and defense private sector industries. Based on those earnings, and subsequent expenditures of the earnings, approximately 5.5% of total Colorado tax revenue is due to the presence of the DOD in the State. Of the 170,000 jobs, approximately 26,000 (15%) are outside the three counties that contain the major military installations.

Tables 2 and 3 distinguish the employment by county and congressional district due to three circumstances: the presence of military installations and DOD contracts in each of the three counties with military installations; other counties with DOD contracts; and the presence of National Guard and Reserves. The employment impacts include jobs created in one county due to the military installation or DOD contracting in another, termed the *trade flow effect*. Almost all of the jobs created in the counties without military installations can be attributed to the trade flow effect, DOD contracts and assistance or National Guard and Reserves.

Table 4 breaks out earnings associated with the jobs by county, while Table 5 presents total earnings by U.S. congressional district. Figure 3 graphically shows the density of employment impacts by county. Note that all Congressional Districts have at least 3,500 full and part-time jobs due to the DOD. In some districts like Second, Fifth and Sixth Districts, DOD can be seen as one of the largest sectors, if not the largest sector in the District.

IMPLAN allows for an estimation of the dispersion of the economic impacts created by the military installations and their expenditures. When jobs are created in one county, it can be expected that some additional jobs will be created in nearby counties as the earnings of employees are spent, and the firm (which in this case is a military installation) buys goods and services from vendors outside the county in which it is based. This is an example of the trade flow effect. Tables 2 and 3 include these trade flow effects. These employment impacts are shown graphically on the Figure 3 map. As would be expected, the majority of the impacts occur along the Front Range; however, 20 counties have employment impacts in the triple digits, with 10 having more than 1,000 jobs created.

**Table 2 - Total DOD Related Employment in Colorado - 2014**Direct, Indirect and Induced Employment from Military Installation Operations,  
DOD Contracts & Assistance Awards and National Guard/Reserves in Each County

|              | Arapahoe<br>County Bases | El Paso County<br>Bases | Weld County<br>Bases | DOD Contracts<br>in Other | National<br>Guard/Reserve | Total Colorado<br>DOD Impact |
|--------------|--------------------------|-------------------------|----------------------|---------------------------|---------------------------|------------------------------|
| Adams        | 589                      | 204                     | 3                    | 119                       | 1,566                     | 2,481                        |
| Alamosa      | 2                        | 16                      | -                    | -                         | 40                        | 58                           |
| Arapahoe     | 36,311                   | 1,458                   | 2                    | -                         | -                         | 37,772                       |
| Archuleta    | 0                        | 3                       | -                    | -                         | 32                        | 35                           |
| Baca         | 0                        | 3                       | -                    | -                         | 10                        | 13                           |
| Bent         | 2                        | 5                       | -                    | 4                         | 16                        | 27                           |
| Boulder      | 138                      | 181                     | 3                    | 2,031                     | 880                       | 3,234                        |
| Broomfield   | 50                       | 33                      | 0                    | 210                       | 155                       | 449                          |
| Chaffee      | 4                        | 29                      | -                    | -                         | 44                        | 78                           |
| Cheyenne     | 1                        | 4                       | -                    | -                         | -                         | 5                            |
| Clear Creek  | 10                       | 26                      | -                    | -                         | 24                        | 60                           |
| Conejos      | 1                        | 5                       | -                    | -                         | 22                        | 27                           |
| Costilla     | 0                        | 2                       | -                    | -                         | 10                        | 12                           |
| Crowley      | 0                        | 1                       | -                    | -                         | -                         | 1                            |
| Custer       | 1                        | 7                       | -                    | -                         | 11                        | 19                           |
| Delta        | 1                        | 3                       | -                    | -                         | 79                        | 83                           |
| Denver       | 1,403                    | 1,119                   | 3                    | 1,128                     | 2,373                     | 6,025                        |
| Dolores      | 0                        | 0                       | -                    | -                         | -                         | 0                            |
| Douglas      | 573                      | 1,376                   | -                    | 57                        | 795                       | 2,801                        |
| Eagle        | 17                       | 50                      | -                    | 8                         | 139                       | 214                          |
| EL Paso      | 113                      | 106,903                 | 0                    | -                         | -                         | 107,016                      |
| Elbert       | 50                       | 22                      | -                    | 2                         | 62                        | 136                          |
| Fremont      | 7                        | 79                      | -                    | -                         | 102                       | 188                          |
| Garfield     | 16                       | 15                      | -                    | 1                         | 150                       | 182                          |
| Gilpin       | 1                        | 2                       | -                    | -                         | 15                        | 18                           |
| Grand        | 7                        | 13                      | -                    | -                         | 37                        | 57                           |
| Gunnison     | 2                        | 12                      | -                    | -                         | 39                        | 53                           |
| Hinsdale     | 0                        | 0                       | -                    | -                         | -                         | 0                            |
| Huerfano     | 0                        | 6                       | -                    | -                         | 17                        | 24                           |
| Jackson      | 1                        | 1                       | -                    | -                         | -                         | 1                            |
| Jefferson    | 363                      | 327                     | -                    | 591                       | 1,488                     | 2,769                        |
| Kiowa        | 1                        | 1                       | -                    | -                         | -                         | 2                            |
| Kit Carson   | 3                        | 11                      | -                    | -                         | 20                        | 34                           |
| Lake         | 2                        | 2                       | -                    | -                         | 19                        | 23                           |
| LaPlata      | 10                       | 19                      | -                    | 3                         | 135                       | 168                          |
| Larimer      | 71                       | 55                      | 1                    | 219                       | 827                       | 1,173                        |
| Las Animas   | 1                        | 15                      | -                    | 11                        | -                         | 27                           |
| Lincoln      | 3                        | 5                       | -                    | -                         | 12                        | 19                           |
| Logan        | 6                        | 5                       | -                    | -                         | 50                        | 61                           |
| Mesa         | 10                       | 20                      | -                    | 345                       | 395                       | 770                          |
| Mineral      | 0                        | 1                       | -                    | -                         | -                         | 1                            |
| Moffet       | 3                        | 4                       | -                    | -                         | 35                        | 42                           |
| Montezuma    | 0                        | 2                       | -                    | -                         | -                         | 2                            |
| Montrose     | 3                        | 17                      | -                    | -                         | 107                       | 126                          |
| Morgan       | 14                       | 11                      | -                    | -                         | 74                        | 98                           |
| Otero        | 1                        | 9                       | -                    | 1                         | 49                        | 60                           |
| Ouray        | 0                        | 1                       | -                    | -                         | 12                        | 13                           |
| Park         | 3                        | 19                      | -                    | 2                         | 43                        | 66                           |
| Philips      | 1                        | 1                       | -                    | -                         | 11                        | 13                           |
| Pitkin       | 12                       | 32                      | -                    | -                         | 46                        | 90                           |
| Prowers      | 1                        | 6                       | -                    | -                         | 32                        | 38                           |
| Pueblo       | 21                       | 473                     | -                    | 475                       | 436                       | 1,404                        |
| RioBlanco    | 1                        | 2                       | -                    | -                         | 18                        | 21                           |
| Rio Grande   | 1                        | 8                       | -                    | -                         | 31                        | 40                           |
| Routt        | 9                        | 24                      | -                    | -                         | 61                        | 95                           |
| Saguache     | 0                        | 1                       | -                    | -                         | 17                        | 18                           |
| SanJuan      | 0                        | 0                       | -                    | 20                        | -                         | 20                           |
| SanMiguel    | 1                        | 9                       | -                    | -                         | -                         | 10                           |
| Sedgwick     | 1                        | 0                       | -                    | -                         | -                         | 1                            |
| Summit       | 9                        | 20                      | -                    | -                         | 74                        | 103                          |
| Teller       | 0                        | 79                      | -                    | 31                        | 62                        | 173                          |
| Washington   | 2                        | 1                       | -                    | -                         | 12                        | 16                           |
| Weld         | 114                      | 80                      | 627                  | -                         | 375                       | 1,196                        |
| Yuma         | 5                        | 2                       | -                    | -                         | 26                        | 33                           |
| <b>Total</b> | <b>39,972</b>            | <b>112,837</b>          | <b>640</b>           | <b>5,258</b>              | <b>11,085</b>             | <b>169,792</b>               |

\* National Guard and Reserve include both full time and part time positions. National Guard and Reserve for Arapahoe, El Paso and Weld are included in their Military Installation figures.

Source: Summit Economics, using Implan Models and data from USASpending.gov and BEA.

**Table 3 - Total DOD Related Employment by Congressional District, 2014**

| County       | Employment by Congressional District by County |              |              |              |                |               |              |
|--------------|--|--------------|--------------|--------------|----------------|---------------|--------------|
|              | CD1  | CD2          | CD3          | CD4          | CD5            | CD6           | CD7          |
| Adams        |  |              |              |              |                | 174           | 2,308        |
| Alamosa      |  |              | 58           |              |                |               |              |
| Arapahoe     |  | 378          |              | 378          |                | 37,016        |              |
| Archuleta    |  |              | 35           |              |                |               |              |
| Baca         |  |              |              | 13           |                |               |              |
| Bent         |  |              |              | 27           |                |               |              |
| Boulder      |  | 3,169        |              | 65           |                |               |              |
| Broomfield   |  | 256          |              |              |                |               | 193          |
| Chaffee      |  |              |              |              | 78             |               |              |
| Cheyenne     |  |              |              | 5            |                |               |              |
| Clear Creek  |  | 60           |              |              |                |               |              |
| Conejos      |  |              | 27           |              |                |               |              |
| Costilla     |  |              | 12           |              |                |               |              |
| Crowley      |  |              |              | 1            |                |               |              |
| Custer       |  |              | 19           |              |                |               |              |
| Delta        |  |              | 83           |              |                |               |              |
| Denver       | 5,784  |              |              |              |                |               | 241          |
| Dolores      |  |              | 0            |              |                |               |              |
| Douglas      |  |              |              | 2,801        |                |               |              |
| Eagle        |  |              | 214          |              |                |               |              |
| EL Paso      |  |              |              |              | 107,016        |               |              |
| Elbert       |  |              |              | 136          |                |               |              |
| Fremont      |  |              |              |              | 188            |               |              |
| Garfield     |  |              | 182          |              |                |               |              |
| Gilpin       |  | 18           |              |              |                |               |              |
| Grand        |  | 57           |              |              |                |               |              |
| Gunnison     |  |              | 53           |              |                |               |              |
| Hinsdale     |  |              | 0            |              |                |               |              |
| Huerfano     |  |              | 24           |              |                |               |              |
| Jackson      |  |              | 1            |              |                |               |              |
| Jefferson    | 28   | 166          |              |              |                |               | 2,575        |
| Kiowa        |  |              |              | 2            |                |               |              |
| Kit Carson   |  |              |              | 34           |                |               |              |
| Lake         |  |              | 23           |              |                |               |              |
| LaPlata      |  |              | 168          |              |                |               |              |
| Larimer      |  | 1,173        |              |              |                |               |              |
| Las Animas   |  |              | 27           |              |                |               |              |
| Lincoln      |  |              |              | 19           |                |               |              |
| Logan        |  |              |              | 61           |                |               |              |
| Mesa         |  |              | 770          |              |                |               |              |
| Mineral      |  |              | 1            |              |                |               |              |
| Moffet       |  |              | 42           |              |                |               |              |
| Montezuma    |  |              | 2            |              |                |               |              |
| Montrose     |  |              | 126          |              |                |               |              |
| Morgan       |  |              |              | 98           |                |               |              |
| Otero        |  |              |              | 60           |                |               |              |
| Ouray        |  |              | 13           |              |                |               |              |
| Park         |  |              |              |              | 66             |               |              |
| Philips      |  |              |              | 13           |                |               |              |
| Pitkin       |  |              | 90           |              |                |               |              |
| Prowers      |  |              |              | 38           |                |               |              |
| Pueblo       |  |              | 1,404        |              |                |               |              |
| RioBlanco    |  |              | 21           |              |                |               |              |
| Rio Grande   |  |              | 40           |              |                |               |              |
| Routt        |  |              | 95           |              |                |               |              |
| Saguache     |  |              | 18           |              |                |               |              |
| SanJuan      |  |              | 20           |              |                |               |              |
| SanMiguel    |  |              | 10           |              |                |               |              |
| Sedgwick     |  |              |              | 1            |                |               |              |
| Summit       |  | 103          |              |              |                |               |              |
| Teller       |  |              |              |              | 173            |               |              |
| Washington   |  |              |              | 16           |                |               |              |
| Weld         |  |              |              | 1,196        |                |               |              |
| Yuma         |  |              |              | 33           |                |               |              |
| <b>Total</b> | <b>5,812</b>                                   | <b>5,379</b> | <b>3,578</b> | <b>4,997</b> | <b>107,519</b> | <b>37,190</b> | <b>5,317</b> |

Source: Summit Economics, LLC





**Table 4 - Total DOD Related Earnings, by County, 2014**

Includes Direct, Indirect and Induced Earnings from Military Base Operations, DOD Contracts and Assistance, and National Guard/Reserves

|                       | Arapahoe County<br>Bases | El Paso County<br>Bases | Weld County<br>Bases | DOD Contracts in<br>Other Counties | National<br>Guard/Reserve | Total Colorado<br>DOD Impact |
|-----------------------|--------------------------|-------------------------|----------------------|------------------------------------|---------------------------|------------------------------|
| Adams                 | \$ 28,793,210            | \$ 10,882,630           | \$ 151,949           | \$ 10,112,524                      | \$ 11,901,600             | \$ 61,841,913                |
| Alamosa               | \$ 13,322                | \$ 903,954              | \$ -                 | \$ -                               | \$ 304,000                | \$ 1,221,277                 |
| Arapahoe              | \$ 2,857,116,375         | \$ 119,842,378          | \$ 182,065           | \$ -                               | \$ -                      | \$ 2,977,140,818             |
| Archuleta             | \$ 9,790                 | \$ 83,935               | \$ -                 | \$ -                               | \$ 243,200                | \$ 336,926                   |
| Baca                  | \$ 13,104                | \$ 140,230              | \$ -                 | \$ -                               | \$ 76,000                 | \$ 229,334                   |
| Bent                  | \$ 4,498                 | \$ 115,972              | \$ -                 | \$ 331,306                         | \$ 121,600                | \$ 9,487,533                 |
| Boulder               | \$ 8,918,655             | \$ 12,719,638           | \$ 149,954           | \$ 172,652,693                     | \$ 6,688,000              | \$ 195,155,845               |
| Broomfield            | \$ 2,945,559             | \$ 2,516,285            | \$ -                 | \$ 17,870,172                      | \$ 1,178,000              | \$ 21,649,220                |
| Chaffee               | \$ 84,763                | \$ 699,369              | \$ -                 | \$ -                               | \$ 334,400                | \$ 1,055,747                 |
| Cheyenne              | \$ 21,978                | \$ 149,883              | \$ -                 | \$ 16,462                          | \$ -                      | \$ 504,397                   |
| Clear Creek           | \$ 338,053               | \$ 657,537              | \$ -                 | \$ -                               | \$ 182,400                | \$ 860,813                   |
| Conejos               | \$ 20,876                | \$ 102,796              | \$ -                 | \$ -                               | \$ 167,200                | \$ 274,866                   |
| Costilla              | \$ 4,870                 | \$ 53,091               | \$ -                 | \$ -                               | \$ 76,000                 | \$ 133,961                   |
| Crowley               | \$ 1,212                 | \$ 39,869               | \$ -                 | \$ -                               | \$ -                      | \$ 41,081                    |
| Custer                | \$ 16,562                | \$ 294,259              | \$ -                 | \$ -                               | \$ 83,600                 | \$ 394,420                   |
| Delta                 | \$ 54,118                | \$ 109,713              | \$ -                 | \$ 11,118                          | \$ 600,400                | \$ 775,349                   |
| Denver                | \$ 119,641,264           | \$ 103,005,328          | \$ 262,618           | \$ 95,846,152                      | \$ 18,034,800             | \$ 336,790,162               |
| Dolores               | \$ 491                   | \$ 1,063                | \$ -                 | \$ -                               | \$ -                      | \$ 1,554                     |
| Douglas               | \$ 38,904,222            | \$ 114,795,515          | \$ -                 | \$ 4,806,329                       | \$ 6,042,000              | \$ 164,548,065               |
| Eagle                 | \$ 815,987               | \$ 2,647,127            | \$ -                 | \$ 693,235                         | \$ 1,056,400              | \$ 5,212,748                 |
| El Paso               | \$ 5,343,092             | \$ 7,573,870,125        | \$ 8,062             | \$ -                               | \$ -                      | \$ 7,579,221,279             |
| Elbert                | \$ 2,046,497             | \$ 741,171              | \$ -                 | \$ 195,895                         | \$ 471,200                | \$ 3,454,763                 |
| Fremont               | \$ 279,119               | \$ 2,998,927            | \$ -                 | \$ -                               | \$ 775,200                | \$ 4,053,246                 |
| Garfield              | \$ 630,045               | \$ 770,073              | \$ -                 | \$ 45,417                          | \$ 1,140,000              | \$ 2,585,535                 |
| Gilpin                | \$ 35,188                | \$ 93,282               | \$ -                 | \$ -                               | \$ 114,000                | \$ 242,470                   |
| Grand                 | \$ 226,758               | \$ 592,886              | \$ -                 | \$ 38,933                          | \$ 281,200                | \$ 1,139,777                 |
| Gunnison              | \$ 77,360                | \$ 561,472              | \$ -                 | \$ -                               | \$ 296,400                | \$ 935,232                   |
| Hinsdale              | \$ 415                   | \$ 1,585                | \$ -                 | \$ -                               | \$ -                      | \$ 2,000                     |
| Huerfano              | \$ 7,997                 | \$ 178,955              | \$ -                 | \$ -                               | \$ 129,200                | \$ 316,152                   |
| Jackson               | \$ 36,988                | \$ 27,040               | \$ -                 | \$ -                               | \$ -                      | \$ 64,028                    |
| Jefferson             | \$ 21,703,744            | \$ 19,540,694           | \$ -                 | \$ 50,276,663                      | \$ 11,308,800             | \$ 102,829,901               |
| Kiowa                 | \$ 13,751                | \$ 32,313               | \$ -                 | \$ -                               | \$ -                      | \$ 46,064                    |
| Kit Carson            | \$ 115,020               | \$ 475,801              | \$ -                 | \$ -                               | \$ 152,000                | \$ 742,822                   |
| Lake                  | \$ 117,474               | \$ 81,537               | \$ -                 | \$ 3,243                           | \$ 144,400                | \$ 346,655                   |
| LaPlata               | \$ 990,451               | \$ 1,861,068            | \$ -                 | \$ 268,482                         | \$ 1,026,000              | \$ 4,146,001                 |
| Larimer               | \$ 3,337,578             | \$ 2,906,621            | \$ 22,915            | \$ 18,582,974                      | \$ 6,285,200              | \$ 31,135,289                |
| Las Animas            | \$ 29,151                | \$ 807,859              | \$ -                 | \$ 922,759                         | \$ -                      | \$ 1,759,769                 |
| Lincoln               | \$ 87,195                | \$ 274,133              | \$ -                 | \$ -                               | \$ 91,200                 | \$ 452,528                   |
| Logan                 | \$ 295,188               | \$ 224,777              | \$ -                 | \$ -                               | \$ 380,000                | \$ 899,964                   |
| Mesa                  | \$ 403,605               | \$ 967,907              | \$ -                 | \$ 29,357,313                      | \$ 3,002,000              | \$ 33,730,825                |
| Mineral               | \$ 1,838                 | \$ 22,377               | \$ -                 | \$ -                               | \$ -                      | \$ 24,214                    |
| Moffet                | \$ 152,982               | \$ 227,870              | \$ -                 | \$ -                               | \$ 266,000                | \$ 646,852                   |
| Montezuma             | \$ 12,422                | \$ 80,332               | \$ -                 | \$ -                               | \$ -                      | \$ 92,753                    |
| Montrose              | \$ 106,578               | \$ 904,606              | \$ -                 | \$ -                               | \$ 813,200                | \$ 1,824,384                 |
| Morgan                | \$ 711,367               | \$ 573,039              | \$ 7,644             | \$ 30,361                          | \$ 562,400                | \$ 1,884,811                 |
| Otero                 | \$ 33,949                | \$ 408,402              | \$ -                 | \$ 122,413                         | \$ 372,400                | \$ 937,164                   |
| Ouray                 | \$ 4,769                 | \$ 22,039               | \$ -                 | \$ -                               | \$ 91,200                 | \$ 118,008                   |
| Park                  | \$ 35,105                | \$ 346,036              | \$ -                 | \$ 141,061                         | \$ 326,800                | \$ 849,002                   |
| Philips               | \$ 29,907                | \$ 31,046               | \$ -                 | \$ -                               | \$ 83,600                 | \$ 144,554                   |
| Pitkin                | \$ 307,851               | \$ 1,147,858            | \$ -                 | \$ -                               | \$ 349,600                | \$ 1,805,309                 |
| Prowers               | \$ 27,386                | \$ 204,871              | \$ -                 | \$ 16,070                          | \$ 243,200                | \$ 491,527                   |
| Pueblo                | \$ 1,172,322             | \$ 25,229,347           | \$ -                 | \$ 40,346,003                      | \$ 3,313,600              | \$ 70,061,272                |
| RioBlanco             | \$ 26,387                | \$ 129,912              | \$ -                 | \$ -                               | \$ 136,800                | \$ 293,098                   |
| Rio Grande            | \$ 28,333                | \$ 354,830              | \$ -                 | \$ -                               | \$ 235,600                | \$ 618,763                   |
| Routt                 | \$ 453,362               | \$ 1,297,014            | \$ -                 | \$ 8,155                           | \$ 463,600                | \$ 2,222,130                 |
| Saguache              | \$ 15,195                | \$ 85,328               | \$ -                 | \$ -                               | \$ 129,200                | \$ 229,723                   |
| SanJuan               | \$ 714                   | \$ 2,441                | \$ -                 | \$ -                               | \$ -                      | \$ 3,155                     |
| SanMiguel             | \$ 27,473                | \$ 317,236              | \$ -                 | \$ -                               | \$ -                      | \$ 344,709                   |
| Sedgwick              | \$ 19,504                | \$ 14,427               | \$ -                 | \$ -                               | \$ -                      | \$ 33,931                    |
| Summit                | \$ 414,701               | \$ 810,601              | \$ -                 | \$ 20,503                          | \$ 562,400                | \$ 1,808,205                 |
| Teller                | \$ 16,068                | \$ 3,598,566            | \$ -                 | \$ 2,665,386                       | \$ 471,200                | \$ 6,751,221                 |
| Washington            | \$ 46,893                | \$ 40,272               | \$ -                 | \$ -                               | \$ 91,200                 | \$ 178,365                   |
| Weld                  | \$ 5,532,978             | \$ 4,305,219            | \$ 33,004,795        | \$ -                               | \$ 2,850,000              | \$ 45,692,991                |
| Yuma                  | \$ 149,482               | \$ 78,499               | \$ -                 | \$ -                               | \$ 197,600                | \$ 425,581                   |
| Total                 | \$ 3,102,823,087         | \$ 8,017,000,964        | \$ 33,790,002        | \$ 445,381,624                     | \$ 84,246,000             | \$ 11,683,242,049            |
| Outside Base Counties | \$ 245,706,713           | \$ 443,130,839          | \$ 785,207           | \$ 445,381,624                     | \$ 81,396,000             | \$ 1,135,004,382             |

\* National Guard and Reserve include both full time and part time positions.

Source: Summit Economics, using Implan Models and data from USASpending.gov and BEA.

| <b>Table 5 - DOD Related Labor Earnings by Congressional District, 2014</b> |    |                 |
|---|----|-----------------|
| CD 1  |    | \$324,346,854   |
| CD 2  |    | \$274,720,540   |
| CD 3  |    | \$130,521,667   |
| CD 4  |    | \$263,869,999   |
| CD 5  |    | \$7,591,930,495 |
| CD 6  |    | \$2,921,926,935 |
| CD 7  |    | \$175,925,558   |
| Total   | \$ | 11,683,242,049  |
| Source: Summit Economics, LLC   |    |                 |

Table 5 shows the total labor earnings by Congressional District. Again, labor income includes wages, benefits and proprietors' income. In summary, Colorado receives almost \$11.7 billion in labor income, with almost 10% spread to counties other than the three that contain military installations.

### **Military Installation County-Level Analysis**

Table 6 shows the key military installation inputs into the economic impact model. The inputs are broken down into military and civilian personnel. It shows the number of those two categories of personnel by installation. The civilian category is further decomposed into professional and non-professional sub-categories. Contractors working on the military installations are not shown as the impact of those contractors is separately estimated in later steps.

The magnitude of the military presence in Colorado can be quickly seen from the presence of 60,000 military and civilian personnel at the seven military installations analyzed.

Data used to build Table 6 was provided by each military installation within the State. The data was subject to some adjustments to account for part-time personnel. Additional classification of employment into specific North American Industry Classification System (NAICS) categories was also required for the analysis phase.

| Table 6 - Employment on Military Installations, 2014  |               |                         |                          |                   |                   |                      |                 |                           |  |
|---|---------------|-------------------------|--------------------------|-------------------|-------------------|----------------------|-----------------|---------------------------|--|
| Military Installations  | Fort Carson   | Peterson Air Force Base | Schriever Air Force Base | Cheyenne Mountain | Air Force Academy | Buckley -            |                 |                           |  |
|   |               |                         |                          |                   |                   | Total El Paso County | Arapahoe County | Greeley ANG - Weld County |  |
| <b>Employment</b>   |               |                         |                          |                   |                   |                      |                 |                           |  |
| Military  | 26,455        | 6,495                   | 2,145                    | 300               | 5,800             | 41,195               | 6,779           | 305                       |  |
| Civilian  |               |                         |                          |                   |                   |                      |                 |                           |  |
| Prof, excl contractors  | 2,529         | 3,218                   | 495                      | 135               | 1,448             | 7,825                | 1,613           | 12                        |  |
| Non Professional  | 843           | 1,073                   | 165                      | -                 | 858               | 2,939                | 538             | -                         |  |
| <b>Total</b>  | <b>29,827</b> | <b>10,785</b>           | <b>2,805</b>             | <b>435</b>        | <b>8,106</b>      | <b>51,958</b>        | <b>8,929</b>    | <b>317</b>                |  |
| Military employment includes Active Duty, National Guard and Reserves. National Guard and Reserves estimated on a FTE basis.                          |               |                         |                          |                   |                   |                      |                 |                           |  |
| Civilian employment separated into two categories: professional and non professional, based on interviews with budget staff. Overall average applied. |               |                         |                          |                   |                   |                      |                 |                           |  |
| Contractor employment is estimated separately. Contractor employment estimated using DOD Contractor databases and Implan modeling.                    |               |                         |                          |                   |                   |                      |                 |                           |  |
| Sources: Summit Economics, LLC and Reports/Briefings Provided by Each Installation  |               |                         |                          |                   |                   |                      |                 |                           |  |

In addition to the employment impacts at the seven installations, each installation spends significant funds to operate. For those familiar with impact analysis, these sorts of expenditures are normally included in employment multipliers; however, for Federal operations they are not included. As a consequence, certain expenditures must be separately estimated and their impacts analyzed. Expenditures for operations and construction at military installations are obligated using several different methods of funding. Many expenditures are performed by contract, while some are made using purchase cards and direct billing. No central reporting source was found that reported expenditures by these categories, so Table 7 presents an approximation of the split. The approximation is based on interviews with several military base budget or base operation managers.

The economic impact of the contract expenditures are then analyzed separately from the impacts of the direct expenditures not shown as DOD contract expenditures. For this analysis, half of all operations and maintenance expenditures, and all construction and “other” spending, are assumed to be contract based. That means that their impact is estimated in a later step to be shown in Table 8. The remaining direct expenditures at the installations are added to the impacts resulting from the military installation personnel.

**Table 7 - Expenditures at Military Installations, 2014**

| Expenditures  | Military Installations | Fort Carson    | Peterson Air Force Base | Schriever Air Force Base | Cheyenne Mountain | Air Force Academy | Buckley -            |                 |                           |
|---|------------------------|----------------|-------------------------|--------------------------|-------------------|-------------------|----------------------|-----------------|---------------------------|
|   |                        |                |                         |                          |                   |                   | Total El Paso County | Arapahoe County | Greeley ANG - Weld County |
| O&M   |                        | \$ 159,163,900 | \$ 130,400,000          | \$ 99,000,000            | \$ 4,700,000      | \$ 32,800,000     | 426,063,900          | \$ 58,000,000   | \$ 600,000                |
| % Non Contract  |                        | 50%            | 50%                     | 50%                      | 50%               | 50%               | 50%                  | 50%             | 50%                       |
| Military Construction   |                        | \$ 229,400,000 | \$ 10,550,000           | \$ 1,900,000             | \$ 1,580,000      | \$ 11,700,000     | \$ 255,130,000       | \$ 22,400,000   | \$ 15,200,000             |
| % Non Contract  |                        | 0%             | 0%                      | 0%                       | 0%                | 0%                | 0%                   | 0%              | 0%                        |
| Other Expenditures  |                        | \$ 150,500,000 | \$ 430,100,000          | \$ 97,000,000            | \$ 126,200,000    | \$ 65,000,000     | \$ 868,800,000       | \$ 152,000,000  | \$ -                      |
| % Non Contract  |                        | 0%             | 0%                      | 0%                       | 0%                | 0%                | 0%                   | 0%              | 0%                        |
| All Non-Contract Expenditure impacts are estimated through direct Implan modeling. Contract expenditure impacts estimated separately based on DOD Contractor impact models. In general, only O&M contained expenditures that were not contract based. |                        |                |                         |                          |                   |                   |                      |                 |                           |
| Source: Summit Economics, LLC   |                        |                |                         |                          |                   |                   |                      |                 |                           |

The non-contract operations and maintenance (O&M) expenditures shown in Table 7 were then broken down into different industry classifications or NAICS codes. Each different NAICS code has a different economic impact. The NAICS codes and the distribution between NAICS code were selected to create a representative look at how those expenditures might look if precise expenditure records were available. The non-contract expenditures at the five military installations in El Paso County were combined. Generally, these expenditures were modeled as a combination of utilities, printing, educational services, transportation, social assistance, food services, furniture and other support activities.

Table 8 presents a summary of the DOD contract and assistance awards modeled in the analysis. DOD contracts and assistance awards were obtained from the federal database USASpending.<sup>7</sup> All contracts and awards given in 2014 were downloaded from the site, and subject to sorting and categorizing. The total number of contracts and awards given in the three military installation counties exceeded 9,500, and the total awarded in all of Colorado exceeded 13,700.

Table 8 shows the dollar amounts awarded in each of the three military installation counties in the most represented three-digit NAICS categories. [NOTE: The NAICS codes were then converted to IMPLAN codes which are a key element to run the economic impact analysis.] In the case of El Paso County, the top thirteen categories represent 90% of all contracts and awards. In the case of Arapahoe County, the top seven categories represent 95% of all expenditures. The economic impacts estimated are based on the amounts shown in Table 8, boosted to equal 100% of all expenditures. The impacts of the contracts and awards in the remaining, non-military installation counties is estimated in a later step but shown earlier in Tables 2-4.

<sup>7</sup> www.USASpending.gov

**Table 8 - Distribution of All DOD Contract and Assistance Awards Expenditures in Counties with Military Installations, 2014**

|   | El Paso County   |   | Arapahoe County  |                               | Weld County  |
|---|------------------|---|------------------|-------------------------------|--------------|
| Utilities - Electric  | \$ 24,354,008    | Nonsched Chartered Freight Air Trans *  | \$ 2,430,661,757 | Justice, Public Order, Safety | \$ 8,713,525 |
| Heavy and Civil Eng Constr  | \$ 33,777,998    | R&D in Phys, Eng, and Life Science  | \$ 318,389,295   | Petroleum Refineries          | \$ 1,519,700 |
| Construction of Buildings   | \$ 380,362,334   | Other Aircraft Parts and Aux. Equip Mfg   | \$ 195,339,093   | Furniture and Related Mfg     | \$ 132,214   |
| Air Transportation  | \$ 15,184,190    | Engineering Services  | \$ 40,037,898    | Contracts Modeled             | \$10,365,439 |
| Truck Transportation  | \$ 14,464,905    | Educational Services  | \$ 26,430,131    |                               |              |
| Telecommunications  | \$ 153,490,795   | Construction of Buildings   | \$ 21,352,361    |                               |              |
| Engineering Services  | \$ 212,323,983   | Heavy and Civil Eng Construction  | \$ 16,917,139    |                               |              |
| Computer Facilities Management  | \$ 305,193,320   | Contracts Modeled   | \$ 3,049,127,675 |                               |              |
| Other Computer Related Services                                       | \$ 17,517,261    |   |                  |                               |              |
| R&D in the Phys, Eng, and Life Science                                | \$ 526,603,729   | * Nonscheduled chartered freight air transportation is the NAICS code for satellite launching |                  |                               |              |
| Facilities Support Services   | \$ 137,520,980   |   |                  |                               |              |
| Facilities Support Services   | \$ 23,783,114    |   |                  |                               |              |
| Offices of Physicians (ex Mental Hlth)                                | \$ 16,062,202    |   |                  |                               |              |
| Contracts Modeled   | \$ 1,860,638,821 |   |                  |                               |              |
| Total DOD Contracts   | \$ 2,044,798,575 | Total DOD Contracts   | \$ 3,190,081,763 | Total DOD Contracts           | \$ 1,652,109 |
| Total DOD Assistance  | \$ 30,607,582    | Total DOD Assistance  | \$ 13,408,710    | Total DOD Assistance          | \$ 8,713,525 |
| Total DOD   | \$ 2,075,406,157 | Total DOD   | \$ 3,203,490,473 | Total DOD                     | \$10,365,634 |
| % Tot Value Modeled   | 90%              |   | 95%              |                               | 100%         |
| Number of Contracts   | 2,924            |   | 6,612            |                               | 102          |
| Total Number of DOD Contracts and Assistance Awards in Colorado, 2014 |                  |   | 13,714           |                               |              |
| Source: Summit Economics, LLC, based on USAspending.gov reports       |                  |   |                  |                               |              |

### Outputs from the Economic Analysis

Once the data was collected, it was entered into economic impact models created using IMPLAN software. IMPLAN is a nationally recognized modeling system, widely used for private and public sector projects.<sup>8</sup>

Models were built for each county (El Paso, Arapahoe and Weld) that contained a military installation. The modeling was done in stages, with the first analysis of the impacts of the military and civilian personnel, followed by a second run of just the operation expenditures, followed by a third run with just the DOD Contract and Assistance expenditures. Each run was then combined. The combined impacts represented the first round of impacts within El Paso, Arapahoe and Weld counties.

Because the analysis is concerned with the impact upon the entire State of Colorado, additional modeling efforts were required. Another series of analysis were then performed to assess the trade flow impacts of expenditures in the three counties upon other counties in Colorado. The trade flow represents how economic activities in one county can impact the economies of other counties through the purchases made by the military installation, its personnel, firms that support the installation, and people who have jobs due to the presence of the installations when they spend their earnings throughout the State. By combining the trade flow effects with the impacts in the three military installation counties, a statewide total was created.

<sup>8</sup> IMPLAN is a product of IMPLAN Group, LLC. It has become an industry standard.

Table 9 shows the combined impact of all seven military installations in the three counties of El Paso, Arapahoe and Weld. In just these three counties, total employment in Colorado is almost 144,000 higher as a result of DOD activities than it would be otherwise. The total labor income in the three counties created by DOD activities is \$10.5 billion. Impacts occurring within other counties were included earlier in Tables 2-4.

**Table 9 - Combined El Paso, Arapahoe and Weld County Military Installation and DOD Contracting Impacts**

| <b>On Base Military and Non Contract Civilian Personnel</b>   |            |                   |                   |                   |
|---|------------|-------------------|-------------------|-------------------|
| This includes all Military and Civilian Employees. Excludes Contractors, O&M and MilCon                   |            |                   |                   |                   |
|   | Employment | Labor Income      | Value Added       | Output            |
| Direct  | 61,204     | \$ 5,562,506,454  | \$ 10,541,770,759 | \$ 11,571,386,807 |
| Indirect  | 3,491      | \$ 168,042,402    | \$ 279,836,245    | \$ 439,773,319    |
| Induced   | 26,341     | \$ 1,073,381,702  | \$ 2,035,581,023  | \$ 3,272,197,942  |
|   | 91,036     | \$ 6,803,930,558  | \$ 12,857,188,027 | \$ 15,283,358,068 |
| <b>Military Base O&amp;M. Excludes Contract O&amp;M and MilCon.</b>                                       |            |                   |                   |                   |
|   | Employment | Labor Income      | Value Added       | Output            |
| Direct  | 3,170      | \$ 106,778,757    | \$ 141,182,810    | \$ 257,631,950    |
| Indirect  | 456        | \$ 21,150,959     | \$ 35,476,200     | \$ 57,934,424     |
| Induced   | 579        | \$ 23,503,108     | \$ 44,551,555     | \$ 71,477,412     |
|   | 4,205      | \$ 151,432,824    | \$ 221,210,565    | \$ 387,043,786    |
| <b>Combined Military &amp; Civilian Employees and Non Contract O&amp;M.</b>                               |            |                   |                   |                   |
|   | Employment | Labor Income      | Value Added       | Output            |
| Direct  | 64,374     | \$ 5,669,285,211  | \$ 10,682,953,569 | \$ 11,829,018,757 |
| Indirect  | 3,947      | \$ 189,193,361    | \$ 315,312,445    | \$ 497,707,743    |
| Induced   | 26,920     | \$ 1,096,884,810  | \$ 2,080,132,578  | \$ 3,343,675,354  |
|   | 95,241     | \$ 6,955,363,382  | \$ 13,078,398,592 | \$ 15,670,401,854 |
| <b>DOD Contracts and Assistance</b>   |            |                   |                   |                   |
|   | Employment | Labor Income      | Value Added       | Output            |
| Direct  | 22,897     | \$ 2,195,643,433  | \$ 2,569,992,694  | \$ 5,548,519,684  |
| Indirect  | 13,667     | \$ 763,245,874    | \$ 1,091,314,474  | \$ 1,671,977,299  |
| Induced   | 12,045     | \$ 547,013,439    | \$ 981,427,931    | \$ 1,543,911,347  |
|   | 48,610     | \$ 3,505,902,746  | \$ 4,642,735,099  | \$ 8,764,408,329  |
| <b>Combined Military &amp; Civilian Employees, Non Contract O&amp;M, and DOD Contracts and Assistance</b> |            |                   |                   |                   |
|   | Employment | Labor Income      | Value Added       | Output            |
| Direct  | 87,271     | \$ 7,864,928,644  | \$ 13,252,946,263 | \$ 17,377,538,441 |
| Indirect  | 17,614     | \$ 952,439,235    | \$ 1,406,626,919  | \$ 2,169,685,042  |
| Induced   | 38,965     | \$ 1,643,898,249  | \$ 3,061,560,509  | \$ 4,887,586,701  |
|   | 143,851    | \$ 10,461,266,128 | \$ 17,721,133,691 | \$ 24,434,810,183 |
| Source: Summit Economics, LLC   |            |                   |                   |                   |

Table 10 shows the economic impacts resulting just from the military and non-contractor civilians at the five El Paso County military installations (Fort Carson, Peterson AFB, Schriever AFB, Cheyenne Mountain AFS and the US Air Force Academy). In summary, it shows the direct employment of 52,000 personnel creates an additional 26,000 indirect and induced jobs. The non-contract O&M expenditures then create about 3,500 more jobs, and finally the DOD contracts and expenditures create almost 25,000 more jobs, for a grand total of almost 107,000 total direct, indirect and induced jobs. The direct employment figures for military and non-contractor civilians come from the military installations. The non-contract O&M from contracts and assistance awards are produced by IMPLAN, based on the dollar expenditures. Total labor income, which includes wages, benefits and proprietors income, exceeds \$7.5 billion. In just El Paso County, total economic output is increased by more than \$17.2 billion.



**Table 10 - El Paso County Military  
Installation and DOD Contracting Impacts**

| <b>On Base Military and Non Contract Civilian Personnel</b>   |            |                  |                   |                   |
|---|------------|------------------|-------------------|-------------------|
| This includes all Military and Civilian Employees. Excludes Contractors, O&M and MilCon                   |            |                  |                   |                   |
|   | Employment | Labor Income     | Value Added       | Output            |
| Direct  | 51,957     | \$ 4,845,246,544 | \$ 9,078,338,342  | \$ 9,949,287,578  |
| Indirect  | 2,827      | \$ 128,386,352   | \$ 221,462,799    | \$ 352,289,432    |
| Induced   | 23,636     | \$ 934,610,413   | \$ 1,801,009,652  | \$ 2,900,979,860  |
|   | 78,420     | \$ 5,908,243,309 | \$ 11,100,810,793 | \$ 13,202,556,870 |
| <b>Military Base O&amp;M. Excludes Contract O&amp;M and MilCon</b>  |            |                  |                   |                   |
|   | Employment | Labor Income     | Value Added       | Output            |
| Direct  | 2,712      | \$ 86,609,385    | \$ 116,841,933    | \$ 213,031,950    |
| Indirect  | 383        | \$ 17,156,026    | \$ 29,592,735     | \$ 48,519,403     |
| Induced   | 492        | \$ 19,465,806    | \$ 37,502,034     | \$ 60,414,275     |
|   | 3,587      | \$ 123,231,217   | \$ 183,936,702    | \$ 321,965,628    |
| <b>Combined Military &amp; Civilian Employees and Non Contract O&amp;M</b>                                |            |                  |                   |                   |
|   | Employment | Labor Income     | Value Added       | Output            |
| Direct  | 54,669     | \$ 4,931,855,929 | \$ 9,195,180,275  | \$ 10,162,319,528 |
| Indirect  | 3,210      | \$ 145,542,378   | \$ 251,055,534    | \$ 400,808,835    |
| Induced   | 24,128     | \$ 954,076,219   | \$ 1,838,511,686  | \$ 2,961,394,135  |
|   | 82,007     | \$ 6,031,474,526 | \$ 11,284,747,495 | \$ 13,524,522,498 |
| <b>DOD Contracts and Assistance</b>   |            |                  |                   |                   |
|   | Employment | Labor Income     | Value Added       | Output            |
| Direct  | 13,942     | \$ 1,072,026,289 | \$ 1,283,465,411  | \$ 2,348,398,039  |
| Indirect  | 4,808      | \$ 227,045,419   | \$ 375,929,808    | \$ 600,760,637    |
| Induced   | 6,156      | \$ 243,323,891   | \$ 468,658,628    | \$ 755,094,759    |
|   | 24,906     | \$ 1,542,395,599 | \$ 2,128,053,846  | \$ 3,704,253,435  |
| <b>Combined Military &amp; Civilian Employees, Non Contract O&amp;M, and DOD Contracts and Assistance</b> |            |                  |                   |                   |
|   | Empl       | Labor Income     | Value Added       | Output            |
| Direct  | 68,611     | \$ 6,003,882,218 | \$ 10,478,645,686 | \$ 12,510,717,567 |
| Indirect  | 8,018      | \$ 372,587,797   | \$ 626,985,342    | \$ 1,001,569,472  |
| Induced   | 30,284     | \$ 1,197,400,110 | \$ 2,307,170,314  | \$ 3,716,488,894  |
|   | 106,913    | \$ 7,573,870,125 | \$ 13,412,801,341 | \$ 17,228,775,933 |
| Source: Summit Economics, LLC   |            |                  |                   |                   |

Table 11 shows the impacts of the military installation (Buckley Air Force Base) and DOD contracts and assistance awards in Arapahoe County. In total, DOD expenditures are responsible for more than 36,000 jobs and \$2.8 billion in labor income in Arapahoe County alone.

| <b>Table 11 - Arapahoe County Military Installation and DOD Contracting Impacts</b>                       |            |                  |                  |                  |
|---|------------|------------------|------------------|------------------|
| <b>On Base Military and Non Contract Civilian Personnel</b>   |            |                  |                  |                  |
| This includes all Military and Civilian Employees. Excludes Contractors, O&M and MilCon                   |            |                  |                  |                  |
|   | Employment | Labor Income     | Value Added      | Output           |
| Direct  | 8,930      | \$ 703,422,279   | \$ 1,421,535,281 | \$ 1,577,933,873 |
| Indirect  | 661        | \$ 39,563,353    | \$ 58,225,768    | \$ 87,230,493    |
| Induced   | 2,654      | \$ 136,928,383   | \$ 231,050,594   | \$ 365,422,006   |
|   | 12,245     | \$ 879,914,015   | \$ 1,710,811,643 | \$ 2,030,586,372 |
| <b>Military Base O&amp;M. Excludes Contract O&amp;M and MilCon.</b>                                       |            |                  |                  |                  |
|   | Employment | Labor Income     | Value Added      | Output           |
| Direct  | 330        | \$ 13,159,193    | \$ 17,156,254    | \$ 29,000,000    |
| Indirect  | 49         | \$ 3,030,474     | \$ 4,537,775     | \$ 6,910,874     |
| Induced   | 58         | \$ 2,981,336     | \$ 5,030,768     | \$ 7,738,648     |
|   | 437        | \$ 19,171,003    | \$ 26,724,797    | \$ 43,649,522    |
| <b>Combined Military &amp; Civilian Employees and Non Contract O&amp;M.</b>                               |            |                  |                  |                  |
|   | Employment | Labor Income     | Value Added      | Output           |
| Direct  | 9,260      | \$ 716,581,472   | \$ 1,438,691,535 | \$ 1,606,933,873 |
| Indirect  | 710        | \$ 42,593,827    | \$ 62,763,543    | \$ 94,141,367    |
| Induced   | 2,712      | \$ 139,909,719   | \$ 236,081,362   | \$ 373,160,654   |
|   | 12,682     | \$ 899,085,018   | \$ 1,737,536,440 | \$ 2,074,235,894 |
| <b>DOD Contracts and Assistance</b>   |            |                  |                  |                  |
|   | Employment | Labor Income     | Value Added      | Output           |
| Direct  | 8,917      | \$ 1,119,705,801 | \$ 1,281,531,056 | \$ 3,189,387,389 |
| Indirect  | 8,839      | \$ 535,275,837   | \$ 714,067,260   | \$ 1,068,818,691 |
| Induced   | 5,872      | \$ 303,049,719   | \$ 511,546,871   | \$ 786,804,102   |
|   | 23,629     | \$ 1,958,031,357 | \$ 2,507,145,188 | \$ 5,045,010,182 |
| <b>Combined Military &amp; Civilian Employees, Non Contract O&amp;M, and DOD Contracts and Assistance</b> |            |                  |                  |                  |
|   | Employment | Labor Income     | Value Added      | Output           |
| Direct  | 18,177     | \$ 1,836,287,273 | \$ 2,720,222,591 | \$ 4,796,321,262 |
| Indirect  | 9,549      | \$ 577,869,664   | \$ 776,830,803   | \$ 1,162,960,058 |
| Induced   | 8,584      | \$ 442,959,438   | \$ 747,628,233   | \$ 1,159,964,756 |
|   | 36,311     | \$ 2,857,116,375 | \$ 4,244,681,628 | \$ 7,119,246,076 |
| Source: Summit Economics, LLC   |            |                  |                  |                  |

Table 12 shows the impacts of the military installation (Greeley Air National Guard Station) and DOD contracts and assistance awards in Weld County. In total, DOD expenditures are responsible for more than 600 jobs and \$30 million in labor income in Weld County alone.

| <b>Table 12 - Weld County Military Installation and DOD Contracting Impacts</b>                           |            |               |               |               |
|---|------------|---------------|---------------|---------------|
| <b>On Base Military and Non Contract Civilian Personnel</b>   |            |               |               |               |
| This includes all Military and Civilian Employees. Excludes Contractors, O&M and MilCon                   |            |               |               |               |
|   | Employment | Labor Income  | Value Added   | Output        |
| Direct  | 317        | \$ 13,837,631 | \$ 41,897,136 | \$ 44,165,356 |
| Indirect  | 3          | \$ 92,697     | \$ 147,678    | \$ 253,394    |
| Induced   | 51         | \$ 1,842,906  | \$ 3,520,777  | \$ 5,796,076  |
|   | 371        | \$ 15,773,234 | \$ 45,565,591 | \$ 50,214,826 |
| <b>Military Base O&amp;M. Excludes Contract O&amp;M and MilCon.</b>                                       |            |               |               |               |
|   | Employment | Labor Income  | Value Added   | Output        |
| Direct  | 128        | \$ 7,010,179  | \$ 7,184,623  | \$ 15,600,000 |
| Indirect  | 24         | \$ 964,459    | \$ 1,345,690  | \$ 2,504,147  |
| Induced   | 29         | \$ 1,055,966  | \$ 2,018,753  | \$ 3,324,489  |
|   | 181        | \$ 9,030,604  | \$ 10,549,066 | \$ 21,428,636 |
| <b>Combined Military &amp; Civilian Employees and Non Contract O&amp;M.</b>                               |            |               |               |               |
|   | Employment | Labor Income  | Value Added   | Output        |
| Direct  | 445        | \$ 20,847,810 | \$ 49,081,759 | \$ 59,765,356 |
| Indirect  | 27         | \$ 1,057,156  | \$ 1,493,368  | \$ 2,757,541  |
| Induced   | 80         | \$ 2,898,872  | \$ 5,539,530  | \$ 9,120,565  |
|   | 552        | \$ 24,803,838 | \$ 56,114,657 | \$ 71,643,462 |
| <b>DOD Contracts and Assistance</b>   |            |               |               |               |
|   | Employment | Labor Income  | Value Added   | Output        |
| Direct  | 38         | \$ 3,911,343  | \$ 4,996,227  | \$ 10,734,256 |
| Indirect  | 20         | \$ 924,618    | \$ 1,317,406  | \$ 2,397,971  |
| Induced   | 17         | \$ 639,829    | \$ 1,222,432  | \$ 2,012,485  |
|   | 75         | \$ 5,475,790  | \$ 7,536,065  | \$ 15,144,712 |
| <b>Combined Military &amp; Civilian Employees, Non Contract O&amp;M, and DOD Contracts and Assistance</b> |            |               |               |               |
|   | Employment | Labor Income  | Value Added   | Output        |
| Direct  | 483        | \$ 24,759,153 | \$ 54,077,986 | \$ 70,499,612 |
| Indirect  | 47         | \$ 1,981,774  | \$ 2,810,774  | \$ 5,155,512  |
| Induced   | 97         | \$ 3,538,701  | \$ 6,761,962  | \$ 11,133,050 |
|   | 627        | \$ 30,279,628 | \$ 63,650,722 | \$ 86,788,174 |
| Source: Summit Economics, LLC   |            |               |               |               |

**Table 13 - Average Labor Income of DOD Related Activities, El Paso, Arapahoe and Weld Counties**

| Job Type     | Employment     | Average Labor Income |
|--------------|----------------|----------------------|
| Direct       | 87,271         | \$ 90,120            |
| Indirect     | 17,614         | \$ 54,073            |
| Induced      | 38,965         | \$ 42,189            |
| <b>Total</b> | <b>143,851</b> | <b>\$ 72,723</b>     |

Source: Summit Economics, LLC

The output of these models included both the direct jobs supported and the indirect and induced jobs created as a result. Table 13 presents the average labor income of DOD related employment for the three counties combined. In total, the employment impact of the military in the three counties is approximately 144,000. Labor income, which includes all benefits and labor overheads, totals over \$10.4 billion. The average labor income for direct jobs is over \$90,000, while the indirect and induced job averages are somewhat lower. Indirect jobs are those that arise due to providing support directly to the military installations and typically consist of a larger mix of non-professional jobs, and subsequently have lower wages. Induced jobs typically include the general retail and service jobs found in all economies, and have the lowest percentage of highly skilled and highly paid workers.

The average direct labor income of \$90,000, and \$72,000 for all jobs, is not the same as an average wage. Average wages will vary significantly between sectors. Most military installations had an effective average wage in the \$58,000 per year range, while aerospace professionals often have wages well above \$100,000 per year. Labor income does include a non-wage component of proprietors' income, and some non-wage benefits. In general, average wages are about 10% lower than average labor income. Wages of indirect and induced workers will more closely reflect the community at large.

The statewide economic impact occurs not just in the three counties with military installations, but throughout the State. Contracts and assistance awards for DOD are identified based on the location of the firm receiving the contract. While the vast majority of such firms are located throughout the Metro Denver area and in El Paso County, significant numbers are located throughout the State. There are almost 14,000 separate contracts and assistance awards let to firms and other entities doing business in Colorado, with almost every county having some recipients of these funds. Table 14 shows the value of DOD contracts made in all counties of Colorado. These economic impacts of the expenditures in all other counties other than El Paso, Arapahoe and Weld Counties were separately modeled in IMPLAN, and added to the impacts from the three counties.

| <b>Table 14 - DOD Contracts by County, 2014</b>   |    |               |            |    |               |
|---|----|---------------|------------|----|---------------|
| ADAMS   | \$ | 12,067,389    | JEFFERSON  | \$ | 59,995,708    |
| ALAMOSA   | \$ | (3,274)       | LA PLATA   | \$ | 320,382       |
| ARAPAHOE  | \$ | 3,190,081,763 | LAKE       | \$ | 3,870         |
| BENT  | \$ | 395,351       | LARIMER    | \$ | 22,175,272    |
| BOULDER   | \$ | 206,028,400   | LAS ANIMAS | \$ | 1,101,139     |
| BROOMFIELD  | \$ | 21,324,678    | MESA       | \$ | 35,032,412    |
| CHEYENNE  | \$ | 19,644        | MONTROSE   | \$ | (21,906)      |
| DELTA   | \$ | 13,267        | MORGAN     | \$ | 36,230        |
| DENVER  | \$ | 114,374,290   | OTERO      | \$ | 146,077       |
| DOUGLAS   | \$ | 5,735,446     | PARK       | \$ | 168,330       |
| EAGLE   | \$ | 827,245       | PROWERS    | \$ | 19,177        |
| EL PASO   | \$ | 2,044,798,575 | PUEBLO     | \$ | 48,145,339    |
| ELBERT  | \$ | 233,763       | ROUTT      | \$ | 9,731         |
| GARFIELD  | \$ | 54,197        | SUMMIT     | \$ | 24,467        |
| GRAND   | \$ | 46,459        | TELLER     | \$ | 3,180,635     |
| GUNNISON  | \$ | (12,720)      | WELD       | \$ | 1,652,109     |
| Grand Total   |    |               |            | \$ | 5,767,973,446 |
| Negative numbers represent contract termination adjustments, intra-year transfers and other repayments or adjustments. Dollars shown represent obligated amounts. |    |               |            |    |               |
| Source: Summit Economics, LLC and USASpending.gov   |    |               |            |    |               |

Like contracts, DOD assistance awards also have a direct impact on the State. These assistance awards are awards to State and local government as well as universities and non-profit organizations. Table 15 shows the assistance awards that were modeled along with the DOD contracts.

| <b>Table 15 - DOD Assistance Awards by County, 2014</b> |               |
|---|---------------|
|   | Total         |
| ADAMS   | \$ 343,980    |
| ALAMOSA   | \$ 248,681    |
| ARAPAHOE  | \$ 18,799,819 |
| BOULDER   | \$ 23,006,672 |
| DENVER  | \$ 9,171,071  |
| EL PASO   | \$ 8,432,838  |
| JEFFERSON   | \$ 3,378,606  |
| LARIMER   | \$ 8,380,309  |
| PUEBLO  | \$ 1,691,279  |
| WELD  | \$ 390,600    |
| TOTAL   | \$ 73,843,855 |
| Source: Summit Economics, LLC and USASpending.gov       |               |

## **Trade Flow Analysis**

As military and civilian employees spend their paychecks, they travel throughout the State for shopping, recreation, tourism, visiting family and friends, and a host of other reasons. As an example, the ski industry of Colorado is made up primarily of skiers from counties other than the county in which the ski resort is located. As military bases purchase goods and services, some of these purchases are made from suppliers outside the home county. These expenditures and their impacts are defined as the *trade flow effects*.

To assess the trade flow effects, additional IMPLAN modeling was performed to determine the number of jobs created in all other counties as a result of economic activity in a military installation county. For example, the impacts of the military installations in El Paso County, plus the DOD contracts and assistance awards were run through a separate IMPLAN model that calculated the employment and earnings impacts in the remaining 63 counties of Colorado. This was done for the five installations in El Paso County, Buckley AFB in Arapahoe County, and Greeley ANGTS in Weld County.

The trade flow job creation totaled almost 15,000 jobs in the rest of Colorado, with a labor income of just over \$1 billion. The employment impact of this trade flow was shown in Table 2, along with the impacts from all DOD impact streams.

## **National Guard/Reserves Analysis**

As a final step, estimates were obtained of National Guard and Reserve employment by each county in Colorado through the Bureau of Economic Analysis (BEA). The figures represent employment by place of work, but do not distinguish between full time and part time employment. The economic impacts of National Guard and Reserve personnel were also run through IMPLAN models, based on estimated earnings of \$7,600 per year per reservist. Actual earnings, in either total or an average earnings figure, were not available. Summit Economics, using the National Guard pay schedules, then estimated the \$7,600 average based on an assumption that 90% of the reservists earn \$4,000 for the one weekend per month and two weeks per year requirement, while 10% are full time earning \$40,000 per year.

## **Colorado Fiscal Impacts**

Table 16 presents the DOD impacts upon the State of Colorado tax revenues. The fiscal impact calculations are based upon DOD being responsible for 5.2% of the total employment and 7.5% of the total labor earnings in Colorado which were previously cited in Table 1 of the same name.

| <b>Table 16 - Fiscal Impacts on the State of Colorado from DOD Related Employment, Earnings and Expenditures</b>   |                   |
|--|-------------------|
| Total Actual State Sales Tax Collections, 2013   | \$ 2,187,244,101  |
| Total State Sales, Use and Excise Tax Collections, 2013  | \$ 3,358,295,290  |
| Total State Sales Tax Collections from DOD Related Expenditures, 2014 (IMPLAN)                                     | \$ 109,431,951    |
| Total State Sales, Use and Excise Tax Collections from DOD Related Expenditures                                    | \$ 168,021,852    |
| Ratio - Estimated Sales Tax from DOD Related Expenditures to Total Sales Tax                                       | 5.0%              |
|  |                   |
| Total State Personal Income Tax Collections  | \$ 5,492,975,311  |
| Total State Personal Income Tax Collections from DOD Related Expenditures, 2014                                    | \$ 300,551,392    |
| Ratio - DOD to Total Income Tax  | 5.5%              |
|  |                   |
| Total State Corporate Income Tax Collections   | \$ 652,180,000    |
| Total State Corporate Income Tax Collections from DOD Related Expenditures, 2014                                   | \$ 48,261,320     |
| Ratio - DOD to Total Labor   | 7.4%              |
|  |                   |
| Total State License, Motor Vehicle, Regulatory & Business, and Other Tax Collections                               | \$ 608,220,356    |
| Total State "Other" Tax Collections from DOD Related Expenditures, 2014  | \$ 45,008,306     |
| Ratio - DOD to Total Labor   | 7.4%              |
|  |                   |
| Total Revenue to the State of Colorado from Taxes Derived Directly or Indirectly from DOD Related Activities, 2014 | \$ 561,842,870    |
| Total State Revenues from All Sources, 2013  | \$ 10,285,452,173 |
| Share of Total State Tax Revenues from DOD Related Activities  | 5.5%              |
| Source: Summit Economics, LLC; Colorado Department of Revenue, 2013 Annual Report                                  |                   |

The State of Colorado imposes a 2.9% sales tax on certain taxable retail expenditures. It is possible to make a reasonable approximation of the sales tax collected by Colorado on the expenditures of earnings by the jobs supported by DOD activities. With a labor income of more than \$11.5 billion (see Table 1) and approximately 90% going directly to wages, \$10.3 billion is earned as wages. Coincidentally, that is about the same as total State revenues from all sources. Assuming approximately 36% of that total is spent on taxable goods and services, \$3.7 billion is taxable by the State. That equates to about 5.0% of the State taxable sales, and sales tax collections. Applying the 5% ratio to all sales, use and excise tax collections, approximately \$168 million is collected by the State due to DOD activities.

State personal income taxes collected by DOD operations were also estimated. Based on the ratio of total personal income as reported by the Bureau of Economic Analysis divided by total personal income taxes paid, the effective average personal income tax rate in Colorado in 2013 was about 3.5% of total personal income. While the nominal State tax rate is 4.5%, some income such as portions of pension and annuity income are non-taxable. Applying the 3.5% average effective personal tax rate to the DOD related personal income suggests that about \$300 million is collected

by Colorado due to DOD earnings. Because of the combination of having some military personnel not being residents of Colorado and not paying any State Personal Income Tax, with the balance of all other military and civilian jobs created not being pensioners (and therefore paying 4.5%), the actual amounts subject to Colorado Personal Income Tax can only be approximated.

Other tax revenue sources for the State include corporate income taxes, and motor vehicle, license, regulatory and business licenses. Applying the 7.5% earnings share of the DOD to total State tax collections in these two categories adds another \$100 million.

In total, DOD related activities contribute about 5.2% of the State’s total jobs and 5.5% of the State’s total tax revenue.

**Other Economic Analyses**

The economic impact analysis presented above represents the most common analysis used nationally to document jobs, income, value added, and output created by an economic sector such as DOD funding of military installations and contracts executed in Colorado. There are other, more subtle impacts that in the course of a region’s history can be just as important. These are discussed below.

**DOD Compared to Other Industry Sectors**

Table 17 presents an analysis of the makeup of the State of Colorado’s economy, based upon a county- by-county analysis prepared by the State Demographer’s Office. The DOD jobs are added for comparison (see Department of Defense row at the bottom of the table). The jobs shown in the table are “basic” jobs. *Basic jobs* are those jobs created directly from dollars coming into the State from the rest of the world. All jobs in an economy result from the basic jobs. In this sense, basic jobs are similar to the direct impact noted previously in this report in that the basic jobs create indirect and induced jobs. This effect is

| Rank Ordered - Largest to Smallest   | Total            | % of Total    |   |
|--|------------------|---------------|---|
| Retiree Households   | 298,789          | 22.9%         |   |
| Tourism  | 159,938          | 12.3%         |   |
| Prof. Tech & Business Srvcs  | 149,994          | 11.5%         | → |
| Other Households Investment Income   | 138,853          | 10.6%         |   |
| Government   | 107,605          | 8.2%          | → |
| Agribusiness   | 100,450          | 7.7%          |   |
| Other Households Transfer Payments   | 92,550           | 7.1%          |   |
| Health & Education   | 87,011           | 6.7%          |   |
| Manufacturing  | 72,837           | 5.6%          | → |
| Trade and Transportation   | 31,643           | 2.4%          |   |
| Mining   | 28,813           | 2.2%          |   |
| Finance, Insurance and Real Estate   | 20,846           | 1.6%          |   |
| Information, Comm.   | 9,908            | 0.8%          |   |
| Construction   | 5,495            | 0.4%          | → |
| <b>Total Basic Jobs</b>  | <b>1,304,733</b> | <b>100.0%</b> |   |
| <b>Total Jobs</b>  | <b>2,975,447</b> | <b>228.1%</b> |   |
| <b>State Economic Multiplier</b>   | <b>2.28</b>      |               |   |
| <b>Department of Defense</b>   | <b>100,445</b>   | <b>7.7%</b>   | ← |
| Industries that include significant DOD Direct Employment  |                  |               |   |
| State Demographer only estimates basic jobs by county. These were summed and adjusted by Summit Economics to account for tradeflows between counties where a basic country job becomes an indirect state level job |                  |               |   |
| Source: State Demographer, Summit Economics  |                  |               |   |



known as the state economic multiplier.

The industries are arranged from largest to smallest in terms of number of basic jobs created in each industry. As the table shows, retirement income coming to Colorado households from out-of-state creates, by far, the largest number of basic jobs in the State. The highlighted rows show those industries which include most of Colorado's DOD jobs, which are also basic jobs since DOD funding originates from out-of-state. In other words, if there was no DOD funding each highlighted row would be substantially less than shown.

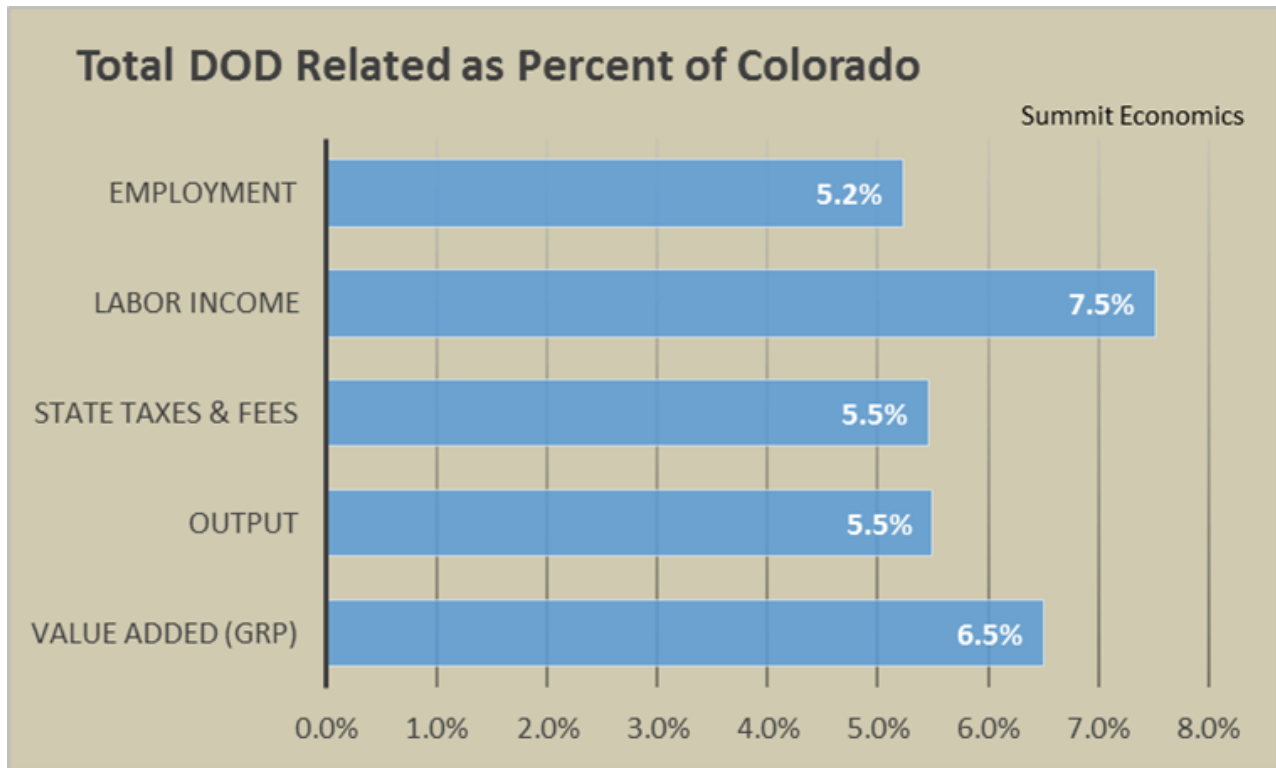
From this perspective, DOD makes up the seventh largest industry – essentially tied with the entire agricultural sector of the State at 7.7% of all basic jobs in state.<sup>9</sup> In fact, without DOD active duty and civilian jobs, the number of government jobs shown would be cut in half thereby moving government basic jobs down in ranking and DOD and agriculture up to 5<sup>th</sup> spot. In terms of traditional industries (excluding basic jobs created from retired households and investment income), DOD and agriculture are tied for the third largest industries behind tourism and the cluster of professional, technical, and business services. It is also worth noting that approximately 10% of the retiree jobs come from VA retirement benefits in the State from compensation and pension benefits paid to military retirees in Colorado.<sup>10</sup>

Figure 4 summarizes the significant economic impact of DOD on the State of Colorado.

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<sup>9</sup> The DOD's creation of 7.7% of total basic jobs is higher than all other impacts because the number of basic DOD jobs includes 11,085 part-time National Guard and Reserve jobs.

<sup>10</sup> Based upon 2013 Veterans Administration expenditures in Colorado.



**Figure 4: Total DOD Economic Impact as a Percentage of Colorado Economy**

- The **employment and labor** percentages include direct, indirect and induced impacts relative to totals in Colorado as derived through IMPLAN modeling. Labor income is higher due to higher average wages and the inclusion of benefits such as base housing allowances.
- **State taxes and fees** include State sales taxes, personal income taxes, corporate income taxes, and other licenses, taxes and fees.
- **Output** is the economic value of the project in the local economy as measured by gross receipts in all industries; the value of production before expenses.
- **Value added** is the equivalent of gross regional product (GRP) which is the state equivalent to national gross domestic product (GDP). Value added includes employee compensation (total payroll costs including benefits), proprietor's income (payments received by self-employed individuals as income), other income (payments for rents, royalties and dividends), and indirect business taxes (excise taxes, property taxes, fees, and sales taxes paid by businesses).

## **Economic Diversity & Cycles**

All economies are made up of some combination of economic sectors. Some economic sectors add greater economic diversity, some add more stability, and some add greater opportunity than others. The diversity of economic sectors is a valuable attribute because diverse sectors operate on different business and economic life cycles compared to the majority of the regional economy.

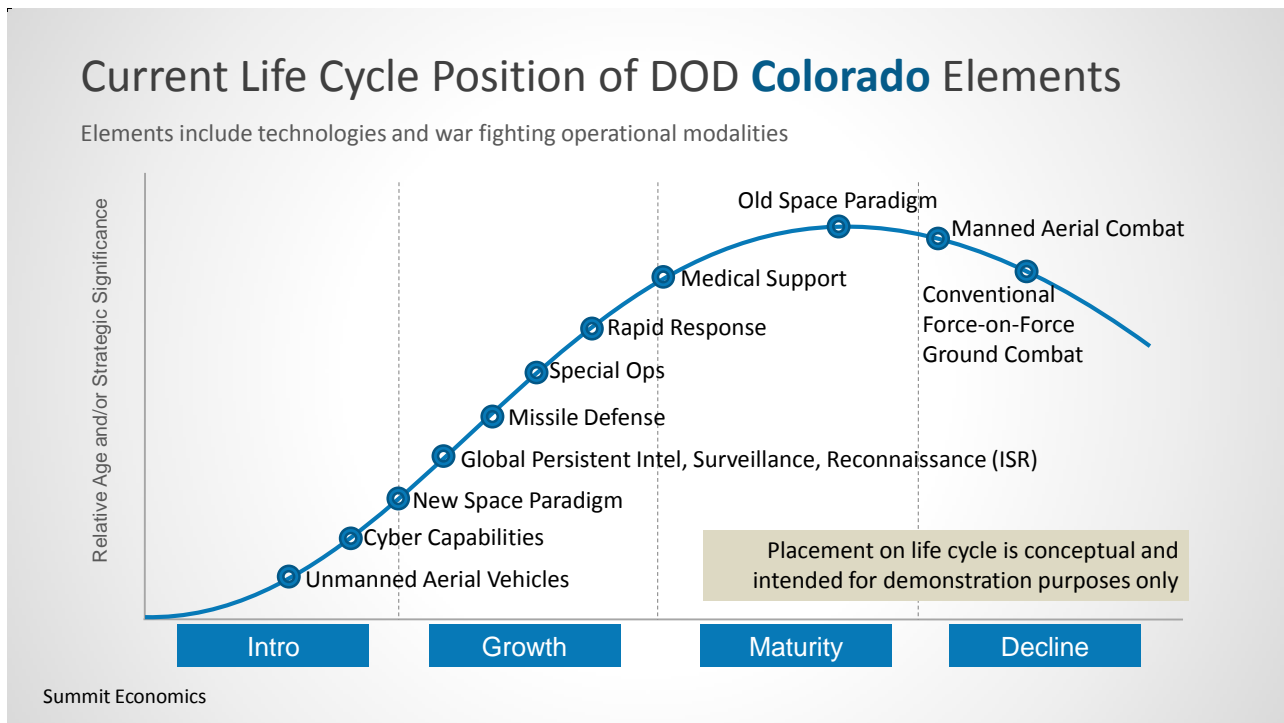
DOD funding for military installations and contracts and assistance adds great diversity to Colorado's economy, since the peaks and valleys of DOD funding have very little to do with the overall business cycle which includes periods of expansion and recession. The DOD cycle is driven by geopolitical events and long-term defense strategies (e.g., the Cold War and the Global War on Terror), mobilizations for intense wars (e.g., WWII), and the need for periodic surges to respond to short-term incidents (e.g., domestic natural disasters and small-scale overseas contingencies). Furthermore, the focus of DOD funding changes based upon technology. When DOD funding is increasing during poor overall economic conditions, a degree of downside stability is created. For example, in January 2009, as the "Great Recession" was hitting its zenith, a major news network reported that the Colorado Springs metropolitan statistical area (MSA) had the largest number of federal job openings outside of the Washington DC MSA. This fact represented a degree of stability to Colorado at the time. The reverse has been the case since the onset of sequestration this decade.

The other types of cycles influencing economies are product and technology lifecycles. These life cycles have introduction, growth, maturity, and decline stages. A diversified economy is not reliant on just one or two niche specialties since different sectors might both hit a maturity and/or decline stage at the same time. Ideally, an economy has a portfolio of activities such as technologies, programs, products, processes and projects at different stages of the lifecycle so that growing sectors counter declining sectors. Well-run organizations with a long-term strategic perspective adjust to different environments, including opportunities and threats. As a result they tend to have different aspects of operations in different phases of the life cycle. The DOD, being one of the largest militaries in the world charged with protecting the U.S. and its global interests, is very aware of the need to change with evolving challenges in the international arena and thus is diverse from a life cycle perspective.

Military history tends to point towards leadership, training, morale, and strategy as wartime critical success factors. All of these efforts occur within the context of a technological state which further defines how wars are fought. Often the tide of a war can change rapidly when one side introduces leap-ahead technological innovation. Since WWII the U.S. has focused on defeating the enemy with mass, or "overwhelming combat power at the decisive place and time". The overwhelming combat power may come from sheer numbers or from far superior technology. This principle has remained constant since the end of WWII and the beginning of the Cold War, but the method of delivery appears to be adopting a doctrine of greater flexibility via small, tactically focused efforts that use the nation's long-standing advantage of superior technology. Maintaining the technological

advantage is critical, not only for benefit of our national defense, but because it also provides a steady source of research and development funding that permeates the entire national economy greatly enhancing private sector research, development, and innovation. In this sense, the DOD is a large national economic driver pushing new technologies as well as capital investment and labor force training. With the advent of cyber threats and more countries having greater access to space and satellites, technology and new skill sets remain of critical importance to our national defense.

One way to view DOD as an economic driver is to consider different military elements placed on a life cycle curve as shown in the Figure 5 below. All of the elements have a presence in Colorado. The stage of the life cycle is shown at the bottom of the Figure. Starting with the decline state, one finds the traditional Army and Air Force in the decline stage being replaced by a growing emphasis on rapid response, intelligence, surveillance, and reconnaissance (ISR) on dispersed threats, both offensive and defensive cyber operational and tactical capabilities, missile defense, a new space paradigm, and timely processing and delivery of big data from multiple sources. This is an important consideration as over time each technology tends to move to the right becoming less cutting edge, until eventually it moves into the maturity and then decline phase. As a result, strategic planning must always be cognizant of the next new technology to introduce to the life cycle.



**Figure 5: Current Life Cycle Position of DOD Colorado Elements**

Some of the life cycle shifts can be seen at Colorado facilities. Fort Carson and Peterson AFB recently hosted a rapid deployment of rocket launchers from Oklahoma to Fort Carson after landing at Peterson and then moving down range to attack targets within three hours. The Air National

Guard (ANG) in Greeley practices rapid deployment to provide defenses for incoming missiles to the U.S. and our allies around the world. This is increasingly important as smaller nations gain nuclear weapon capability. Schriever AFB hosts space war games with allied leaders. This is important as the old paradigm of U.S. space dominance enters the decline phase to be replaced with space access by more countries, new generation satellites, and growing debris fields in historical space orbits. Buckley AFB provides air sovereignty/air control for the Rocky Mountain and Great Plains regions and hosts the Aerospace Data Facility (ADF). From this perspective, Colorado fares well economically in terms of the life cycle as it has DOD operations dispersed throughout the cycle. The State is especially well positioned in the space sector, including missile defense.

### **Locational Economics – Why Colorado? A Historical Perspective**

Location economics addresses the reasons organizations and people locate where they do. By understanding the reasons, one can gain a greater sense of the underlying attributes of a location and the organizational functions being performed. The beginning of the modern DOD presence in Colorado is traceable to the onset of WWII. Land was typically donated by local governments to the war effort. Colorado offered two distinct features for military training – high altitude mountain training and a central location relative to the east, west, and Gulf of Mexico coasts. The high altitude training was important to both ground and air forces, especially for fighting in the European Alps. The central U.S. location provided flexibility so that forces could be easily deployed to any coast of the United States. Being removed from the coasts also provided a natural geographic defensive position. This gave Colorado an absolute advantage which was not easily replicable by any other region in the nation.

After WWII the massive military ramp-ups reversed as there was little locational advantage since Colorado was still rather remote from a transportation perspective and had a relatively small population base at 1.3 million people. However, with the creation of the Air Force as a new branch of the military, Peterson Field was retained and in the 1950s Colorado Springs won out against competing cities by offering the future Air Force Academy land and a reliable supply of water by constructing a pipeline from the Continental Divide. The Korean and Vietnam Wars and expansion of Camp Carson to Fort Carson through the acquisition of additional land for mechanized training created a more permanent Army presence in Colorado. The construction of the NORAD facility in Cheyenne Mountain as the nerve center for intercontinental ballistic missile threats again played on Colorado's central U.S. and naturally protective mountainous location in order to enhance survivability and additional response time in the event of a nuclear attack from the Soviet Union.

These historical events from the early 1940s through the 1960s ended the first stage of DOD development in Colorado. During the second stage, from 1970 to 2010, Colorado's population grew from 2.2 million people to 5 million thereby adding substantial urban elements such as more broad-based education, housing, shopping, and recreation opportunities to enhance the overall quality of life of military personnel and veterans who frequently returned to Colorado after being stationed in the State. Further growth of DOD installations was related to the urbanization

phenomenon combined with land availability and localization economies of scale. The urbanization and opportunities for economies of scale allowed the Colorado DOD installations to increase their effectiveness and efficiencies through capacity additions, moving more DOD tenants onto existing facilities and locating more installations in the area. This was evident with Peterson AFB in the 1970s, Schriever AFB in the 1980s, Greeley ANG Station in the 1990s, and is evident with Buckley AFB today. With Buckley AFB, the central U.S. location and lower transportation costs have returned as relevant due to the location of Denver International Airport (DIA) close to Buckley. These events are summarized in the Table 18.

**TABLE 18: Fundamental Location Forces - History of Colorado Installations**

|   | 1940s  | 1950s  | 1960s  | 1970s   | 1980s  | 1990s  | 2000s                                    | 2010s |
|---|--|--|--|---|--|--|--|-------|
| <b>Absolute &amp; Comparative Advantage</b>   | Camp Carson and Peterson Field - High altitude flying and mountaineering. Buckley developed in WWII as air station   | USAFA - Central to U.S. -- land, air, and water availability | Cheyenne Mountain Station - Distance from nuclear missile attacks and mountain |   |  |  | Buckley becomes home to 460th Space Wing |       |
| <b>Transportation Cost Differentials</b>  |  | Flexible Deployment to any Coast                             |  |   |  |  | Central Location for Air Transport       |       |
| <b>Localization Economies (Increase in output of all firms in a given industry in a given location)</b> | Buckley had different "owners" during early post-WWII era. Peterson became an Air Force station when the AF became an official branch of the military, but most non-airfield operations were in downtown Colorado Springs at Ent AFB. Camp Carson went from 36,000 troops during WWII to 600 post-war, but had value for mechanized divisions due to land availability and gradually grew during the Cold War. |  |  | Ent AFB closed and ops moved to Peterson AFB under Strategic Air Command (Due to Cheyenne Mountain and USAFA) | Peterson home to AF Space Com. Schriever - Missile Defense & Satellite operations              | Greeley ANG to consolidate in Colorado with other Missile Defense agencies |  |       |
| <b>Workforce Cost &amp; Quality</b>   |  | Army Veterans  |  | Emerging AF Veterans  | Full fledged military retirement & veterans (many well educated) complement defense contractor |  |  |       |
| Source: Summit Economics, LLC   |  |  |  |   |  |  |  |       |

### Economies of Agglomeration

The historical growth of DOD expenditures and the associated indirect impacts create spinoff sectors and economies of agglomeration which can also have substantial impacts that are much more difficult to measure. Economic *agglomeration* is a cumulative, self-reinforcing process that concentrates talent, productive capacity and innovation creating spin-off industries and organizations that attract funding from the other firms in the same industry (in this case, DOD) as well as non-DOD entities such as other federal agencies and public and private organizations from around the world. Agglomeration effects typically begin with the localization economies of scale

which then attract organizations seeking the specialized workforce and economic infrastructure that develops to support the sector. As the agglomeration process reinforces itself and accumulates over time, it supports economic urbanization forces resulting in further workforce growth with higher paying wages, more innovation, and more agglomeration.

The Colorado agglomeration economies centered on DOD were greatly enhanced by the number of veterans who, after experiencing the overall quality of life in Colorado while stationed in the State, chose to settle in the area after their military careers. They found extensive outdoor recreation opportunities, urban amenities, and both on-post and off-post support for veterans and their families. Historically, veterans often choose retirement communities to settle in when they are in their 20s through early 50s. Thus a capable workforce began developing and became noticeable in El Paso County as early as the 1960s. The Census Bureau estimates 10.4% of Colorado's 2010 adult population are veterans (340,000 people) ranking the State 20<sup>th</sup> among the 50 states where an average of 8.9% of all adults are veterans. El Paso County has 87,000 veterans or 18.7% of its population over the age of 18. This ranks El Paso County 14<sup>th</sup> out of 3,180 counties nationwide.<sup>11</sup>

Veterans, including retired veterans, provide support to military installations as DOD civilians, employees of DOD contractors, and Reserve Component members. The DOD civilians and contractors are especially noticeable in the higher technology sectors such as aerospace and information technology. Veterans are also notable in defense contracting with global allies where they may train foreign military personnel or help implement new technologies. In its heyday of the 1980s and 1990s high technology manufacturing made extensive use of military spouses and veterans in El Paso County. Today the same applies in sectors such as call centers, education, and non-profits. Non-profit leadership and more commission-based services such as financial services are especially attractive to retired military as the retirees are often in a better position to assume these positions with their supplemental income sources. Many of the firms in these sectors serve regional, national, and international markets.

While active duty military are compensated more or less equally regardless of their duty station, the availability of veterans provides a more flexible workforce which can lower contractor costs, thereby making Colorado more competitive for DOD and other major contracts, both public and private, which furthers economy diversification. The lower contractor cost may come from lower wages and salaries, but often comes from a labor force acculturated to DOD, with more suitable training, and with security clearances. This helps provide better returns and promotes economies of scale, thereby making existing military installations more attractive for DOD-directed growth and investment if suitable land and airspace are available.

The active duty military and veterans in Colorado significantly impact higher education in the State. In 2013, the Veterans Administration spent 2.7% of its educational benefits and vocational rehab

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<sup>11</sup> Fort Carson and Peterson AFB have been anecdotally cited as the most frequently requested last tours of duty in their respective branches. The VA reports 391,000 veterans in Colorado in 2013 representing 1.8% of veterans nationally. This compares to 1.7% of the U.S. population residing in Colorado.

(EBVR) budget (\$324 million) in Colorado even though the State only had 1.8% of the nation's veterans. Only three states (California, Virginia, and Texas) garnered more of the VA's EBVR budget relative to their respective veteran populations. The post-9/11 GI Bill website lists 89 colleges, universities and training programs in Colorado where these benefits may be used. The post-9/11 GI Bill program provides 36 months of tuition, a monthly living allowance that varies by zip code, and a stipend for books and supplies of \$1,000 annually. The 36-month benefit for a full time student can exceed \$100,000 which provides a source of revenue to colleges and universities beyond traditional sources. The *2015 Guide to Military Friendly Schools* includes eight of Colorado's community colleges. Pikes Peak Community College in Colorado Springs tops the list with 24% of its students either active duty military or veterans. It is among the top 20 in the nation in terms of number of veterans served.

Through the generous education benefits afforded active duty military and veterans, Colorado's workforce, which ranks 3<sup>rd</sup> in the nation in terms of adults 25+ with at least a bachelor degree, is further enhanced. Interviews with staff at three University of Colorado campuses, where thousands of veterans and active duty military are pursuing post-secondary degrees, reveals very busy Offices of Veterans Services on each campus supporting student veterans and veteran dependents. These Veterans Services offices are attractive targets for donations from private companies and foundations seeking to better support our veterans as they transition in their lives. JP Morgan Chase, which has given \$25 million to support veterans nationwide since 2011, recently made a \$65,000 donation to The University of Colorado, Colorado Springs campus (UCCS).<sup>12</sup>

One veteran services director pointed out that, with the exception of the VA hospitals, higher education campuses are the primary place where veterans concentrate. Some of the other findings related to post-secondary education include:

- The active ROTC program on the Boulder CU campus helps finance the education of hundreds of students -- providing \$6.85 million in tuition annually to almost 400 students.
- UCCS is ranked 44th among 140 public and private institutions by *Military Times*. Of the 11,120 students enrolled at UCCS in the Fall of 2014, 1,065 were attending on post-9/11 GI Bill benefits, 468 veterans and active duty attended on vocational rehab and other tuition assisted programs, and 97 were attending without using military benefits. This accounted for 14% of the student body, a 6% increase from the Fall of 2013.
- CU Denver has 700 full time students, primarily using the post-9/11 GI Bill, on the campus in the Fall of 2014. CU Denver has teamed up with the Denver Metro Chamber of Commerce to create CU Denver Boots to Suits, a program designed to help veterans shift from their roles as service members to students and, from there, to business professionals and leaders in the community.<sup>13</sup>

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<sup>12</sup> The Anschutz Family Foundation also has issued a \$1 million challenge grant to UCCS for its veteran services.

<sup>13</sup> UCCS has also created a Boots to Suits programs.



The magnitude of DOD and VA dollars flowing into Colorado universities enables the schools to increase both the depth and breadth of their curricula. It can also assist in promoting faculty research by providing a stronger resource base for attracting faculty who are leaders in their respective fields. This is growing in importance as the role of university research in economic development is apparent. Universities can serve as sources of innovation and entrepreneurship. Sometimes this occurs through research and development and subsequent technology licensing. Some specific examples where the agglomeration effects in colleges and universities create even greater economic growth include:

- The U.S. Air Force Academy has the highest level of research and development funding of any undergraduate college or university in the nation. USAFA recently entered into an agreement with the Colorado Springs Technology Incubator for licensing technology.
- Webster University created the first space operations management Master of Science degree in the world in 1983 due to demand in Colorado Springs. The program expanded into Denver and last year Webster introduced an online format which is anticipating global distribution.
- UCCS created a Cyber Security Department within their engineering school. The cyber security program, which has finished as high as 4<sup>th</sup> in national competitions, now offers undergraduate, masters, and doctorate degrees in cyber security and recently was selected by the Army Reserves to be one of six schools to receive Reserve funding so that qualified reservists can further their education in the realms of cyber security to better defend critical infrastructure such as utilities.

The natural growth of specialized education and the resulting unique workforce, including entrepreneurs, operates like a self-reinforcing system that stimulates growth in other economic sectors, some of which are closely related to DOD and others of which have nothing to do with national defense. Figure 6 demonstrates systematically how initial economic impacts from DOD installations and contracts in Colorado can grow far beyond the direct, indirect, and induced impacts from the DOD expenditures made in the State as measured in the traditional economic impact analysis section of this Report (see the top of Figure 6 with the red boxes and large green arrows).

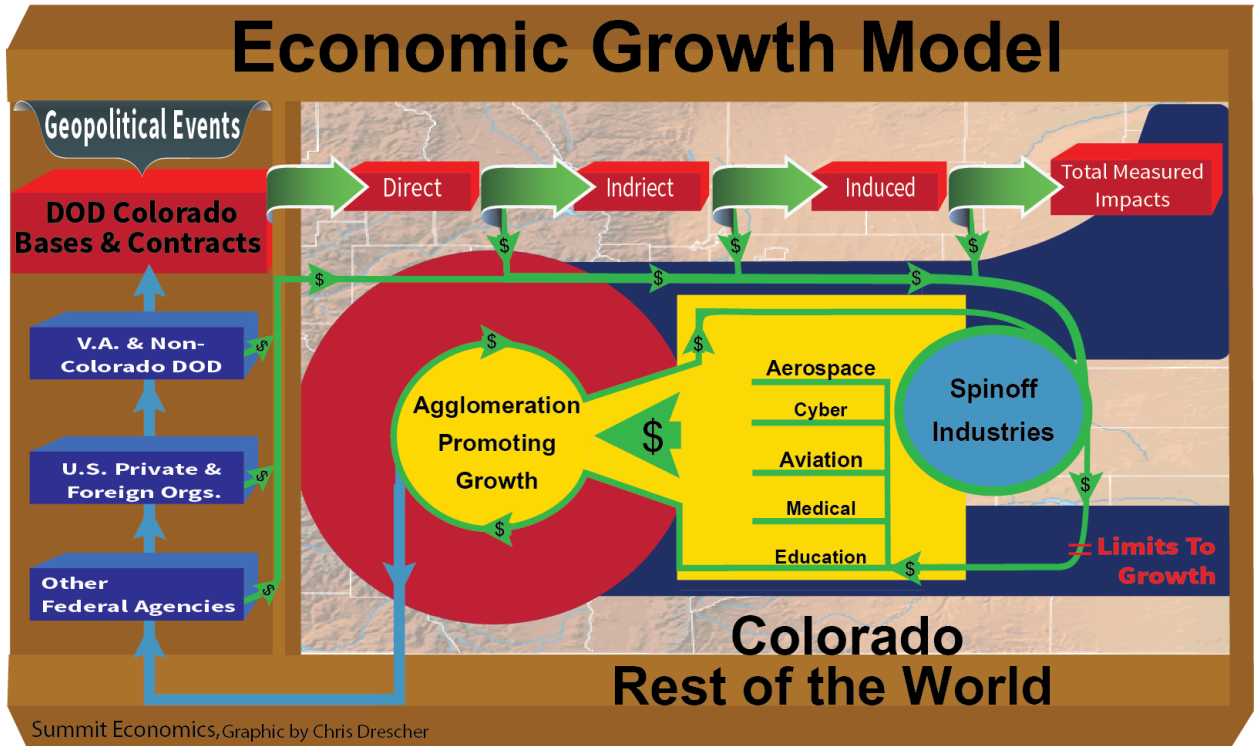


Figure 6: Colorado Economic Growth Model

The Colorado map and flag represent the Colorado economy related to and stimulated by defense spending. Outside the Colorado map, in brown, is the rest of the world including (on the left side) DOD funding for Colorado bases or installations and contracts (red box), as well as spending from non-Colorado DOD<sup>14</sup>, the Veterans Administration, other federal agencies, and private and foreign organizations (blue boxes). In addition to the traditional economic impacts flowing across the top of the Figure, other economic growth is stimulated which is not reliant on DOD spending. These impacts, conceptually at least, should be added to the DOD traditional economic impacts to yield a total “Economic Growth Model” depicting a self-reinforcing system. As the total measured impacts from the initial DOD spending (upper right) grow over time, the workforce grows and creates additional education and other economic infrastructure. This in turn results in spinoff industries, organizations, and new departments or product lines within DOD-related organizations. The spinoffs and DOD growth reinforce one another (shown by the green money flow) and in some cases create economies of agglomeration resulting in related, but separate industries such as aerospace, cyber, aviation, medical, and education (in the yellow section of the Figure). As the agglomeration effect grows additional sources of funding from the rest of the world can be supported by the Colorado economy (blue arrows and boxes on the left). This is the fundamental

<sup>14</sup> Non-Colorado DOD funding includes DOD spending on education or travel in Colorado that is not included in Colorado base or installation budgets nor contracts with Colorado companies.

self-reinforcing dynamic of economies of agglomeration. Organizations and functions clustering close to one another, even as competitors, can experience more efficient operations due to the development of specialized suppliers, workers, and education systems to support the cluster.

There are also limits to growth of DOD and agglomeration economies as shown in red at the bottom right of the Figure. In this case the most obvious limits are possible over-concentration of key defense assets and capabilities in a single location, encroachment from non-DOD uses which limit the expansion of DOD facilities, and existing DOD facilities running out of land for continued growth. These limits create a degree of economic drag on growth tendencies.

In some cases the spinoff of technologies and processes result in entirely new industries. An example was the post WWII acceleration of the Colorado ski industry spurred by the 10<sup>th</sup> Mountain Division. While the State and national ski industry would have developed regardless of the military, the involvement of 10<sup>th</sup> Mountain Division WWII veterans was certainly catalytic at the time when they developed Aspen and Vail and other resorts across the country. Today, 18% of Colorado's tourism industry -- Colorado's largest industry in terms of employment -- is based on skiing resulting in a \$3 billion economic impact representing between 0.5% and 1.0% of the State's economy.<sup>15</sup>

These spinoff and agglomeration progressions are occurring in many areas including retrofitting aircraft from around the globe with more efficient engines and modern avionics to promoting environmental sustainability. For instance, according to locally-provided information, Fort Carson might have the highest concentration of LEED-certified buildings anywhere in the world. This results from Fort Carson being an Army demonstration site for sustainability for over a decade. During this period approximately \$2 billion has been spent from the military construction budget -- most funding projects meeting the LEED standards. While one might question the economic return of those investments to DOD, it has become apparent that the Colorado architects and contractors who participated in the construction gained substantial LEED knowledge to the point where they are able to design and build to the LEED standards at a cost similar to typical construction, thereby becoming leading-edge innovators in the field.

The largest industry to grow as a result of DOD's history in Colorado is the aerospace industry. Today Colorado ranks second in private sector space employment with 66,000 workers, including those working on DOD contracts, and a total value added of \$8.7 billion - almost 3% of the State's total GDP.<sup>16</sup> The nine counties within the Denver Metro area contribute to ranking Denver first of the largest 50 cities in private aerospace employment concentration.<sup>17</sup> Arapahoe County is the center for DOD-funded aerospace manufacturing. Several of the larger aerospace companies are

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<sup>15</sup> It is unclear if the \$3 billion is value added or total output. Depending upon which is the relevant number, ski tourism represents between 0.5% and 1% of the Colorado economy.

<sup>16</sup> OEDIT website and Brookings Report *Launch, Taking Colorado's Space Economy to the Next Level*. Based on 2011 data. DOD's contribution is at least \$2.4 billion of the \$8.7 billion.

<sup>17</sup> Aerospace -- Metro Denver and Northern Colorado Cluster Profile, Metro Denver Economic Development Corporation January 29, 2015

developing next-generation launch vehicles, including United Launch Alliance (a partnership between Boeing and Lockheed Martin) and a consortium led by Sierra Nevada Space Systems Group.

While much of this industry is based on DOD contracts, the aerospace industry ranks 4<sup>th</sup> in receiving NASA contracts totaling \$1.5 billion, and is actively competing for a place in emerging space markets such as tourism, point-to-point sub-orbital flights, and horizontal take off and landings.<sup>18</sup> Spaceport Colorado, in close proximity to Denver International Airport and Buckley AFB, has applied for an FAA license and is signing up international partners. Organizations like the Space Foundation, located in Colorado Springs, conduct an annual international symposium at the Broadmoor Hotel in Colorado Springs to promote the State as a global leader in space.

Another important connection with DOD is the information technology (IT) sector. Twenty-two percent of respondents to a business climate survey in El Paso and Teller counties who indicated they are substantially in the IT sector also indicated they are substantially in the defense sector. While DOD contracts with these firms that show up in the DOD contract database are included in the economic impact analysis, revenue sources from non-DOD federal agencies and private sector firms outside Colorado create additional impacts. Some IT defense contractors are increasingly looking to the healthcare, financial, and utility sectors for additional growth and business diversification as DOD faces the effects of sequestration cutbacks.

Where might future spinoffs occur? Some possibilities include:

- New generation GPS since the entire global system is operated from Schriever AFB. Lockheed Martin is currently developing GPS III.
- Cyber security since USAF Space Command, a tenant at Peterson AFB, oversees cyber for the Air Force, and the National Reconnaissance Organization (NRO) is Buckley's largest tenant at the Aerospace Data Facility. Given the Army presence in Colorado Springs and growth at UCCS, it is a natural progression to apply new cyber technologies to emerging threats to critical infrastructure like local utilities.
- New generations of artificial neural networks to process big data or massive amounts of data for machine learning and predicting the location and propensity of many small but significant threats from around the world.
- Unmanned aerial vehicles (UAV) -- while Colorado did not win their bid to become a FAA test site, it is likely the State will become a center for military drone training due to the availability of a high altitude airspace environment.
- Commercialization and globalization of high value U.S. declassified technology. There is a high concentration of retired senior officers who bring global networks of high level international allied leaders who are increasingly looking to develop their own military, aviation, and space capabilities.

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<sup>18</sup> Spaceport Colorado Marketing Plan 5-14-13, Webster University, Space Systems Operations Management (SPSM) graduate students Mark Perkins, Wesley Gunnar White and Anthony Winstead with guidance from: William Hoffman – the SPSM6000 Webster Graduate Program Study Director.

- Growing demand for space-based earth monitoring systems for commercial, scientific, social, and defense needs.
- Potential for more advanced materials research, founded in the materials research efforts launched with the growth of the space launch businesses in Colorado.
- Potential for growth in astronomy research and applications. With space-based astronomy taking the place of some remote mountain telescopes, world class astronomy no longer must be centered in remote locations.

These are all possibilities. What we know is that many defense contractors who are facing cutbacks under sequestration and who anticipate a period of DOD austerity are transferring their systems and marketing efforts to more promising markets like healthcare and foreign governments, as well as basic scientific, technical, engineering and mathematics (STEM) research and applications.

Table 19 summarizes how DOD agglomeration economies have played out over time in Colorado.

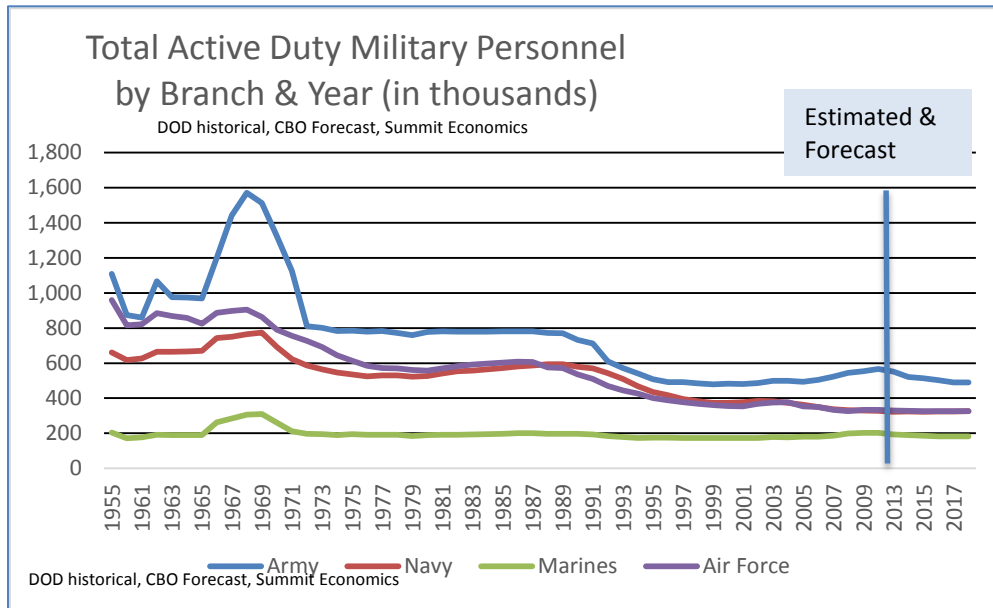
**Table 19: Economies of Agglomeration: Concepts and History**

|  | 1940s   | 1950s | 1960s | 1970s | 1980s  | 1990s | 2000s  | 2010s |
|--|---|-------|-------|-------|--|-------|--|-------|
| <b>Complementary Firms -- Shared Workforce</b>         |   |       |       |       | High Tech Manufacturing, Call Centers, Aviation, Aerospace, Information Technology, Non-Profit, Financial Services |       |  |       |
| <b>Large Scale Economies - Increasing Returns</b>      | Fort Carson + Colorado Air Force Space Com and Missile Defense + Pinon Canon Maneuver Site + Buckley Growth |       |       |       |  |       |  |       |
| <b>Urbanization Economies</b>                          | Installations, Education and Veteran Support  |       |       |       |  |       |  |       |
| <b>Innovation, Tech Transfers, &amp; Start-ups</b>     |   |       |       |       |  |       | Carson LEED w/ \$200 M MilCon/yr. DOD tech oriented retirees and more recently USAFA R&D, Technology Licensing |       |
| <b>Inherited and Substantial "Production" Networks</b> | Post WWII Ski Industry Development  |       |       |       | Colorado Aerospace Industry  |       |  |       |

Source: Summit Economics

## DOD Economic Outlook

Given that direct DOD expenditures in Colorado support 5.2% to 7.5% of overall state economic activity (depending on which measure is used), it is valuable to consider the economic outlook for DOD in Colorado. All branches of the military have experienced declining active duty personnel numbers over the last 40 years except the Marine Corps. There have been distinct periods of force reduction after the Korean and Vietnam Wars, as well as the “peace dividend” force reduction following the political disintegration of the Soviet Union. Forecasts by DOD and the Congressional Budget Office (CBO) show force reductions are expected through 2018, especially in the Army. This is confirmed in the DOD Future Years Defense Plan (FYDP) base budget. If the forecasts come true, the total force size will be the lowest in post-WWII history as shown in the following Figure 7.



**Figure 7: Total Active Duty Military Personnel by Branch and Year**

The impacts of the Budget Control Act of 2011 (sequestration) are more severe than the FYDP forecast in two ways. First, the automatic sequestration enforcement procedures which began implementation in 2013 will reduce DOD forecasted expenditures by approximately 15% relative to the CBO forecast. Second, the law mandates cuts across-the-board without considering the need to strategically invest or divest. The impacts of sequestration could even be more severe than the CBO estimates if funds are reallocated away from DOD proper, which historically received 95.5% of the national defense budget, to other national security agencies, a possibility given growing national concerns over cyber security. The two biggest budget items DOD must contend with are forecasted growth in:

- Operations and support (67% of DOD budget) which is forecast to grow at rates 1.2% higher than general inflation and is being driven by significant increases in military health care, some costly legacy weapon systems maintenance expenses, and increasing compensation of active duty and civilian employees.
- The cost of modernizing and replacing weapons systems (31% of DOD budget) and forecast to increase faster than inflation by 3% per annum.<sup>19</sup>

Long-term fiscal austerity and cost consciousness for DOD’s base budget appears inevitable. The CBO’s forecasts are predicated upon current laws and policies and do not consider future changes in the political environment in Washington D.C. The forecasts also assume continued economic growth consistent with recent years. Given that Colorado receives about 3.2% of the DOD base budget (excluding overseas contingency operations) and has 1.7% of the nation’s population, it is

<sup>19</sup> Forecast info is from the Congressional Budget Office, Long-Term Implications of 2014 Future Years Defense Program, <http://www.cbo.gov/sites/default/files/44683-FYDP.pdf>

clear that, relatively speaking, DOD's future funding levels are more important economically to Colorado than to many other states.

Fortunately the State has fared well in terms of DOD expenditures since WWII. Between the military choosing Colorado for some significant strategic and operational commands, stations and posts, and the State being very attractive in terms of the quality of life, opportunities exist to continue to attract military operations to the State from higher cost and lower quality of life regions. This is especially true where the current location has no particular strategic justification and/or where there could be excellent synergies with the multitude of military operations located in Colorado. But Colorado is vulnerable to losing military operations to locations that might be more strategic and/or on the cutting edge of technology research and development. Emerging technologies and approaches are reasonably well represented in the State with medical, missile defense, rapid deployment, space, cyber, and (eventually) even unmanned aircraft.

In summary, DOD is the third largest industry in the State of Colorado, exclusive of jobs created from retirement and investment income to households, and clearly the largest single customer and source of funding for the Colorado economy. DOD is an advanced industry pushing 21<sup>st</sup> century technologies and offering above average wages as well as substantial workforce training and advancement. Colorado has significant strengths and as a result has attractive opportunities to act on. DOD's agglomerated economic impact on Colorado is noteworthy and warrants attention to the recommendations that follow.

## **2. Summary of Prioritized Recommendations**

Section 1 of this Report postulates a number of strengths, vulnerabilities and opportunities at the State level and at the level of individual installations. In the first case, the analysis used nine attributes that DOD has stated are important to assessing military value. In the second case, the analysis used 11 military and economic value criteria that have been used by past BRAC examinations, modified to highlight the relevance of assessing DOD's economic contributions to a state's economy. The installation-oriented analysis is traceable to conversations, surveys and on-site visits, and thus some recommendations may reflect a level of granularity more specific than is the case with the first set of analyses. The most compelling recommendations are those that jointly promote enhancements to military value and economic impact. Actions taken by Colorado to improve the conditions borne out by the 11 military value criteria are not likely to undermine economic growth and prosperity, and all the recommendations that appear below promote both military value and economic impact.

- The State should continue to review, refine and advocate for the military value that Colorado's military installations, units and associated mission sets provide to DOD. The Air Force analogy to this recommendation is the persistent intelligence, surveillance and reconnaissance (ISR) capability the Service provides 24/7 to selected warfighters. Persistent ISR feeds into common operating pictures or views of the battlespace. That is what Colorado needs – a persistent picture of the Washington arena that is widely available to the stakeholders and advocates for the DOD across the State. The nation's legislators are currently ambivalent about supporting a BRAC in the near future. But all of the Military Services, the Chairman of the Joint Chiefs of Staff and the Secretary of Defense are on record advocating for a BRAC, sooner rather than later. The specter of sequestration beginning in FY16 is a shadow hanging over most internal DOD planning and programming deliberations. Colorado should be proactively monitoring the Washington political climate on DOD budget reductions, force structure realignments, and strategy changes.
- An array of entities exists within Colorado that advocate for the continued presence and future growth of DOD missions within the State. Many of these organizations are associated with chambers of commerce or other similarly oriented groups. An umbrella organization, similar to the Colorado Space Coalition, which could bring these organizations together, would create a synergy in messaging and intelligence (see previous recommendation) that would unify various regions in the State and strengthen the shared goals of military supporters. This umbrella organization should be supported within the auspices of an existing regional group but open to all stakeholders who seek to promote and support Colorado's continued role in national security.
- Pursue resolution of major challenges cited in Front Range Regional Encroachment Management Plan. These challenges are often jeopardizing – or have the potential to diminish – the military value of Colorado military installations to DOD. If a BRAC study were commissioned and used some semblance of the 11 military value criteria employed by



this Study, encroachment would not be a major detractor in part because of the successful attention that State and local officials have paid to it. But in a future BRAC Colorado needs to do more than just defend its current suite of installations, units and missions. It needs to position itself as a potential recipient of displaced units and missions, because of the many attractive strengths the State demonstrates. Showing a BRAC study that the State is aggressively addressing vulnerabilities in encroachment – no matter their extent – might be the special factor that separates Colorado from other potential state hosts seeking orphaned units and missions.

- Continue to monitor, inform and shape HQ US Army deliberations over the future of the Piñon Canyon Maneuver Site. The Study Team noted the HQ Department of the Army staff visit to Fort Carson in February 2015 and the exchange of information and concerns from both Colorado and senior Army leaders on the topic of impending force structure reductions. The Piñon Canyon Maneuver Site is a “wild card” that can be played a number of ways in this calculation – Colorado needs to ensure it is played to Colorado’s advantage, and that means remaining proactively engaged.
- Promote the State nationally in DOD, education and industry venues as a center of excellence for developing cyber and UAS capabilities. These are two consistently reliable and positively trending development areas in DOD and industry, and they both integrate easily within the existing synergistic strengths the State possesses with aerospace and high technology industry and with institutions of higher education. Colorado should work closely with the FAA to obtain the broadest possible permissions to operate UAS for research and development purposes, to present itself nationally as a state with the airspace and industrial resources supportive of commercial and DOD UAS development. Cyber is both software and hardware intensive, and Colorado already demonstrates advantages in computers and software development which can be easily translated into positive messages for promoting itself as the right “home” for DOD and non-DOD organizations and businesses looking to settle and develop new cyber enterprises.
- Another exciting commercial venture Colorado should continue to aggressively endorse is the Front Range Airport's application to the Federal Aviation Administration for Spaceport Colorado. The effort will increase Colorado’s competitiveness in the aerospace industry and support new opportunities in the future growth of commercial space research and transportation. Plans for Spaceport Colorado include the development of an aerospace and technology park to support a broad range of activities and commercial opportunities, including research and development, testing and evaluation, manufacturing, crew training, scientific research, suborbital flight, point-to-point travel, and unmanned aircraft systems. The Economic Impacts section of this Report offers compelling evidence that the agglomeration effect of a multi-dimensional enterprise like Spaceport Colorado would foster enhancements to Colorado’s military value to DOD as well as contribute to economic growth and prosperity.

- Monitor and, when allowed, provide information to the congressionally-mandated Commission on the Future of the United States Army, required to report out to lawmakers by 1 February 2016. When Congress directed a similar Commission examine the U.S. Air Force earlier this decade the Commission's findings either validated or advocated challenging positions for re-structuring the balance of Guard, Reserve and Active Duty force structure and missions. This is an important calculus for Colorado because of the complexion of the balance in Fort Carson's Army force structure. The recent HQ Department of Army town hall or Listening Session in Fort Carson's Centennial Hall shone a spotlight on the local, regional and state-wide implications of potential Army force structure reductions at the installation. The Commission on the Future of the United States Army will consider the future of Fort Carson and other major Army installations – its public hearings, data calls and final report deserve close attention.
- Colorado should provide legislative support and funding to accelerate select military installation transportation improvements and road construction. There are already mature plans for a number of installations written and waiting on the shelf, ready for final legislative endorsement and/or funding. This Study did not analyze nor prioritize installation transportation plans, but the Team was briefed by a number of base officials and can report that many plans are completed or are underway. The State might consider a follow-on investigation and assessment of installation plans to determine where the needs are greatest.

### **3. Recommended Strategic Message Themes and Audiences**

Colorado leaders at local and county levels, at the State level, and within the delegations in the U.S. Senate and House of Representatives represent key champions for a number of prioritized strategic themes that emerged during this Study:

- The military value of Colorado to the Department of Defense is reflected in world-class military installations hosting vital mission responsibilities executed by a highly-skilled military and civilian workforce of over 100,000, which draws from a superbly educated population -- Colorado ranks third nationally in adults 25 and older with at least a bachelor degree.
- The military is a significant driver of Colorado's economy, accounting for 7.5% of total State labor earnings, making it the third largest industry in the State. As an industry, Colorado military installations promote a synergistic dynamic which reinforces the value of the State to supporting DOD mission requirements. The aerospace industry, for example, employs 66,000 individuals and contributes \$8.7 billion (3% of State GDP).
- Colorado's robust mix of private industry and higher education capabilities emphasizing high technology development, coupled with the sophisticated military mission sets assigned to State military installations, position Colorado as an incubator for commercial economic growth and expanded 21st century mission support to DOD.
- Colorado's geography and altitude create an unrivaled environment for unique training of special operations forces, rotary wing aviation, and UAS.
- Colorado air and land joint training environments are flexibly postured to provide year-round world-class training for land, air and space forces.
- The communities and businesses surrounding Colorado's military installations are supportive of the mission sets assigned at those installations and visit Washington D.C. frequently to reinforce their support by meeting with Pentagon and Congressional leaders.
- The variety and unique character of Colorado's natural attributes, the depth of higher education opportunities, and the impressive fact that the State has the 6<sup>th</sup> fastest growing economy<sup>20</sup> in the United States all foster an outstanding quality of life for DOD military and civilian personnel, and for the growing number of veterans and military retirees who settle in the State. Veterans comprise 10.4% of the Colorado population exceeding the national average of 8.9%.

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<sup>20</sup> U.S. Bureau of Economic Analysis, ["Widespread But Slower Growth in 2013: Advance 2013 and Revised 1997—2012 Statistics of GDP by State,"] news release (June 11, 2014), [http://www.bea.gov/newsreleases/regional/gdp\\_state/gsp\\_newsrelease.htm](http://www.bea.gov/newsreleases/regional/gdp_state/gsp_newsrelease.htm).

- DOD’s investment of about 3.2% of its base budget in Colorado despite the State having only 1.7% of the total U.S. population demonstrates the value and return on investment offered to Colorado installations and communities.

The themes elaborated above can be championed in targeted messages delivered by key messengers to specific audiences or constituencies. The following outline provides some recommended alliances between audiences, messengers and messages:

**Audience: Local organization (city and county governments, military affairs groups, civil/business organizations, industry)**

**Messenger: State Leaders**

**Message:**

- Coordinate your installation support efforts to ensure that State and federal officials as well as congressional offices hear a unified voice from the community.
- Promote compatible industries and industrial development while understanding that some potential developments could lead to encroachment issues adversely impacting military operations at the installations.
- Continue to show support for military personnel, defense civilians, families and veterans to preserve and enhance the outstanding quality of life that is present today.
- Continue to foster education opportunities that augment a highly-skilled workforce which supports 21<sup>st</sup> century military missions and defense technologies.
- Continue to recruit, enhance, and retain high-technology industries to work with military installations and thereby continue to provide quality jobs in the community.
- Identify and pursue mutually beneficial partnerships with local installations, DOD, and the Military Services in areas such as shared services, research and technological development.

**Audience: State of Colorado (legislators and senior executive branch officials)**

**Messenger: State and Civic Leaders**

**Message:**

- The State of Colorado’s world class military installations require first-rate transportation infrastructure to provide access, allow execution of new missions, promote joint training, and ensure mobilization capability – this requires State as well as federal assistance.

- Assist local governments in protecting Colorado’s military installations from incompatible development (encroachment) outside “the wire” that might impair or threaten military operations and training and the longevity of these facilities.
- Support existing and new high-technology industry and higher education in the State, since both promote a vital and modern military presence in Colorado and create a synergistic environment for military installations and industry partners to support one another.
- The State through legislative and regulatory methods should continue to provide accommodations to military personnel and families (e.g., mandatory education requirements for secondary school graduation, licenses, professional certification) relocating from other states so they are not disadvantaged when moving to Colorado in response to military-directed permanent move orders.
- With DOD contributing 5.2% of the State’s total employment and 5.5% of the State’s total tax revenue, Colorado should continually assess the economic impact from military installations and from surrounding space and defense industries to identify opportunities for expansion and development.

**Audience: Colorado Congressional Delegation (U.S. Senate and House of Representatives)**

**Messenger: State and Civic Leaders**

**Message:**

- In a very competitive funding environment, you need to ensure that funding for installation infrastructure on and off base is a high priority within the DOD and Committees of jurisdiction so that Colorado’s world-class military installations and training environments are retained and potentially enhanced.
- Promote DOD and Government policies and programs that enable and encourage innovative partnerships between military installations and community stakeholders, which provide cost savings, mutual economic and quality of life benefits, increasing the installation’s military value to DOD. An example is the participation of Peterson AFB and Buckley AFB in the Air Force Community Partnership Initiative, where these two bases have bolstered ties to their local communities and industry partners with mutually beneficial arrangements.
- Through your contacts and networks continue to foster the importance of growth in defense and related industries, which are a major economic driver for the State contributing \$11.7 billion in labor income in 2014. The synergy between the defense industries, installation military missions, and education institutions is integral to fostering an enviable quality of life in Colorado.

- At public events and private meetings, express support for Colorado military installation mission growth and expansion by highlighting the capacity, unique attributes, and highly-skilled workforce resident within the State.
- Utilize positions on Armed Services, Defense Appropriations, and other relevant committees and subcommittees to actively engage at a number of levels with Pentagon and Administration officials on the military value and economic impact of Colorado assets and opportunities.

**Audience: Department of Defense and related Executive Branch agencies**

**Messenger: Congressional, State, and Civic Leaders**

**Message:**

- The State of Colorado possesses military installations, associated commercial industry, robust higher education opportunities, and a versatile, highly-skilled workforce that together assures tremendous military value to DOD and provides the capacity to support new missions and mission growth.
- The sophisticated workforce, industry synergies, and pervasive military jointness in the State's installations and mission sets make Colorado an ideal partner for contributing to successful completion of Department of Defense strategic objectives and a welcoming host for military installations.
- Colorado's diversity of terrain, altitude, and training environments are critical assets for 21<sup>st</sup> century military operations and training.
- The Colorado congressional delegation will have abundant opportunities to convey the military value of the State's military installations as well as the contribution and economic impact of the industries that support DOD, NASA, and related organizations. These opportunities could include Congressional hearings where Administration officials are testifying, Administration office visits, and meetings with Administration appointees. Consistently telling the story of the military value of Colorado military installations, institutions, defense and the aerospace industries needs to be an ongoing endeavor.

#### **4. Summary of Tasking and Background Information**

The nation's defense enterprise is changing in response to declining budgets, new warfighting technologies, and evolving strategic threats across the global commons. The realities of the current era have led many states – like Colorado – to assess their military functions' strengths, vulnerabilities and opportunities to provide Department of Defense decision makers with relevant information regarding military installations and their associated missions and assigned units.

The General Assembly of Colorado, pursuant to Senate Bill 14-157, tasked the Department of Military and Veterans Affairs (DMVA) to develop a data-driven analysis on the value of military activities in the State. A Study Team consisting of Whitney, Bradley & Brown, Inc. (WBB), Summit Economics, and Madison Government Affairs (MGA), was competitively selected to perform this analysis. DMVA and the Study Team developed a shared understanding of how to proceed with the data-driven analysis based on Governor Hickenlooper's formal press release on 15 October 2014:

*“Colorado’s military and defense industry is an important and diversified anchor in our statewide economy, employing tens of thousands across the state while driving innovation, aerospace, engineering, technology and advanced manufacturing. Colorado has long been a vital contributor to the nation’s defense and with the data from this study, we will be better able to protect installations and build related industry as national budgets continue to shift. The study will provide the state with data that will help to assess, protect and build upon Colorado’s military installations and defense industry.”*

The 1990s-era BRAC Commissions in particular, as well as the Department of Defense in general, were focused on reducing the number of military bases as well as major installation and military mission realignments. In the early 1990s the DOD force structure was being significantly reduced and there were far more bases than needed to satisfy the requirements of a shrinking force structure. The Department went 10 years without a BRAC with Congress reluctant to reauthorize another round until 2005. Secretary of Defense Rumsfeld directed the BRAC 2005 round to focus on transformation and joint-basing; the outcome of his guidance and final Congressionally-approved BRAC recommendations left the Department with excess bases. In the decade following the 2005 BRAC, both the Army and the Air Force have repeatedly stated they manage about 20-25% infrastructure in excess of needs. The differential between basing structure and force structure requirements has widened in the last three years of sequestration-driven budget constraints and reduced military operations overseas. Deputy Secretary of Defense Robert Work, in a November 2014 Pentagon press conference, confirmed that DOD is currently operating with 24% excess capacity in bases and facilities and doing away with them could save \$2 billion a year.

In the report that accompanied the FY 2015 Military Construction/Veterans Affairs Appropriations Bill, Congress expressed concern that the DOD “does not consider the intellectual capabilities of a region when evaluating the criteria for BRAC”. The Committee went on to recommend that the

DOD should “clearly establish an intellectual capabilities criteria consideration, especially when considering academic and technical institutions, in addition to the already established BRAC final selection criteria”. This Study accounted for Colorado’s “intellectual capabilities” by developing and analyzing metrics associated with advanced education and technical skills training capabilities within the region proximate to the seven major military installations under review.

In the 2015 budget, Congress refused to authorize another BRAC Commission for 2017. The President’s Budget Request for FY16 requests authorization for another BRAC round, but none of the recently selected House and Senate committee chairmen with legislative authority in this area have publicly expressed support for another BRAC in 2017. In testimony before House and Senate Armed Services Committees, a number of senior Air Force and Army civilian and military leaders stated that sequestration-driven budget cuts might lead them to make limited base realignment decisions for which they have current authority. Some observers characterize this possible action as a “micro” BRAC. Whatever happens, the stakes are high for Colorado to preserve the economic contribution that DOD makes to the State economy while simultaneously ensuring that her military installations, units and mission sets provide the highest military value to DOD.



## 5. Summary of the Analytical Methodologies and Tools

The approach was grounded in independent, data-driven analysis. It implemented a methodology that combined subject matter expert perspectives with a proven process for analyzing military value to the Department of Defense and expertise in measuring economic impacts to the State of Colorado. The methodology required five steps: (1) developing the analytical model for the State of Colorado; (2) collecting data by conducting surveys and visiting Colorado military installations; (3) analyzing the data to assess military value and economic impact; (4) identifying and assessing Colorado strengths, vulnerabilities and opportunities, and; (5) developing and coordinating strategic messages and the opportunities and approaches for conveying and communicating. Figure 8 illustrates the approach and methodology.

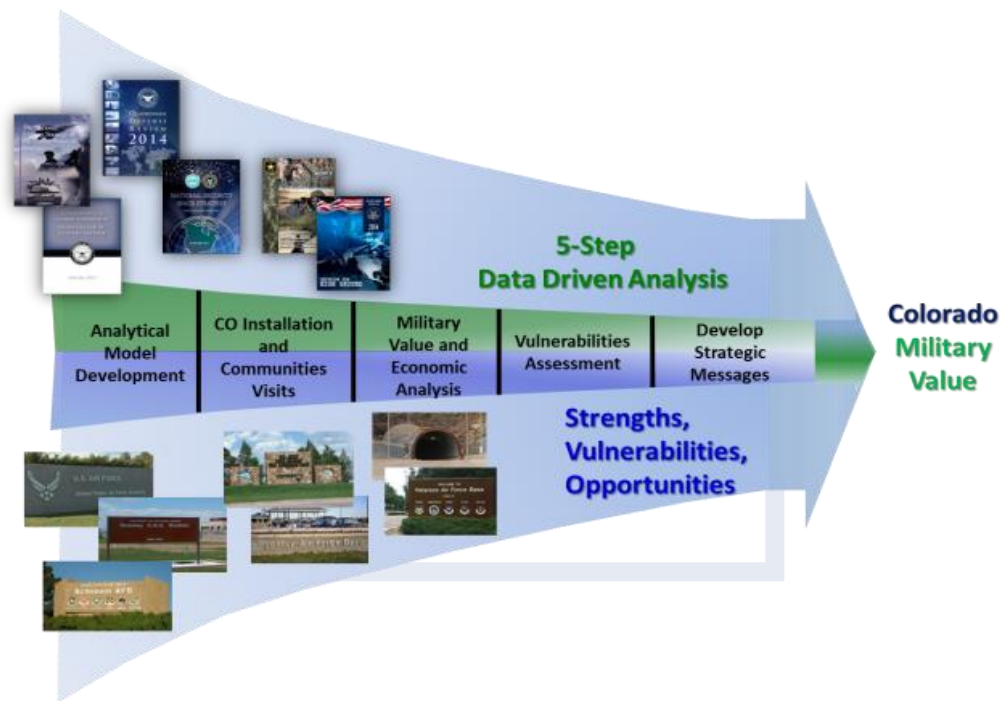


Figure 8: Colorado Military Value and Economic Impact Approach and Methodology

### **Analytical Model Development**

Developing the analytical model began with an assessment of DOD military value criteria<sup>21</sup> for their relevancy, inclusion and completeness. A review of current national, DOD, and Service strategic documents such as the National Security Strategy 2015, the Defense Strategic Guidance 2012, the National Military Strategy 2011, the 2014 Quadrennial Defense Review, and the DOD 20-year

<sup>21</sup> The starting point for developing the complete set of military value criteria was the set of DOD criteria listed in the DMVA Request for Proposal: military capabilities; availability and condition of land; facilities and airspace; the ability to accommodate contingency mobilization; surge capability/capacity; future total force requirements; cost of operations; manpower implications/personnel availability.

force structure plan was the foundation for assessing relevancy, inclusion, and completeness. The Study Team modified the set of criteria to include criteria for measuring the economic impact of DOD to the State of Colorado. The resulting set of criteria and their definitions are provided below. Criteria identified in *italics* were tailored to ensure appropriate attention was given to post-2005 changes in BRAC evaluation context and to important economic impact-related dimensions of assessing value.

- Military capabilities -- The abilities provided by tenant and non-tenant units of an installation associated with satisfying mission tasks cited in the Universal Joint Task List and the taxonomy of capabilities listed in the Joint Staff's list of Joint Capability Areas
- Availability and condition of land -- The ability of the installation's land, both inside and outside "the wire", to support installation missions
- Availability and condition of airspace -- The ability of the proximate/accessible airspace to support installation missions
- Facilities/infrastructure – The value, contribution and impact that an installation's real property and facilities have on tenant and non-tenant unit missions
- Ability to accommodate contingency mobilization -- The ability to deliberately provide for the movement of installation personnel, supplies, and equipment in support of contingency deployments and rapid enhanced training
- Surge capability/capacity – The ability for an installation to rapidly increase support to satisfy assigned State and Federal missions
- Future total force requirements – The ability of an installation's Active, Guard, Reserve and DOD civilian manpower to transform through training and support future DOD force requirements
- Cost of operations -- The annual operating cost of an installation supported by both State and Federal funding
- Manpower implications/personnel availability -- The versatility and agility of assigned military and civilian personnel to adjust to changes in operations, State and Federal policy, and operating budgets

- Community Interaction -- The character of social, economic, quality of life, and cultural mutual dependence between military installations and their assigned personnel with their surrounding communities
- Economic Contribution -- The economic impact generated by DOD activities, investments, support contracts, construction, salaries, etc., associated with an installation

Each criterion was concisely defined through an integrated process team (IPT) effort. The definitions ensured the Study Team proceeded from a common baseline of understanding. Next, measures for each criterion were similarly developed and defined. An iterative IPT effort refined the set of draft measures into the set of final measures. The set of final measures were then aligned with respective criteria and, together, became the model against which data was collected and the analysis was performed. Figure 9 illustrates the Military Value and Economic Impact Model.

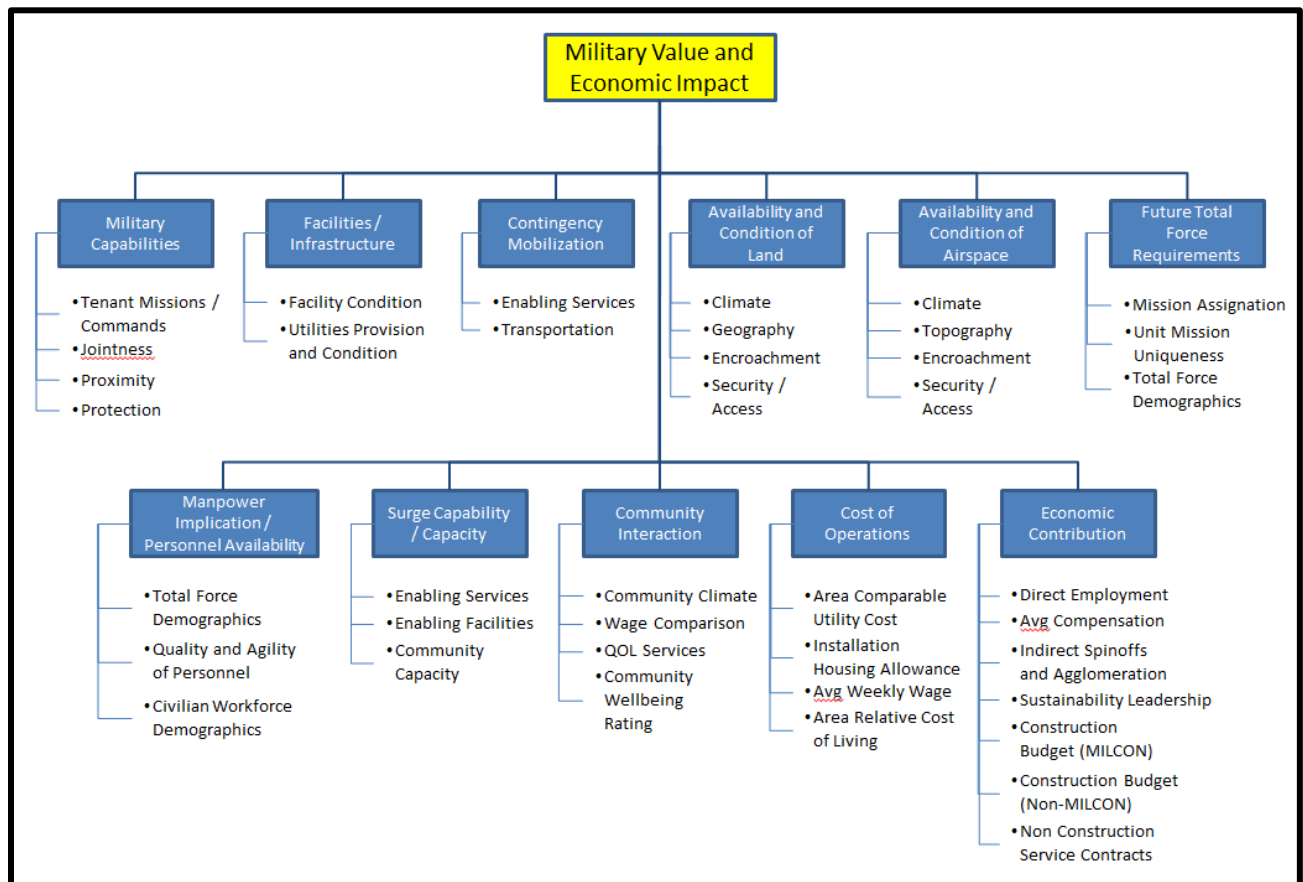


Figure 9: Military Value and Economic Impact Data Collection and Analysis Model

## Data Assessment Tools and Collection Effort

While the Colorado DMVA coordinated the schedule of visits to installations, the Study Team developed data collection tools. Two integrated tools were developed: a written survey and an installation characterization matrix. The written survey consisted of questions that were distributed in advance to each installation. The survey provided the installations’ insights to the focus of the data collection and the means to respond with detailed information and data following the site visits. These were distributed and retrieved through DMVA. The second tool, the installation characterization matrix, was an internal tool the Study Team used to document individual team member assessments of the installations and tenant commands. The matrix aligned each criterion and its respective measures with a range of characterization statements. The individual assessments were subsequently consolidated into a single master assessment matrix. Figure 10 illustrates a partial example of a criterion-measure-characterization alignment from the consolidated collection matrix.<sup>22</sup>

| Mil Value & Economic Impact Criteria  | Measure  | Characterization   |   |   |                                |   |                                |   |   |  |
|---|--|--|---|---|--------------------------------|---|--------------------------------|---|---|--|
|   |  | Frequency Scored Installations   | Frequency Scored Installations  | Frequency Scored Installations                    | Frequency Scored Installations | Frequency Scored Installations  | Frequency Scored Installations | Frequency Scored Installations                    | Frequency Scored Installations                                |  |
| <b>Military Capabilities</b><br>The abilities provided by tenant and non-tenant units of an installation with respect to the Universal Joint Task List (UJTL) and Joint Capability Areas (JCA). | <b>Tenant Missions / Command; Jointness</b><br>Characterization of installation tenants (assigned units) and their missions with respect to single service, joint service, non-DoD, or uniqueness.   | Installation has Joint operational tenants assigned and conducts joint functions | (5)<br>Cheyenne Mtn<br>Peterson<br>Schriever<br>Greeley<br>Buckley          |   |                                | Installation includes some Other Service Tenants; or Other Gov't Agencies | (1)<br>Carson                  |   | Installation has service specific tenants and functions       | (1)<br>USAFA   |
|   | <b>Tenant Missions / Command; Jointness</b><br>Characterization of installation tenants (assigned units) and their missions with respect to single service, joint service, non-DoD, or uniqueness. (Unique = only Installation providing aggregate capabilities) | Installation includes unique missions in DoD and other US Govt Agencies          | (6)<br>USAFA<br>Cheyenne Mtn<br>Peterson<br>Schriever<br>Greeley<br>Buckley |   |                                | Installation includes unique missions in DoD                              | (1)<br>Carson                  |   | Installation aggregate capabilities are not unique within DoD |  |
|   | <b>Tenant Missions / Command</b><br>Characterization of installation tenants (assigned units) and their missions with respect to single service, joint service, non-DoD, or uniqueness.  | Senior Command on Installation is a 4-star billet                                | (1)<br>Peterson   | Senior Command on Installation is a 3-star billet | (2)<br>USAFA<br>Buckley        | Senior Command on Installation is a 2-star billet                         | (1)<br>Carson                  | Senior Command on Installation is a 1-star billet | No Flag/General Office billets                                | (3)<br>Cheyenne Mtn<br>Schriever<br>Greeley          |
|   | <b>Tenant Missions / Commands</b><br>Characterization of installation tenants (assigned units) and   | Extensive / Substantive non-DoD Missions   | (1)<br>USAFA  |   |                                | Few non-DoD Missions  | (2)<br>Schriever<br>Buckley    |   | No Non-DoD Missions   | (4)<br>Carson<br>Cheyenne Mtn<br>Peterson<br>Greeley |

Figure 10: Example Characterization Matrix for Data Collection

## Military Value and Economic Impact Analysis Methodologies and Tools

The military value and economic impact criteria were assessed during two virtual workshops using Expert Choice - Comparison™ collaborative software as the assessment tool. Members made informed judgments based on the shared understanding the Study Team derived from the initial review of National, DOD, and Service strategic documents and the installation visits. All Study Team members and a DMVA representative participated in each workshop event. The first

<sup>22</sup> The complete consolidated assessment matrix is available from DMVA on request.

workshop weighted the importance of the military value and economic impact criteria and their respective measures. Weighting the criteria and measures required assigning the importance of each to DOD using a numerical scale of 1 (little importance) to 9 (significant importance) and resulted in a set of universal weights for DOD installations. The second workshop scored the value of each installation to DOD with respect to the measures. Scoring the installations required the participants to make informed judgments as to the extent of the value each Colorado installation has with respect to each measure. Study Team members used a subjective scale with nine gradations that ranged from “none” to “outstanding”. The software automatically applied the “importance” weights of the measures and criteria from the first workshop to each member’s value score. Additionally, each member documented their rationale for each score made using a comment/text entry feature of Expert Choice - Comparison™ and also identified areas of potential strength or vulnerability.

### **Vulnerabilities Assessment Methodology**

The areas identified during the post-workshop analysis of the Expert Choice - Comparison™ output as potential strengths and vulnerabilities for Colorado were consolidated into a candidate list. The list was screened using DOD strategic objectives (such as preserving training areas suitable for maneuver by ground and air forces in order to ensure readiness; preserving staging areas for use during homeland defense missions; and preserving installations with a substantial impact on joint warfighting, training, and readiness); economic impact to Colorado; and the depth of available information and understanding of the related issues. The items that passed screening were put into a refined list and then developed in greater detail. Specifically, each item was given a concise description and assessed for likelihood and consequence(s). Each item was assessed and documented in a succession of IPTs, and the conclusions documented as described in Section 1 above.

### **Determining Military Value**

A military installation with resident forces and missions contributes military value to DOD to the extent that the forces and missions support established national security objectives. Evaluating military value is both an *objective* and *subjective* exercise. The military value of Colorado installations to DOD was determined through post-workshop analysis of the Expert Choice - Comparison™ output. The output data was quantitatively and qualitatively analyzed to draw conclusions and visually display results. The approach required several IPTs to synthesize the information, draw conclusions, develop the strengths, vulnerabilities and opportunities, and form the results. The methodology analyzed the military value and economic impact scores for the measures and criteria, identified areas of emphasis and pattern, identified preliminary strengths and vulnerabilities, identified preliminary opportunities, and developed statements to articulate *meaning* for the State of Colorado.

## **Determining Economic Impact**

The purpose of this portion of the study is to estimate the overall impact of the Department of Defense on the Colorado economy, both in total and within political subdivisions such as counties and U.S. congressional districts. The impacts, while all generated by DOD, fall into three general categories:

- Impact of military installations located in Colorado, including the personnel and non-contract expenditures
- Impact of all DOD contracts
- Military National Guard and Reserve personnel residing in each Colorado county

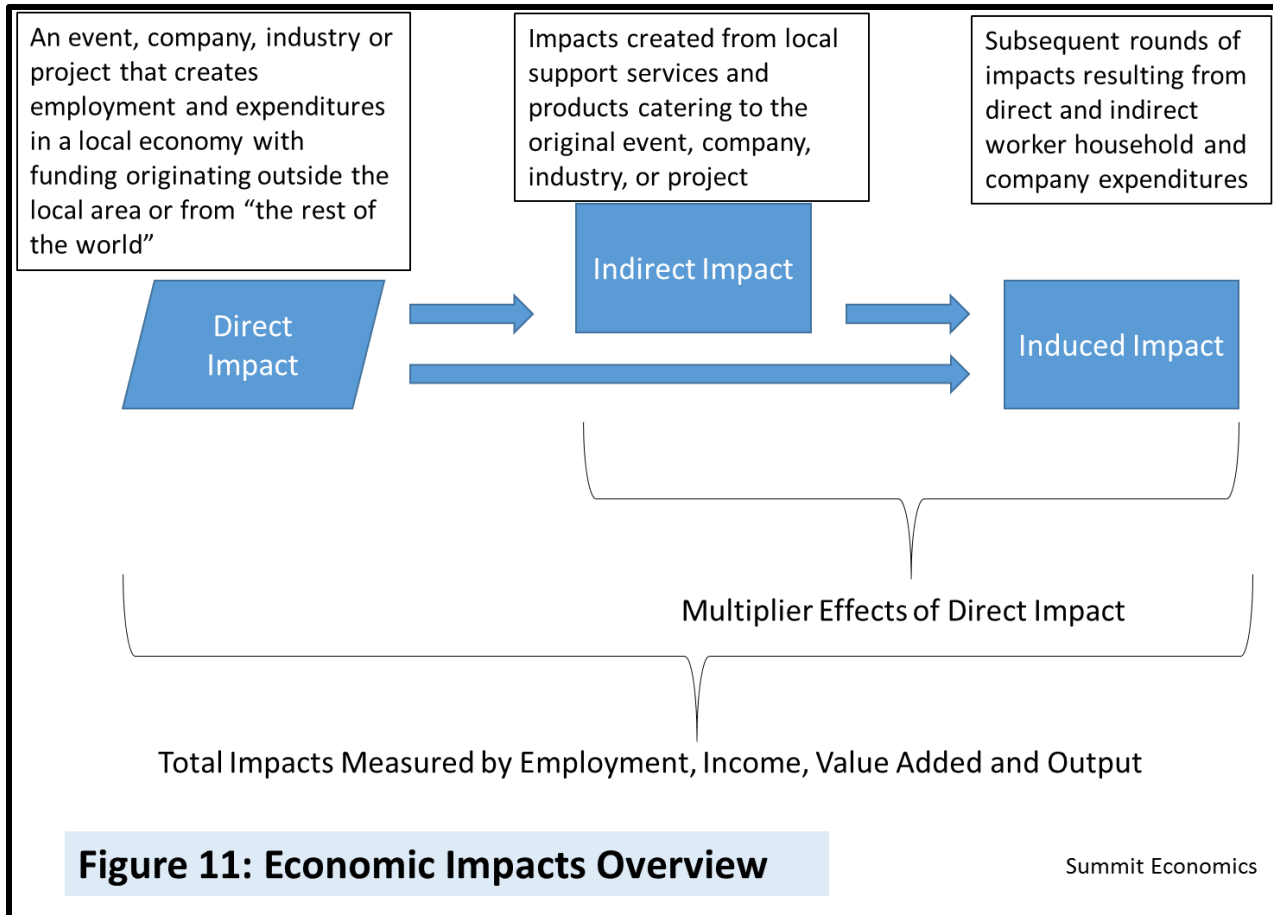
In essence this study attempts to identify and measure all DOD funding flowing into the State. Some DOD expenditures are not captured or are only partially included in the data collection process. The DOD expenditures not captured are considered to be relatively minor and include:

- DOD personnel traveling to Colorado for work if their travels are funded by their home base outside of Colorado
- DOD personnel pursuing higher education when tuition reimbursement does not come from DOD installations located in Colorado

Also excluded from this study are detailed analyses of:

- The economic impact of veterans residing in Colorado and the benefits they receive
- The Department of Homeland security and national intelligence agencies unless their personnel are included in DOD base head counts such as at Buckley AFB
- All other Federal agencies which might be collaboratively funding research with DOD or might be providing direct social assistance at a DOD facility such as the Department of Health and Human Services channeling block grants through State and county governments with the beneficiary of such funding being military personnel

The economic impact analysis presented is based on a standard regional impact analysis approach that is commonly used among regional economists. This form of analysis measures impacts from an event, company, industry, or project on a region's total employment, household incomes, value added (gross regional product), and total output (gross revenues). The impacts are highlighted in Figure 11.



As noted in Figure 11, there are three types of impacts: direct, indirect and induced. The direct impacts are derived from the first three categories listed above and represent in inflow of funding into Colorado from the DOD. The inflow of funds is similar to funds flowing into an economy as a result of products and services they export. Direct impacts create indirect impacts in the case of military installations and other DOD contracts and induced impacts in all cases. The indirect impacts derive from local companies and other organizations (located within the region of study) providing products and services in support of the direct impact.<sup>23</sup> The induced impacts result from both direct and indirect workers and organizations spending money derived originally from the direct impacts in the regional economy. For instance, military personnel working at an installation and employees of a wholesale company providing goods to the installation, spend a portion of their income within the region thereby creating more jobs, incomes, value added, and output. The indirect and induced impacts are referred to as the multiplier effect indicating that a direct impact gets multiplied and has a greater total impact within the region.

Regions are defined relative to study areas. In this case the region is defined as Colorado. What makes this economic impact study relatively unique compared to most impact studies is that the

<sup>23</sup> A nuance in this analysis is that induced impacts are often calculated by total expenditures creating the direct impact. To avoid possible double counting a review of all DOD contracts in Colorado were reviewed and DOD expenditures at military bases were discounted.

Colorado Department of Military and Veteran Affairs desired estimates of impacts from DOD expenditures on multiple political jurisdictions within the State – by county and U.S. congressional district. This level of detail required further analysis known as trade flow analysis. Trade flow analysis enables the impacts generated from a specific point to be shown as cascading throughout a region from the point of origin such as a military installation. In this study the trade flow impacts are estimated down to the county level.

To generate the economic and trade flow estimates the study utilized the econometric model known as IMPLAN. The model is updated annually with data and model coefficients specific to Colorado and the industrial mix within the State. Due to the complexity of the model and its application internationally, test runs were used to calibrate the model to assure compatibility with older Regional Input-Output Modeling System (RIMS)-based approaches. After IMPLAN was adjusted, data was input into the model to generate impacts for the entire State as well as all counties within the State. IMPLAN output was then checked against some high level impacts using proprietary methods and RIMS multipliers from the Bureau of Economic Analysis. Based upon these approaches final expert judgments were made to outline the final impacts.

Inputs for the direct impacts were derived from multiple sources including:

- Site visits and interviews with officials at each military installation in Colorado
- Economic Impact Assessments provided by the U.S. Air Force for some installations
- Written answers to questions posed by the Study Team
- Interviews with several military base budget managers
- Two contract and assistance databases from DOD
- Secondary data sources from the Bureau of Economic Analysis, U.S. Census Bureau, U.S. Bureau of Labor Statistics, Colorado Department of Labor and Employment, and Colorado State Demographer

Additional economic impacts are also considered. These include:

- Colorado state government revenues resulting from total impacts
- Economic diversification and economic life cycle effects resulting from the DOD presence
- Spin off and economies of agglomeration which result as momentum is gained in one economic sector such as DOD funding of installations which in turns grows into a larger mass of clusters and economic activity. These are secondary, longer-term effects that would likely not have developed were it not for the original economic event.

The diversification, life cycle and agglomeration effects were noticed during the research. Most of the reporting on these effects is anecdotal in nature based upon interviews, other reports, and historical datasets.





