NEIL ABERCROMBIE
GOVERNOR

LATE

Testimony of
GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
FORD N. FUCHIGAMI
RANDY GRUNE
AUDREY HIDANO
JADINE URASAKI

IN REPLY REFER TO:

**STATE OF HAWAII**
**DEPARTMENT OF TRANSPORTATION**
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

February 25, 2014
9:25 a.m.
State Capitol, Room 211

## S.B. 3053, S.D. 1
## RELATING TO UNMANNED AERIAL SYSTEMS TEST SITES

Senate Committee on Ways and Means

The Department of Transportation (DOT) **supports** this bill which provides funding for the management of Hawaii's participation in the Pan-Pacific Unmanned Aerial System Test Range Complex. Hawaii with partners Alaska and Oregon, were selected as one of only six test sites throughout the country by the Federal Aviation Administration and will play a unique and significant part in the test. This bill provides the funding that will enable Hawaii to fulfill its obligation to this national test program, and to its test range partners.

Thank you for the opportunity to provide this testimony.

STATE OF HAWAII
DEPARTMENT OF DEFENSE

TESTIMONY ON SENATE BILL 3053 SD1
A BILL RELATING TO UNMANNED AERIAL SYSTEMS TEST SITES

PRESENTATION TO
THE SENATE COMMITTEE ON WAYS AND MEANS

BY

MAJOR GENERAL DARRYLL D. M. WONG
ADJUTANT GENERAL AND DIRECTOR OF STATE CIVIL DEFENSE
February 25, 2014

Chair Ige, Vice Chair Kidani, and Members of the Senate Committee on Ways and Means.

I am Major General Darryll D. M. Wong, State Adjutant General and the Director of State Civil Defense. I am testifying in **SUPPORT** of Senate Bill 3053 SD1.

The Federal Aviation Administration (FAA) recently selected the Pan Pacific UAS Test Range Complex (involving Alaska, Oregon, and Hawaii) as one of the six national test sites to safely integrate Unmanned Aerial Systems (UAS) into the National Airspace System. Testing UAS at these sites, in restricted, non-public airspace, will lead to the development of federal regulations that will help ensure public privacy and safety during UAS operations.

UAS technologies are already in use include: wildlife counts, fisheries management, disaster management, and has great potential in any application where an aerial task needs completing. In these tasks, UAS offers several advantages over manned flight:

- Lower-costs
- Reduced safety risks and increased capability related to manned operations
- Reduced impacts on the environment
- The growth of intellectual capital

In addition to the intellectual capital gained, there are positive economic impacts to Hawaii as a result of test range users as well as creation of new jobs to support commercial industry testing and services.

The establishment and appropriation of funding for Hawaii's Chief Operating Officer and Advisory Board is critical in both establishing Hawaii's test ranges and tracking both state and national efforts to address UAS safety and privacy concerns, including the development of federal regulations pertaining to such issues.

Thank you for the opportunity to testify in **SUPPORT** of Senate Bill 3053 SD1.

Testimony Presented Before the
Senate Committee on Ways and Means
Committee on Higher Education
February 25, 2014 at 9:25 a.m.
by
Donald O. Straney
Chancellor, University of Hawai`i at Hilo

**SB 3053, SD1 - RELATING TO UNMANNED AERIAL SYSTEMS TEST SITES**

Chair Ige, Vice Chair Kidani and Members of the Committee:

Thank you for the opportunity to submit testimony for SB 3053, SD1. My name is Donald Straney, Chancellor of the University of Hawai'i at Hilo (UH Hilo). I am testifying as a member of the Hawai'i Island community and I support the intent of SB 3053, SD1 to appropriate funds to staff and support Unmanned Aerial Systems (UAS) test site activities in Hawai'i.

The State of Hawai'i offers many unique qualities to support UAS operations in areas of agricultural monitoring, archaeological survey, disaster management and damage assessment, geological monitoring and surveys, invasive species monitoring, fisheries and coral reef management, land-use planning and monitoring and, wildlife detection and management. UH Hilo views the proposal as an opportunity to develop innovative research, business and educational initiatives and provide higher education and career options to the people of our Hawai'i Island.

Thank you for the opportunity to provide testimony on SB 3053, SD1. Aloha.

# DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

**NEIL ABERCROMBIE**
GOVERNOR

**RICHARD C. LIM**
DIRECTOR

**MARY ALICE EVANS**
DEPUTY DIRECTOR

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Statement of

**RICHARD C. LIM**
**Director**
Department of Business, Economic Development & Tourism

before the

**SENATE COMMITTEE ON WAYS AND MEANS**

Tuesday, February 25, 2014
9:25 a.m.
State Capitol, Conference Room 211

in consideration of

**SB 3053, SD1**

**RELATING TO UNMANNED AERIAL SYSTEMS TEST SITES.**

Chair Ige, Vice Chair Kidani, and members of the Committee. The Department of Business, Economic Development and Tourism **supports** this bill to establish a chief operating officer position and an advisory board to oversee and manage, as well as to appropriate funds to staff and conduct, unmanned aerial systems (UAS) test site operations in Hawaii.

Our State, in partnership with Alaska and Oregon, has been selected by the Federal Aviation Administration (FAA) to serve as one of six national test sites for unmanned aerial systems. The goal is to develop a Pan-Pacific UAS Test Range that will use existing aviation ranges and facilities in all three states to develop operating standards and regulations that will safely integrate these technologies into the national air space, and in so doing develop procedures to protect manned aviation and policies to protect privacy.

The civilian UAS applications to be studied at these test sites are truly diverse and far-reaching, ranging from environmental monitoring and wildlife management to emergency search and rescue, flood and pollution control, power line inspections, air quality monitoring, watershed management, and other applications with substantial civic and commercial benefits.

In developing these applications, multiple research, business, education, and professional training opportunities will also emerge, such as the development of miniaturized high performance remote sensing instruments, aerial tracking systems and related command and control software, training courses and certification programs for UAS operators, and other innovative programs with high revenue generation and job creation potential.

In addition, UAS test range operations in Hawaii will help reduce or eliminate shipping and other costs associated with demonstrating and evaluating new sensor technologies developed by Hawaii-based companies at U.S. mainland sites, facilitate cost-effective operations of both military and government contractors supporting local fire and police departments, and both strengthen and diversify statewide programs conducted by the U.S. Civil Air Patrol and Coast Guard, the U.S. and Hawaii National Guard, the U.S. and Hawaii Departments of Defense, and other federal and State agencies.

As such, we support this measure, provided that its passage does not replace or adversely impact priorities indicated in the Executive Budget.

Thank you for the opportunity to testify on this bill.

# UNIVERSITY OF HAWAIʻI SYSTEM
Legislative Testimony

Testimony Presented Before the
Senate Committee on Ways and Means
Tuesday, February 25, 2014 at 9:25 a.m.
by
Dr. Vassilis L. Syrmos
Vice President for Research and Innovation, University of Hawaiʻi

SB 3053 SD1 – RELATING TO UNMANNED AERIAL SYSTEMS TEST SITES

Chair Ige, Vice Chair Kidani, and members of the committee:

I am respectfully submitting written testimony on behalf of the University of Hawaiʻi in support of SB 3053 SD1 relating to unmanned aerial systems (UAS) test sites which proposes to establish the chief operating officer position, establish an advisory board to oversee and manage the test site operations, and appropriates the funds to staff and operate Hawaiʻi's unmanned aerial systems test site activities.

As a research institution that specializes in technologies and activities related to UAS, the University of Hawaiʻi supports this bill and perceives it as an opportunity for advancements in innovation, commercialization, and economic development. Hawaiʻi offers unique qualities to support the operations of a UAS such as its location within the Pacific and its proximity to the U.S. Pacific Command and other military test sites; and is considered to be an attractive location to the UAS industry for real development.

With the current organization and implementation of the Hawaiʻi/Alaska/Oregon Pan-Pacific Unmanned Aerial Systems Test Range Complex, it is essential that the UAS in Hawaiʻi be provided the resources to remain an active participant. The University of Hawaiʻi sees great value and potential in assisting with the establishment of UAS test sites due to its positive impacts for our State which range from emergency search and rescue operations, fisheries management, agricultural monitoring, reef health surveys, lava flow monitoring, disaster management and damage assessment, land use surveys, watershed management, mapping of coastal topography, and many other applications.

Thank you for your consideration and for the opportunity to submit testimony on this matter.

**From:** mailinglist@capitol.hawaii.gov
**To:** WAM Testimony
**Cc:** jcrisafu@dbedt.hawaii.gov
**Subject:** Submitted testimony for SB3053 on Feb 25, 2014 09:25AM
**Date:** Sunday, February 23, 2014 10:59:47 PM
**Attachments:** AUVSI Report.pdf

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**SB3053**
Submitted on: 2/23/2014
Testimony for WAM on Feb 25, 2014 09:25AM in Conference Room 211

| Submitted By | Organization | Testifier Position | Present at Hearing |
|---|---|---|---|
| Jim Crisafulli | Individual | Support | No |

Comments: Report submitted on behalf of Gov. George Ariyoshi as part of his testimony on SB3053.

Please note that testimony submitted less than 24 hours prior to the hearing, improperly identified, or directed to the incorrect office, may not be posted online or distributed to the committee prior to the convening of the public hearing.

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# THE ECONOMIC IMPACT

## OF UNMANNED AIRCRAFT SYSTEMS INTEGRATION IN THE UNITED STATES

MARCH 2013

AUVSI®
ASSOCIATION FOR UNMANNED VEHICLE SYSTEMS INTERNATIONAL

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## About the Authors

**Darryl Jenkins**, author of "The Handbook of Airline Economics," is an airline analyst with more than 30 years of experience in the aviation industry. Jenkins also served as director of the Aviation Institute at George Washington University for more than 15 years. As an independent aviation consultant, Jenkins has worked for the majority of the world's top 50 airlines. In addition, he has consulted for the FAA, DOT, NTSB and other U.S. government agencies as well as many foreign countries. Jenkins also is the author of several aviation books and is a regular commentator for major media including ABC, CBS, NBC, MSNBC, CNN, FOX and major print publications. Jenkins was a member of the Executive Committee of the White House Conference on Aviation Safety and Security.

**Dr. Bijan Vasigh** is professor of economics and finance in the Department of Business Administration at Embry-Riddle Aeronautical University in Daytona Beach, Florida, and a managing director at Aviation Consulting Group LLC. Vasigh received a Ph.D. in economics from the State University of New York in 1984, and he has written and published many articles concerning the aviation industry. The articles have been published in numerous academic journals such as the "Handbook of Airline Economics," "Journal of Economics and Finance," "Journal of Transportation Management," "Transportation Quarterly," "Airport Business," "Journal of Business and Economics" and "Journal of Travel Research." He was a consultant with the International Civil Aviation Organization and provided assistance on the evolution of aeronautical charge structure for the Brazilian Institute of Civil Aviation. He is a member of the editorial board of "Journal of Air Transport Management," the "Southwest Journal of Pure and Applied Mathematics" and "Journal of Air Transportation World Wide." He is currently a member of the international faculty at the IATA Learning Center, where he is faculty leader of the Airline Finance and Accounting Management division.

# Executive Summary

The purpose of this research is to document the economic benefits to the United States (U.S.) once Unmanned Aircraft Systems (UAS) are integrated into in the National Airspace System (NAS).

In 2012, the federal government tasked the Federal Aviation Administration (FAA) to determine how to integrate UAS into the NAS. In this research, we estimate the economic impact of this integration. In the event that these regulations are delayed or not enacted, this study also estimates the jobs and financial opportunity lost to the economy because of this inaction.

While there are multiple uses for UAS in the NAS, this research concludes that **precision agriculture** and **public safety** are the most promising commercial and civil markets. These two markets are thought to comprise **approximately 90%** of the known potential markets for UAS.

We conclude the following:

1. The economic impact of the integration of UAS into the NAS will total more than $13.6 billion (Table 19) in the first three years of integration and will grow sustainably for the foreseeable future, cumulating to more than $82.1 billion between 2015 and 2025 (Table 1);
2. Integration into the NAS will create more than 34,000 manufacturing jobs (Table 18) and more than 70,000 new jobs in the first three years (Table 19);
3. By 2025, total job creation is estimated at 103,776 (Table 1);
4. The manufacturing jobs created will be high paying ($40,000) and require technical baccalaureate degrees;
5. Tax revenue to the states will total more than $482 million in the first 11 years following integration (2015-2025); and
6. Every year that integration is delayed, the United States loses more than **$10 billion** in potential economic impact. This translates to a loss of **$27.6 million per day that UAS are not integrated into the NAS.**

## Utility of UAS

The main inhibitor of U.S. commercial and civil development of the UAS is the lack of a regulatory structure. Because of current airspace restrictions, non-defense use of UAS has been extremely limited. However, the combination of greater flexibility, lower capital and lower operating costs could allow UAS to be a transformative technology in fields as diverse as urban infrastructure management, farming, and oil and gas exploration to name a few.

Present-day UAS have longer operational duration and require less maintenance than earlier models. In addition, they can be operated remotely using more fuel efficient technologies. These aircraft can be deployed in a number of different terrains and may be less dependent on prepared runways. Some argue the use of UAS in the future will be a more responsible approach to certain airspace operations from an environmental, ecological and human risk perspective.

UAS are already being used in a variety of applications, and many more areas will benefit by their use, such as[1]:

- **Wildfire mapping[2];**
- **Agricultural monitoring;**
- **Disaster management;**
- **Thermal infrared power line surveys;**
- **Law enforcement;**
- **Telecommunication;**
- **Weather monitoring;**
- **Aerial imaging/mapping;**
- **Television news coverage, sporting events, moviemaking[3];**
- **Environmental monitoring;**
- **Oil and gas exploration; and**
- **Freight transport.**

## Applicable Markets

There are a number of different markets in which UAS can be used. This research is concentrated on the two markets, commercial and civil, with the largest potential. A third category (Other) summarizes all other markets:

1. Precision agriculture;
2. Public safety; and
3. Other.

> While we project more than 100,000 new jobs by 2025, states that create favorable regulatory and business environments for the industry and the technology will likely siphon jobs away from states that do not.

Public safety officials include police officers and professional firefighters in the U.S., as well as a variety of professional and volunteer emergency medical service providers who protect the public from events that pose significant danger, including natural disasters, man-made disasters and crimes.

Precision agriculture refers to two segments of the farm market: remote sensing and precision application. A variety of remote sensors are being used to scan plants for health problems, record growth rates and hydration, and locate disease outbreaks. Such sensors can be attached to ground vehicles, aerial vehicles and even aerospace satellites. Precision application, a practice especially useful for crop farmers and horticulturists, utilizes effective and efficient spray techniques to more selectively cover plants and fields. This allows farmers to provide only the needed pesticide or nutrient to each plant, reducing the total amount sprayed, and thus saving money and reducing environmental impacts.

As listed above, a large number of other markets will also use UAS

[1]Market Intel Group (MiG), November, 2010
[2]Predators improve wildfire mapping: Tests under way to use unmanned aircraft for civilian purposes, Tribune Business News, August 26, 2007
[3]Honeywell International Inc 2004-2012

once the airspace is integrated. We believe the impact of these other markets will be at least the size of the impact from public safety use.

With sensible regulations in place, we foresee few limitations to rapid growth in these industries. These products use off-the-shelf technology and thus impose few problems to rapidly ramping up production. The inputs (i.e., parts) to the UAS can be purchased from more than 100 different suppliers; therefore, prices will be stable and competitive. The inputs to the UAS can all be purchased within the U.S., although these products can be imported from any number of foreign countries without the need of an import license. UAS have a durable life span of approximately 11 years and are relatively easy to maintain. The manufacture of these products requires technical skills equivalent to a baccalaureate degree. Therefore, there will always be a plentiful market of job applicants willing to enter this market. In summary, there are no production problems on the horizon that will impact the manufacturing and output of this product. Most of the barriers of potential usage are governmental and regulatory. For this study, we assume necessary airspace integration in 2015, on par with current legislation.

Covering and justifying the cost of UAS is straightforward. In the precision agriculture market, the average price of the UAS is a fraction of the cost of a manned aircraft, such as a helicopter or crop duster, without any of the safety hazards. For public safety, the price of the product is approximately the price of a police squad car equipped with standard gear. It is also operated at a fraction of the cost of a manned aircraft, such as a helicopter, reducing the strain on agency budgets as well as the risk of bodily harm to the users in many difficult and dangerous situations. Therefore, the cost-benefit ratios of using UAS can be easily understood.

## Economic Benefit

The economic benefits to the country are enormous and were estimated as follows. First, we forecast the number of sales in the three market categories. Next, we forecast the supplies needed to manufacture these products. Using estimated costs for labor, we forecast the number of direct jobs created. Using these factors, we forecast the tax revenue to the states.

In addition to direct jobs created by the manufacturing process, there is an additional economic benefit. The new jobs created and the income generated will be spread to local communities. As new jobs are created, additional money is spent at the local level, creating additional demand for local services which, in turn, creates even more jobs (i.e., grocery clerks, barbers, school teachers, home builders, etc.). These indirect and induced jobs are forecast and included in the total jobs created.

The economic benefits to individual states will not be evenly distributed. The following 10 states are predicted to see the most gains in terms of job creation and additional revenue as production of UAS increase, totaling more than $82 billion in economic impact from 2015-2025 (Table 1).

In rank order they are:

**1) California**
**2) Washington**
**3) Texas**
**4) Florida**
**5) Arizona**
**6) Connecticut**
**7) Kansas**
**8) Virginia**
**9) New York**
**10) Pennsylvania**

It is important to note that the projections contained in this report are based on the current airspace activity and infrastructure in a given state. As a result, states with an already thriving aerospace industry are projected to reap the most economic gains. However, a variety of factors—state laws, tax incentives, regulations, the establishment of test sites and the adoption of UAS technology by end users—will ultimately determine where jobs flow.

By 2025, we estimate more than 100,000 new jobs will be created nationally. For the purposes of this report, we base the 2025 state economic projections on the current aerospace employment in the states. We also presume that none of the states have enacted restrictive legislation or regulations that would limit the expansion of the technology. These landscapes will likely shift, however, as states work to attract UAS jobs in the years following integration. Future state laws and regulations could also cause some states to lose jobs while others stand to gain jobs. In conclusion, while we project more than 100,000 new jobs by 2025, states that create favorable regulatory and business environments for the industry and the technology will likely siphon jobs away from states that do not.

The trend in total spending, total economic impact and total employment impact was investigated for 2015 through 2025. The total spending in UAS development and total economic and employment impacts are expected to increase significantly in the next five years. This study demonstrates the significant contribution of UAS development and integration in the nation's airspace to the economic growth and job creation in the aerospace industry and to the social and economic progress of the citizens in the U.S. See Table 1 for the results of the total impact of UAS integration in the United States.

**TO READ THE FULL REPORT ONLINE, VISIT http://www.auvsi.org/econreport**

| Table 1: Total Economic Impact of UAS Integration in the United States | | | | | | |
|---|---|---|---|---|---|---|
| | 2015 - 2017 | | | 2015-2025 | | |
| State | Economic Impact $(M) | Taxes ($M) | Jobs Created | Economic Impact ($M) | Taxes ($M) | Jobs Created |
| Alabama | $294 | $2.43 | 1,510 | $1,765 | $14.60 | 2,231 |
| Alaska | $19 | $0.00 | 95 | $112 | $0.00 | 141 |
| Arizona | $561 | $2.59 | 2,883 | $3,371 | $15.55 | 4,260 |
| Arkansas | $80 | $0.94 | 411 | $481 | $5.63 | 608 |
| California | $2,390 | $13.64 | 12,292 | $14,372 | $82.03 | 18,161 |
| Colorado | $232 | $1.79 | 1,191 | $1,392 | $10.76 | 1,760 |
| Connecticut | $538 | $4.32 | 2,764 | $3,232 | $25.97 | 4,084 |
| Delaware | $17 | $0.16 | 88 | $103 | $0.97 | 131 |
| Florida | $632 | $0.00 | 3,251 | $3,801 | $0.00 | 4,803 |
| Georgia | $379 | $3.72 | 1,949 | $2,279 | $22.34 | 2,880 |
| Hawaii | $32 | $0.39 | 166 | $194 | $2.35 | 245 |
| Idaho | $29 | $0.36 | 149 | $174 | $2.16 | 220 |
| Illinois | $204 | $1.71 | 1,049 | $1,226 | $10.30 | 1,549 |
| Indiana | $208 | $1.18 | 1,067 | $1,248 | $7.12 | 1,577 |
| Iowa | $159 | $0.92 | 817 | $956 | $5.53 | 1,208 |
| Kansas | $489 | $4.84 | 2,515 | $2,941 | $29.13 | 3,716 |
| Kentucky | $89 | $0.90 | 459 | $537 | $5.41 | 678 |
| Louisiana | $213 | $1.44 | 1,097 | $1,282 | $8.67 | 1,620 |
| Maine | $107 | $1.26 | 548 | $641 | $7.56 | 810 |
| Maryland | $335 | $2.64 | 1,725 | $2,017 | $15.85 | 2,549 |
| Massachusetts | $386 | $3.36 | 1,985 | $2,321 | $20.22 | 2,933 |
| Michigan | $188 | $1.37 | 965 | $1,128 | $8.26 | 1,426 |
| Minnesota | $142 | $1.68 | 730 | $853 | $10.08 | 1,078 |
| Mississippi | $162 | $1.10 | 832 | $973 | $6.60 | 1,230 |
| Missouri | $260 | $1.73 | 1,338 | $1,565 | $10.37 | 1,978 |
| Montana | $14 | $0.15 | 74 | $86 | $0.91 | 109 |
| Nebraska | $25 | $0.22 | 128 | $149 | $1.30 | 189 |
| Nevada | $38 | $0.00 | 196 | $229 | $0.00 | 290 |
| New Hampshire | $85 | $0.00 | 439 | $514 | $0.00 | 649 |
| New Jersey | $263 | $3.24 | 1,353 | $1,582 | $19.50 | 1,999 |
| New Mexico | $101 | $0.73 | 518 | $606 | $4.41 | 765 |
| New York | $443 | $4.66 | 2,276 | $2,661 | $28.05 | 3,363 |
| North Carolina | $153 | $1.79 | 785 | $918 | $10.75 | 1,160 |
| North Dakota | $14 | $0.07 | 71 | $83 | $0.40 | 105 |
| Ohio | $359 | $2.43 | 1,844 | $2,156 | $14.60 | 2,725 |
| Oklahoma | $106 | $0.93 | 545 | $637 | $5.61 | 805 |
| Oregon | $81 | $0.41 | 416 | $486 | $2.47 | 614 |
| Pennsylvania | $393 | $2.02 | 2,021 | $2,363 | $12.12 | 2,986 |
| Rhode Island | $42 | $0.38 | 217 | $253 | $2.28 | 320 |
| South Carolina | $99 | $1.16 | 507 | $593 | $6.99 | 749 |
| South Dakota | $9 | $0.00 | 48 | $56 | $0.00 | 71 |
| Tennessee | $112 | $0.00 | 578 | $675 | $0.00 | 853 |
| Texas | $1,087 | $0.00 | 5,588 | $6,533 | $0.00 | 8,256 |
| Utah | $143 | $1.21 | 735 | $859 | $7.26 | 1,085 |
| Vermont | $36 | $0.47 | 184 | $215 | $2.81 | 271 |
| Virginia | $463 | $4.47 | 2,380 | $2,783 | $26.86 | 3,517 |
| Washington | $1,312 | $0.00 | 6,746 | $7,888 | $0.00 | 9,967 |
| West Virginia | $47 | $0.47 | 240 | $280 | $2.83 | 354 |
| Wisconsin | $88 | $0.96 | 450 | $527 | $5.76 | 665 |
| Wyoming | $5 | $0.00 | 24 | $28 | $0.00 | 36 |
| **Total** | $13,657 | $80.22 | 70,240 | $82,124 | $482.39 | 103,776 |

# Forecast

In this chapter, we describe the methodology for the forecasts we used as inputs to the economic benefits section. In accomplishing this task, we were fortunate to obtain and use comparable product sales from other countries. In making the forecasts, we relied on four different methods:

1) Comparable sales from other countries;
2) Survey results;
3) Land ratios; and
4) A literature search on rates of adoption of new technology.

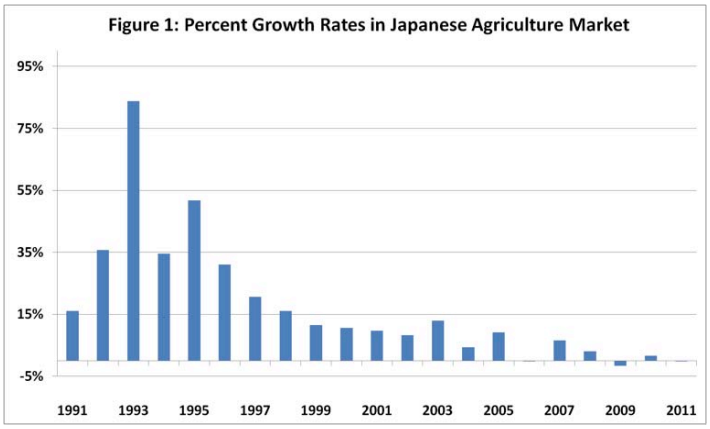
The four different methodologies yielded similar results and provide confidence in our final results.

Throughout this study, we use the following terms. When we use the term output, we are referring to the UAS. The inputs to the UAS are the parts and labor that go into making these products. In turn, the parts that go into the inputs we refer to as derived demand.

As part of this section, we provide a detailed discussion of the factors that may make our forecasts inaccurate and their potential impact. Our forecasts are for an 11-year period. That unit of measurement was chosen as that is the expected life of a UAS. We did not include maintenance, training or other revenue streams, which makes our overall estimates conservative. In addition, there are multiple options on sales including leasing the equipment and having third-party providers as an outsourced service, all of which add to our conservative estimates.

## Sales in Foreign Countries

Other countries have already adopted UAS technology from a zero base (i.e., first year of adoption). By now, these technologies have been operational for more than two decades. The growth curve is found to be logistic with a rapid beginning and then a leveling off of the market (Figure 1). The issue is not whether these products will be adopted once the airspace is integrated, but at what rate(s). The experience in Japan started out at rates of growth in excess of 20% annually. This was from no unmanned vehicles in 1990 (i.e., the zero base), where neither the companies nor the consumers had previous experience with this technology (see Appendix A for detailed data).




As is readily apparent, the growth rates in the early years in Japan were very high. The question of interest is: How fast will growth occur in the U.S.? We chose a short time period for growth in the U.S. (doubling the first year, 50% growth the next year and thereafter a 5% growth rate). Our justification is as follows. First, there is considerable experience with these products. American farmers are not starting out from a zero-knowledge base as did Japan. Second, UAS are not sold in the U.S. domestic market only because FAA regulations prohibit them in the nation's airspace. It is noted that the dampening of the Japanese growth curve happened within six years. The literature review found higher initial rates of product acceptance than the previous Japanese experience and lower leveling off of rates.

## Adoption Rates of New Technology

There are many factors that influence the rate at which new technologies are adopted and diffused into a society. We found considerable literature on this topic. The conclusion from the brief search we conducted is that new technologies are either accepted or rejected quickly. There is already a trade association that is doing outreach to the primary targets and showing products in their trade show(s). Because there is previous experience in this field, we reject the notion that these products will not be adopted. However, it is suggested that a follow up to this study be conducted on adoption of new technology. There is considerable literature on this topic, which needs to be investigated, and will help develop further adoption strategies.

## Methodology

We performed three separate forecasts for this study:

1) The estimated number of sales by state;
2) The estimated sales by state for the inputs to the final product; and
3) The estimated sales by state for the derived demand for the final products.

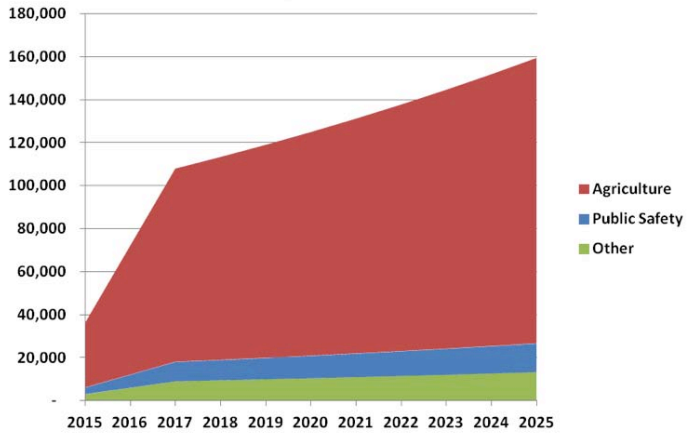
To complete these forecasts, we developed a telephone survey and pilot-tested it on five participants to refine our survey questions. We next conducted 30 telephone interviews with industry experts. An industry expert was defined as a person with more than three years of practical and relevant experience. Each interview lasted about 30 minutes. The participants were guaranteed confidentiality so we cannot divulge the individual results. However, we were able to obtain a reasonable estimate on what the group as a whole felt was the size of the market and the cost structure. Because there was considerable variance in these estimates, we ignored the outliers and calculated the average cost structure. We estimate that approximately 60% of the overall cost of a UAS is parts with an average annual labor cost of $37,000. In this report, we use $40,000 and hold it at a constant cost, as we do with the parts numbers. Thus the results can be interpreted as constant dollars over the entire term, as we are not forecasting the inflation rate. As for profitability, we consider this a competitive industry with a normal rate of return.

We found that almost all respondents considered agriculture to be far and above the largest market given that the public safety market is limited by the number of first-response teams. We next looked at some simple ratios between UAS sales in Japan and the amount of arable farmland and imputed these ratios to the United States. The survey results indicated an agricultural market of approximately 150,000 unit sales per year at maturity (i.e., 2020), and the Japanese land ratio indicated a market size of 165,000 unit sales per year. For the purposes of this forecast, we used 100,000 unit sales per year as a conservative benchmark. See Figure 2 for total expected sales for 2015-2025. Actual sales could be a multiple of this estimate.

As to the public safety market, the consensus was that the agriculture market will be at least 10 times the public safety market. Our follow-up task to the questionnaire was to find the number of first-response domestic teams and survey a small number of this group. We found their purchase issues to be minimal. They simply have a budget given to them by the local governmental unit that oversees them, and they work within it. Purchases of this size are not uncommon and public safety officials have all of the appearances of being early adopters, especially when safety is involved.

During the survey interviews, we discovered that there were unlimited uses of UAS. For example, many respondents discussed the potential uses of UAS for real estate purposes or for examining oil pipelines. In the case of oil pipelines, the consensus of the experts was that the total annual sale was approximately 1,000 units. For real estate personnel, there was not a consensus. From the surveys and follow-up calls with other professionals, we estimate that the aggregate size for other sales was approximately 10% of the total. In reality, this figure is a lower boundary and should be interpreted as at least 10% of the total. Depending on the promotions to this segment, the final price and, most importantly, the federal regulations, this segment could be significantly larger. We estimate the lower boundary at 10% to be conservative.

**Figure 2: Annual UAS Sales for Agriculture, Public Safety, and Other Markets**




In making the first round of forecasts, we tried several different methods but ultimately used a ratio of the number of direct aerospace and defense (A&D) industry employees in each state[4] to the total number of direct A&D industry employees in the U.S. For example, Alabama has an estimated 23,090 direct A&D industry employees out of a total of 1,040,796 direct A&D employees in the U.S., or 2.22% of the total. So we took the total forecast of agriculture sales and multiplied by 2.22% for Alabama. See Table 2 for a complete list of states and their estimated manufacturing distribution.

For the inputs, we find no constraints. There are plenty of manufacturers of these parts; they are off-the-shelf and require little lead time. If one supply line goes down, there are multiple sources as backups. For the input forecast, we relied on the size of the aerospace labor force in each state as the metric. These numbers were obtained from a Deloitte report, commissioned by the Aerospace Industries Association, titled "The Aerospace and Defense Industry in the U.S.: A Financial and Economic Impact Study"[5]. In this forecast, we also looked at employment and taxes. Using the estimated labor dollar amount, we simply divided by 40,000 to find the number of jobs. Subtracting adjacent years yields the number of new jobs created. We used marginal state tax rates for the $40,000 income range, the assumption being that states will hold this rate constant over time.

**Table 2: Estimated Manufacturing Distribution**

| State | Manufacturing Distribution | State | Manufacturing Distribution |
|---|---|---|---|
| Alabama | 2.22% | Montana | 0.11% |
| Alaska | 0.15% | Nebraska | 0.19% |
| Arizona | 4.10% | Nevada | 0.30% |
| Arkansas | 0.61% | New Hampshire | 0.67% |
| California | 15.58% | New Jersey | 1.99% |
| Colorado | 1.77% | New Mexico | 0.78% |
| Connecticut | 3.95% | New York | 3.30% |
| Delaware | 0.13% | North Carolina | 1.17% |
| Florida | 4.74% | North Dakota | 0.11% |
| Georgia | 2.83% | Ohio | 2.71% |
| Hawaii | 0.25% | Oklahoma | 0.81% |
| Idaho | 0.22% | Oregon | 0.63% |
| Illinois | 1.56% | Pennsylvania | 3.00% |
| Indiana | 1.59% | Rhode Island | 0.32% |
| Iowa | 1.24% | South Carolina | 0.76% |
| Kansas | 3.54% | South Dakota | 0.07% |
| Kentucky | 0.69% | Tennessee | 0.81% |
| Louisiana | 1.65% | Texas | 8.43% |
| Maine | 0.82% | Utah | 1.10% |
| Maryland | 2.53% | Vermont | 0.27% |
| Massachusetts | 2.90% | Virginia | 3.55% |
| Michigan | 1.44% | Washington | 9.02% |
| Minnesota | 1.09% | West Virginia | 0.36% |
| Mississippi | 1.25% | Wisconsin | 0.67% |
| Missouri | 1.97% | Wyoming | 0.04% |

4Deloitte, The Aerospace and Defense Industry in the U.S., A financial and economic impact study, March, 2012
5http://www.deloitte.com/view/en_US/us/Industries/Aerospace-Defense-Manufacturing/b4c8ae98118f5310VgnVCM3000001c56f00aRCRD.htm

## Necessary Conditions for the Forecasts

We now turn our attention to the conditions that must happen to validate this forecast:

1) The FAA must develop new regulations integrating UAS into the nation's airspace;
2) Job growth distribution will mimic current aerospace manufacturing employment;
3) Creative destruction of existing jobs will have a net-zero impact;
4) There must be sufficient capital available to smaller manufacturing companies;
5) There must be financing available to UAS purchasers;
6) There must be insurance to cover liabilities;
7) Gross Domestic Product (GDP) needs to grow at least 3% annually over the designated time period;
8) The adoption rate(s) of this product in the U.S. will mimic Japan; and
9) Other unforeseen factors.

### The FAA Must Develop New Regulations Integrating UAS into the Nation's Airspace

Perhaps the single most important aspect of this forecast is that the FAA develops new guidelines allowing the integration of UAS in the nation's airspace. In the absence of these guidelines, this report is simply the opportunity cost to the economy (new jobs, tax revenue, etc.) of a good idea that was hindered due to government interference or inaction. The FAA regulatory process, like all government entities, is slow and unpredictable.

### Job Growth Distribution Will Mimic Current Aerospace Manufacturing Employment

The employment growth described in this report is all new employment, that is, jobs that do not currently exist. To project the statewide distribution of this employment, we used current aerospace manufacturing employment. However, there are many external factors that will affect this distribution that are impossible to predict in this report. These include, among other things, tax incentives, test sites and where new product development will actually occur.

### Creative Destruction of Existing Jobs Will Have a Net Zero Impact

As UAS are introduced, some uses will replace existing capabilities, because there are efficiencies to be gained by using a UAS versus a traditional capability. As such, there is likely to be some job destruction from UAS. However, UAS will still need many similar capabilities to manned systems including training, maintenance and pilots. Any jobs that will be made immaterial by UAS will be transitioned to regular UAS operations. Because of the efficient use of UAS, there will be job creation in other areas. For instance, a farmer that saves money because he or she can use less pesticide since UAS can provide precision application will spend less money on pesticides and less on taxes due to pesticide use. That money back into the farmer's pocket will provide economic impact to the U.S. that is not calculated in this report. To simplify, we generalize that there will be a net-zero impact of job creation in the application of these systems. A detailed analysis of this potential job creation is recommended for further research.

### There Must be Sufficient Capital Available to Smaller Manufacturing Companies

One of the biggest problems with growing companies is their access to capital. As companies grow, their need for capital to buy new equipment, hire additional personnel, rent extra space and all of the other requirements are seldom met from working capital. The need for short-term working capital to accommodate growth can stymie any otherwise well thought out business plan.

### There Must be Financing Available to UAS Purchasers

While the costs of these purchases are not the same as other farm equipment, they are seldom made as a cash purchase. Farm implements, such as tractors, are usually bought with company financing as they do not have serial numbers like cars. Banks may finance a tractor, but usually at a higher interest rate with the credit worthiness of the person as the collateral. This means that the industry or consortia of companies will need to be created for these purchases. There is probably less of a need for these arrangements for public safety, but they are only a shadow market compared to the agriculture market. It is clear that offering financing from a small company standpoint, outside of normal banking realms, is impossible and impractical at this time. This may be one of the most important factors outside of regulation reform to move this industry forward.

### Insurance to Cover Liabilities Must be Supplied

One of the many great unknowns about the infant commercial UAS industry is its product liability exposure. Suppose a UAS used by a public safety agency malfunctions and crashes into a building. The assumption is that this event is covered by the local government's umbrella insurance policy. What if this happens elsewhere? Perhaps the thrust of this argument is that the industry as a whole needs to start collecting relevant data in this realm. A Google search on this topic turned up little information, as governments use UAS mainly for wartime purposes. However, anything mechanical can malfunction, and a UAS is no exception. There will be issues of proper maintenance and liability, as there always are with aircraft of any type, in addition to workmen's compensation and other potential problems. The long-term issue is the need for industry-wide data collection.

### GDP Needs to Grow at Least 3% Annually Over the Designated Time Period

All studies of this nature require GDP assumptions. The typical scenario is that over a longer time period, the economy will grow at 3% per year. This is our assumption as well. Our forecast is that with new and improved products, they will grow at a slightly higher rate.

There may be several problems with this assumption. First, the current economic stagnation may persist. If so, this may favor sunken capital over new capital. Thus, we may see growth, but at a much later date, and significantly slower growth thereafter. If this happens, it has the potential to make our forecast inaccurate.

### The Adoption Rate(s) of this Product in the U.S. Will Mimic Japan

Consumers in different counties or even different segments of the same country can react differently to the same product offering. Our assumption is that consumers in both countries will react similarly.

### Other Unforeseen Factors

Any researcher knows that economic analysis and forecasts may not include hundreds of unforeseen events that impact economic estimates that were not taken into account. Any of these may materially affect our forecast.

## Discussion of Forecast Results

In this section, we will discuss the forecast results for the year 2015, which is the first forecast year. Table 3 shows the rank ordering of UAS manufacturing by state for agriculture uses in 2015, and Table 4 shows it for public safety. Other markets besides agriculture and public safety are estimated to have the same total economic impact as the public safety market, so in the following we only show the agriculture and public safety markets. Final economic impact calculations include agriculture, public safety and other markets (i.e., the public safety total economic impact multiplied by two to account for "other markets").

**Table 3: 2015 Total UAS Agriculture Sales Inputs**

| State | Labor | Parts | Taxes | Employment |
|---|---|---|---|---|
| California | $65,438,414 | $ 98,157,622 | $2,094,029 | 1,636 |
| Washington | $37,902,240 | $ 56,853,360 | $ - | 948 |
| Texas | $35,422,907 | $ 53,134,361 | $ - | 886 |
| Florida | $19,927,882 | $ 29,891,823 | $ - | 498 |
| Arizona | $17,225,796 | $ 25,838,695 | $ 396,882 | 431 |
| Connecticut | $16,575,698 | $ 24,863,547 | $ 663,028 | 414 |
| Virginia | $14,907,071 | $ 22,360,607 | $ 685,725 | 373 |
| Kansas | $14,873,981 | $ 22,310,972 | $ 743,699 | 372 |
| New York | $13,878,051 | $ 20,817,077 | $ 716,107 | 347 |
| Pennsylvania | $12,598,434 | $ 18,897,651 | $ 309,418 | 315 |
| Massachusetts | $12,175,124 | $ 18,262,685 | $ 516,225 | 304 |
| Georgia | $11,882,156 | $ 17,823,233 | $ 570,343 | 297 |
| Ohio | $11,362,400 | $ 17,043,599 | $ 372,687 | 284 |
| Maryland | $10,645,314 | $ 15,967,971 | $ 404,522 | 266 |
| Alabama | $ 9,317,676 | $ 13,976,514 | $ 372,707 | 233 |
| New Jersey | $ 8,353,625 | $ 12,530,438 | $ 497,876 | 209 |
| Missouri | $ 8,276,550 | $ 12,414,825 | $ 264,850 | 207 |
| Colorado | $ 7,416,208 | $ 11,124,313 | $ 274,696 | 185 |
| Louisiana | $ 6,918,647 | $ 10,377,970 | $ 221,397 | 173 |
| Indiana | $ 6,686,613 | $ 10,029,919 | $ 181,876 | 167 |
| Illinois | $ 6,571,201 | $ 9,856,802 | $ 262,848 | 164 |
| Michigan | $ 6,060,323 | $ 9,090,485 | $ 210,899 | 152 |
| Mississippi | $ 5,268,583 | $ 7,902,874 | $ 168,595 | 132 |
| Iowa | $ 5,193,121 | $ 7,789,682 | $ 141,253 | 130 |
| North Carolina | $ 4,898,943 | $ 7,348,414 | $ 274,341 | 122 |
| Utah | $ 4,636,240 | $ 6,954,360 | $ 185,450 | 116 |
| Minnesota | $ 4,561,989 | $ 6,842,984 | $ 257,296 | 114 |
| Maine | $ 3,444,594 | $ 5,166,891 | $ 192,897 | 86 |
| Oklahoma | $ 3,410,294 | $ 5,115,440 | $ 143,232 | 85 |
| Tennessee | $ 3,390,117 | $ 5,085,175 | $ - | 85 |
| New Mexico | $ 3,271,880 | $ 4,907,821 | $ 112,553 | 82 |
| South Carolina | $ 3,185,523 | $ 4,778,285 | $ 178,389 | 80 |
| Kentucky | $ 2,877,624 | $ 4,316,437 | $ 138,126 | 72 |
| Wisconsin | $ 2,825,568 | $ 4,238,352 | $ 146,930 | 71 |
| New Hampshire | $ 2,817,497 | $ 4,226,246 | $ - | 70 |
| Oregon | $ 2,632,274 | $ 3,948,411 | $ 63,175 | 66 |
| Arkansas | $ 2,565,690 | $ 3,848,535 | $ 143,679 | 64 |
| West Virginia | $ 1,504,791 | $ 2,257,186 | $ 72,230 | 38 |
| Rhode Island | $ 1,364,360 | $ 2,046,539 | $ 58,326 | 34 |
| Nevada | $ 1,255,001 | $ 1,882,501 | $ - | 31 |
| Vermont | $ 1,150,888 | $ 1,726,333 | $ 71,815 | 29 |
| Hawaii | $ 1,041,126 | $ 1,561,689 | $ 59,969 | 26 |
| Idaho | $ 932,978 | $ 1,399,467 | $ 55,232 | 23 |
| Nebraska | $ 807,478 | $ 1,211,217 | $ 33,074 | 20 |
| Alaska | $ 611,763 | $ 917,644 | $ - | 15 |
| Delaware | $ 557,285 | $ 835,928 | $ 24,743 | 14 |
| Montana | $ 462,857 | $ 694,286 | $ 23,328 | 12 |
| North Dakota | $ 453,576 | $ 680,364 | $ 10,233 | 11 |
| South Dakota | $ 305,881 | $ 458,822 | $ - | 8 |
| Wyoming | $ 155,765 | $ 233,648 | $ - | 4 |

**Table 4: 2015 Total UAS Public Safety Sales Inputs**

| State | Labor | Parts | Taxes | Employment |
|---|---|---|---|---|
| California | $ 2,804,503 | $ 4,206,755 | $ 89,744 | 70 |
| Washington | $ 1,624,382 | $ 2,436,573 | $ - | 41 |
| Texas | $ 1,518,125 | $ 2,277,187 | $ - | 38 |
| Florida | $ 854,052 | $ 1,281,078 | $ - | 21 |
| Arizona | $ 738,248 | $ 1,107,373 | $ 17,009 | 18 |
| Connecticut | $ 710,387 | $ 1,065,581 | $ 28,415 | 18 |
| Virginia | $ 638,874 | $ 958,312 | $ 29,388 | 16 |
| Kansas | $ 637,456 | $ 956,184 | $ 31,873 | 16 |
| New York | $ 594,774 | $ 892,160 | $ 30,690 | 15 |
| Pennsylvania | $ 539,933 | $ 809,899 | $ 13,261 | 13 |
| Massachusetts | $ 521,791 | $ 782,687 | $ 22,124 | 13 |
| Georgia | $ 509,235 | $ 763,853 | $ 24,443 | 13 |
| Ohio | $ 486,960 | $ 730,440 | $ 15,972 | 12 |
| Maryland | $ 456,228 | $ 684,342 | $ 17,337 | 11 |
| Alabama | $ 399,329 | $ 598,993 | $ 15,973 | 10 |
| New Jersey | $ 358,013 | $ 537,019 | $ 21,338 | 9 |
| Missouri | $ 354,709 | $ 532,064 | $ 11,351 | 9 |
| Colorado | $ 317,838 | $ 476,756 | $ 11,773 | 8 |
| Louisiana | $ 296,513 | $ 444,770 | $ 9,488 | 7 |
| Indiana | $ 286,569 | $ 429,854 | $ 7,795 | 7 |
| Illinois | $ 281,623 | $ 422,434 | $ 11,265 | 7 |
| Michigan | $ 259,728 | $ 389,592 | $ 9,039 | 6 |
| Mississippi | $ 225,796 | $ 338,695 | $ 7,225 | 6 |
| Iowa | $ 222,562 | $ 333,844 | $ 6,054 | 6 |
| North Carolina | $ 209,955 | $ 314,932 | $ 11,757 | 5 |
| Utah | $ 198,696 | $ 298,044 | $ 7,948 | 5 |
| Minnesota | $ 195,514 | $ 293,271 | $ 11,027 | 5 |
| Maine | $ 147,625 | $ 221,438 | $ 8,267 | 4 |
| Oklahoma | $ 146,155 | $ 219,233 | $ 6,139 | 4 |
| Tennessee | $ 145,291 | $ 217,936 | $ - | 4 |
| New Mexico | $ 140,223 | $ 210,335 | $ 4,824 | 4 |
| South Carolina | $ 136,522 | $ 204,784 | $ 7,645 | 3 |
| Kentucky | $ 123,327 | $ 184,990 | $ 5,920 | 3 |
| Wisconsin | $ 121,096 | $ 181,644 | $ 6,297 | 3 |
| New Hampshire | $ 120,750 | $ 181,125 | $ - | 3 |
| Oregon | $ 112,812 | $ 169,218 | $ 2,707 | 3 |
| Arkansas | $ 109,958 | $ 164,937 | $ 6,158 | 3 |
| West Virginia | $ 64,491 | $ 96,737 | $ 3,096 | 2 |
| Rhode Island | $ 58,473 | $ 87,709 | $ 2,500 | 1 |
| Nevada | $ 53,786 | $ 80,679 | $ - | 1 |
| Vermont | $ 49,324 | $ 73,986 | $ 3,078 | 1 |
| Hawaii | $ 44,620 | $ 66,930 | $ 2,570 | 1 |
| Idaho | $ 39,985 | $ 59,977 | $ 2,367 | 1 |
| Nebraska | $ 34,606 | $ 51,909 | $ 1,417 | 1 |
| Alaska | $ 26,218 | $ 39,328 | $ - | 1 |
| Delaware | $ 23,884 | $ 35,825 | $ 1,060 | 1 |
| Montana | $ 19,837 | $ 29,755 | $ 1,000 | 0 |
| North Dakota | $ 19,439 | $ 29,158 | $ 439 | 0 |
| South Dakota | $ 13,109 | $ 19,664 | $ - | 0 |
| Wyoming | $ 6,676 | $ 10,013 | $ - | 0 |

The next series of tables we refer to as derived demand. The products that are used as inputs are manufactured by other companies, and the platform manufacturer must buy inputs for their finished goods. Table 5 shows the results for the derived demand for inputs for agriculture and Table 6 for public safety.

**Table 5: 2015 Total UAS Agriculture Derived Demand**

| State | Labor | Parts | Taxes | Employment |
|---|---|---|---|---|
| California | $39,263,049 | $58,894,573 | $1,256,418 | 982 |
| Washington | $22,741,344 | $34,112,016 | $ - | 569 |
| Texas | $21,253,744 | $31,880,616 | $ - | 531 |
| Florida | $11,956,729 | $17,935,094 | $ - | 299 |
| Arizona | $10,335,478 | $15,503,217 | $ 238,129 | 258 |
| Connecticut | $ 9,945,419 | $14,918,128 | $ 397,817 | 249 |
| Virginia | $ 8,944,243 | $13,416,364 | $ 411,435 | 224 |
| Kansas | $ 8,924,389 | $13,386,583 | $ 446,219 | 223 |
| New York | $ 8,326,831 | $12,490,246 | $ 429,664 | 208 |
| Pennsylvania | $ 7,559,061 | $11,338,591 | $ 185,651 | 189 |
| Massachusetts | $ 7,305,074 | $10,957,611 | $ 309,735 | 183 |
| Georgia | $ 7,129,293 | $10,693,940 | $ 342,206 | 178 |
| Ohio | $ 6,817,440 | $10,226,160 | $ 223,612 | 170 |
| Maryland | $ 6,387,188 | $ 9,580,782 | $ 242,713 | 160 |
| Alabama | $ 5,590,606 | $ 8,385,908 | $ 223,624 | 140 |
| New Jersey | $ 5,012,175 | $ 7,518,263 | $ 298,726 | 125 |
| Missouri | $ 4,965,930 | $ 7,448,895 | $ 158,910 | 124 |
| Colorado | $ 4,449,725 | $ 6,674,588 | $ 164,818 | 111 |
| Louisiana | $ 4,151,188 | $ 6,226,782 | $ 132,838 | 104 |
| Indiana | $ 4,011,968 | $ 6,017,952 | $ 109,126 | 100 |
| Illinois | $ 3,942,721 | $ 5,914,081 | $ 157,709 | 99 |
| Michigan | $ 3,636,194 | $ 5,454,291 | $ 126,540 | 91 |
| Mississippi | $ 3,161,150 | $ 4,741,725 | $ 101,157 | 79 |
| Iowa | $ 3,115,873 | $ 4,673,809 | $ 84,752 | 78 |
| North Carolina | $ 2,939,366 | $ 4,409,048 | $ 164,604 | 73 |
| Utah | $ 2,781,744 | $ 4,172,616 | $ 111,270 | 70 |
| Minnesota | $ 2,737,193 | $ 4,105,790 | $ 154,378 | 68 |
| Maine | $ 2,066,757 | $ 3,100,135 | $ 115,738 | 52 |
| Oklahoma | $ 2,046,176 | $ 3,069,264 | $ 85,939 | 51 |
| Tennessee | $ 2,034,070 | $ 3,051,105 | $ - | 51 |
| New Mexico | $ 1,963,128 | $ 2,944,692 | $ 67,532 | 49 |
| South Carolina | $ 1,911,314 | $ 2,866,971 | $ 107,034 | 48 |
| Kentucky | $ 1,726,575 | $ 2,589,862 | $ 82,876 | 43 |
| Wisconsin | $ 1,695,341 | $ 2,543,011 | $ 88,158 | 42 |
| New Hampshire | $ 1,690,498 | $ 2,535,748 | $ - | 42 |
| Oregon | $ 1,579,364 | $ 2,369,046 | $ 37,905 | 39 |
| Arkansas | $ 1,539,414 | $ 2,309,121 | $ 86,207 | 38 |
| West Virginia | $ 902,874 | $ 1,354,312 | $ 43,338 | 23 |
| Rhode Island | $ 818,616 | $ 1,227,924 | $ 34,996 | 20 |
| Nevada | $ 753,001 | $ 1,129,501 | $ - | 19 |
| Vermont | $ 690,533 | $ 1,035,800 | $ 43,089 | 17 |
| Hawaii | $ 624,676 | $ 937,014 | $ 35,981 | 16 |
| Idaho | $ 559,787 | $ 839,680 | $ 33,139 | 14 |
| Nebraska | $ 484,487 | $ 726,730 | $ 19,845 | 12 |
| Alaska | $ 367,058 | $ 550,586 | $ - | 9 |
| Delaware | $ 334,371 | $ 501,557 | $ 14,846 | 8 |
| Montana | $ 277,714 | $ 416,572 | $ 13,997 | 7 |
| North Dakota | $ 272,146 | $ 408,218 | $ 6,140 | 7 |
| South Dakota | $ 183,529 | $ 275,293 | $ - | 5 |
| Wyoming | $ 93,459 | $ 140,189 | $ - | 2 |

**Table 6: 2015 Total UAS Public Safety Derived Demand**

| State | Labor | Parts | Taxes | Employment |
|---|---|---|---|---|
| California | $ 1,682,702 | $2,524,053 | $53,846 | 42 |
| Washington | $ 974,629 | $1,461,944 | $ - | 24 |
| Texas | $ 910,875 | $1,366,312 | $ - | 23 |
| Florida | $ 512,431 | $ 768,647 | $ - | 13 |
| Arizona | $ 442,949 | $ 664,424 | $10,206 | 11 |
| Connecticut | $ 426,232 | $ 639,348 | $17,049 | 11 |
| Virginia | $ 383,325 | $ 574,987 | $17,633 | 10 |
| Kansas | $ 382,474 | $ 573,711 | $19,124 | 10 |
| New York | $ 356,864 | $ 535,296 | $18,414 | 9 |
| Pennsylvania | $ 323,960 | $ 485,940 | $ 7,956 | 8 |
| Massachusetts | $ 313,075 | $ 469,612 | $13,274 | 8 |
| Georgia | $ 305,541 | $ 458,312 | $14,666 | 8 |
| Ohio | $ 292,176 | $ 438,264 | $ 9,583 | 7 |
| Maryland | $ 273,737 | $ 410,605 | $10,402 | 7 |
| Alabama | $ 239,597 | $ 359,396 | $ 9,584 | 6 |
| New Jersey | $ 214,808 | $ 322,211 | $12,803 | 5 |
| Missouri | $ 212,826 | $ 319,238 | $ 6,810 | 5 |
| Colorado | $ 190,703 | $ 286,054 | $ 7,064 | 5 |
| Louisiana | $ 177,908 | $ 266,862 | $ 5,693 | 4 |
| Indiana | $ 171,941 | $ 257,912 | $ 4,677 | 4 |
| Illinois | $ 168,974 | $ 253,461 | $ 6,759 | 4 |
| Michigan | $ 155,837 | $ 233,755 | $ 5,423 | 4 |
| Mississippi | $ 135,478 | $ 203,217 | $ 4,335 | 3 |
| Iowa | $ 133,537 | $ 200,306 | $ 3,632 | 3 |
| North Carolina | $ 125,973 | $ 188,959 | $ 7,054 | 3 |
| Utah | $ 119,218 | $ 178,826 | $ 4,769 | 3 |
| Minnesota | $ 117,308 | $ 175,962 | $ 6,616 | 3 |
| Maine | $ 88,575 | $ 132,863 | $ 4,960 | 2 |
| Oklahoma | $ 87,693 | $ 131,540 | $ 3,683 | 2 |
| Tennessee | $ 87,174 | $ 130,762 | $ - | 2 |
| New Mexico | $ 84,134 | $ 126,201 | $ 2,894 | 2 |
| South Carolina | $ 81,913 | $ 122,870 | $ 4,587 | 2 |
| Kentucky | $ 73,996 | $ 110,994 | $ 3,552 | 2 |
| Wisconsin | $ 72,657 | $ 108,986 | $ 3,778 | 2 |
| New Hampshire | $ 72,450 | $ 108,675 | $ - | 2 |
| Oregon | $ 67,687 | $ 101,531 | $ 1,624 | 2 |
| Arkansas | $ 65,975 | $ 98,962 | $ 3,695 | 2 |
| West Virginia | $ 38,695 | $ 58,042 | $ 1,857 | 1 |
| Rhode Island | $ 35,084 | $ 52,625 | $ 1,500 | 1 |
| Nevada | $ 32,271 | $ 48,407 | $ - | 1 |
| Vermont | $ 29,594 | $ 44,391 | $ 1,847 | 1 |
| Hawaii | $ 26,772 | $ 40,158 | $ 1,542 | 1 |
| Idaho | $ 23,991 | $ 35,986 | $ 1,420 | 1 |
| Nebraska | $ 20,764 | $ 31,146 | $ 850 | 1 |
| Alaska | $ 15,731 | $ 23,597 | $ - | 0 |
| Delaware | $ 14,330 | $ 21,495 | $ 636 | 0 |
| Montana | $ 11,902 | $ 17,853 | $ 600 | 0 |
| North Dakota | $ 11,663 | $ 17,495 | $ 263 | 0 |
| South Dakota | $ 7,866 | $ 11,798 | $ - | 0 |
| Wyoming | $ 4,005 | $ 6,008 | $ - | 0 |

## Forecast Conclusion

In this section, we outline the assumptions and methodology used in making our forecasts. We drew on experience in Japan for comparable sales. Japan and the U.S. are both countries that readily adapt new technologies. We conclude the following:

1) If the FAA adopts new rules allowing for commercial use of UAS in the nation's airspace, these products will be received rapidly into the marketplace;

2) The doubling rate can take place over either a three-year or six-year period. With the known rates of change in newer technologies, it is likely to be a three-year scenario given the fact that the potential marketplace is well aware of the product(s) unlike the introduction in Japan; and

3) The commercial agriculture market is by far the largest segment, dwarfing all others.

Agriculture is an important product group. It has the potential for bringing a more reliable, cost-effective and safe method to domestic farmers for a variety of uses. In the event that a new set of regulations is not enacted and UAS are not integrated in the U.S. National Airspace System (NAS), this study estimates the lost jobs, lost tax revenue, and total economic loss to the states and nation. In addition, a delay in airspace integration will impact the U.S. in terms of a lag in technology development, manufacturing, job development and economic stimulus. With U.S. integration of UAS, more than 103,000 good paying jobs with benefits will be created.

While this section shows the huge potential available to the nation, the exact calculations of these benefits are laid out in the next section, where we estimate the total economic impact of NAS integration.

# Economic Impact Analysis

Economic impact is based on the theory that a dollar flowing into a local economy from the outside is a benefit to the regional economy. The financial return for residents is in the form of new jobs, more earnings and new tax revenues that follow because of the initial development of a new business organization, and through new spending, in the municipality due to the operation of such a business or industry. These earnings, for instance, are generated for residents who are not directly associated with the business but who are the beneficiaries of the positive externalities that the business or industry can provide to communities.

External benefits, or positive externalities, are those returns that are generated by a business but that are not captured by the business or local region. When the employees of a company spend money at local businesses, such as restaurants, gas stations and retail stores, their spending will benefit the owners and employees of those establishments, thereby creating a positive incremental impact.

According to Davis (1990) an impact analysis is purposely designed to produce quantitative results of the effects that a certain segment of an industry has in the local economy. From an industry's standpoint, these impact studies are based on the grounds of aggregate economic growth that may be derived from additional spending by the business. The range of the impact can be limited to the city, county, state or national levels.

There are various methodologies that aid the economic valuation of specific organizations in their local economies. From the literature review, we concluded that Economic Impact Analysis (EIA) mostly relies on input-output economic models. Economists evaluate the impact that one sector has on another in terms of indirect and induced effects. The total economic impact is then the sum of the direct, indirect and induced effects.

## Direct Impacts

Direct impacts are consequences of economic activities carried out by a company or organization in the economy. For example, institutions (public or private) have a direct impact on the local economy because of the activities conducted by the institution, management, employees, visitors and other related events. Employing labor, purchasing locally produced goods and services, and contracting for construction and capital improvements are all examples of activities that generate direct impacts. Some direct impacts, such as UAS, occur on site. Others, such as local production of goods and services for use at the institution, may occur off site.

Expenditures by management, owners and visitors also generate direct impacts, but only those expenditures that lead to local business activity are relevant for a regional economic assessment. For this reason, it is important to distinguish between (a) the local value-added component of expenditures and (b) the regional import component. Thus, the manufacturers of UAS expenditures on utilities, supplies, professional services, meals and entertainment generate significant economic benefits to the local and national economy. In most parts of the country, only the former component is relevant for the analysis. The following is a list of local value-added components:

- Direct Spending Effects:
  Construction, maintenance, operations
- Direct Business Cost Savings:
  Value of user benefits
- Other Business Cost Savings:
  Logistics/inventory/ processing, scale economies
- Regional Business Markets:
  Tourism, business relocation effects
- Personal Cost Savings:
  Effect on disposable income

The distinguishing feature of a direct impact is that it is an immediate consequence of the manufacturers of UAS' economic activity.

## Indirect Impacts

In addition to the direct effect of an economic activity, there are also indirect effects and induced effects. Indirect impacts derive from off-site economic activities that are attributable to the business activities of the manufacturers of UAS' presence. For example, if we are looking at the job impacts of a new UAS being manufactured in Arizona, the direct effect is the number of new jobs created by the company itself. The indirect effect is the number of new jobs created at those firms that supply ancillary services for individuals who are employed at the UAS manufacturing facility and for customers of the firm. These can include, but are not limited to, hotels, restaurants and other businesses that may expand because of the presence of the UAS manufacturing facility. These suppliers and clients employ labor, purchase locally produced goods and services, and invest in capital expansion and improvements. Indirect impacts differ from direct impacts in that they originate entirely off site.

Examples of indirect impacts would be:

- Ancillary business expansion due to the UAS firm;
- New capital investment in response to the UAS firm; and
- Supplies and equipment that may be purchased because of the new business opportunities created by the UAS manufacturing facility.

## Induced Impacts

Induced impacts are the result of spending of the wages and salaries of the direct and indirect employees on items such as food, housing, transportation and medical services. In other words, induced effects are the multiplier effects caused by successive rounds of spending throughout the economy as a result of the direct and indirect effects discussed above.

For example, most of the take-home income earned by the manu-

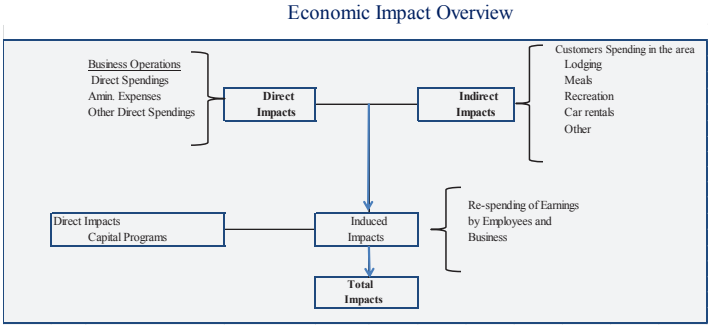
facturers of UAS employees is spent locally. Some of this spending becomes income to local businesses and their employees that provide services to the firm's employees. Then part of these second-round incomes are also spent locally and thus become income to another set of individuals. As successive rounds of spending occur, additional income is created. Although some of the induced impacts occur locally, some are felt outside the region because of the regional import components of the goods and services purchased. More economically self-sufficient regions have higher multipliers than do regions that are more dependent on regional imports, because more of the spending and respending is accomplished in the area. Similarly, two or more counties considered together as one economic region would have a higher multiplier than would each individual county.

## Total Impact

The total impact is the sum of direct impacts, indirect impacts and induced impacts. Total impact is expressed in economic output, earnings or jobs.

Total Impacts = Direct Impacts + Indirect Impacts + Induced Impacts

Economic Impact Overview




Economists sometimes say that the direct economic impacts are "multiplied" through their indirect economic impacts. The ratio of the total (direct + indirect) economic impacts to the direct economic impacts is frequently referred to as the economic multiplier. The employment multiplier is the ratio of total employment to direct employment. The income multiplier is the ratio of total income to direct income created.

Multipliers are not directly observed; rather, they are inferred from an economic model. The direct measure is generally the most accurate since it can be measured more easily, but it only represents a part of the impact, so other multipliers are added to get the total. However, it should be emphasized that the sum of the multipliers is very important since these are virtually the only tools available to researchers attempting to identify the overall impact of activity within a regional economy.

Although a variety of methods can be used to generate economic multipliers, input-output (I-O) models are the most popular tool for such analysis and will be our focus. IMPLAN is a standard economic impact software package used to generate indirect, induced employment and sales estimates. IMPLAN utilizes user-supplied estimates of the direct sales and/or employment and provides associated indirect and induced effects estimates. Direct effects are the changes in the industries to which a final demand change was made; indirect effects are the changes in interindustry purchases as the response to demand of the directly affected industry; and induced effects generally reflect changes in household spending resulting from activity generated by the direct and indirect effects (MIG, p.102).

$$Multiplier = \frac{indirect\ impacts}{direct\ impacts}$$

## Previous Economic Impact Studies

Conducting an economic impact study is important, because it is a useful tool to evaluate the economic impact of a business in a community in terms of jobs, income and tax revenue. Ten studies were selected from the literature to illustrate the different facets of economic impact and approaches used to assess impact. The purpose is to illustrate the range of values that may be achieved by different economic entities. The 10 examples are listed below:

- Marshall County Hospital Impact in Marshall County, Kentucky;
- Port of Baltimore impact in Maryland;
- University of Florida in Florida;
- Intel impact in Washington County;
- Intel impact in Oregon;
- Intel impact in Portland, Oregon Metro;
- Boeing impact in Arizona;
- All Acute Care Hospital Systems impact in New Hampshire;
- National Aeronautics and Space Administration (NASA) impact in Florida; and
- Nike impact in Oregon.

## Methodology

The aircraft industry, undoubtedly, provides significant economic and social benefits for the regional, state and national economies. Most economic impact analyses utilize input-output models to provide detailed descriptions on how money invested in an economy travels and, through multiplier effects, creates additional employment and income. The basis of these input-output models is a summation of expenditures of the manufacturer (operations, capital and payroll) and the application of the multipliers to account for the interdependency of economic activity in a local economy (Siegfried et al., 2007). There are two well-known input-output programs: Regional Input-Output Modeling System (RIMS II) and the more advanced Impact Analysis for Planning (IMPLAN) software.

To more effectively use the multipliers for impact analysis, users must provide geographically and industrially detailed information

on the initial changes in output, earnings or employment that are associated with the project or program under study.

RIMS II was developed by the Bureau of Economic Analysis (BEA) and is based on an accounting framework called an I-O table, which shows the industrial distribution of inputs purchased and outputs sold for each industry (BEA, 2010). There are two sources for the I-O table: BEA's national I-O table, which shows the input and output structure of nearly 500 U.S. industries, and BEA's regional economic accounts, which are used to adjust the national I-O table to show a region's industrial structure and trading patterns. RIMS II has several advantages:

- Multipliers can be estimated for any region and for any industry;
- Low-cost estimates of regional multipliers because of data source accessibility are available; and
- Expensive surveys and RIMS II-based estimates are similar in magnitude.

IMPLAN is a more specialized software; it captures the actual dollar amounts of all business transactions taking place in a regional economy by utilizing Social Accounting Matrices (SAMs) accounts (IMPLAN, 2011). IMPLAN's advantages are:

- SAMs are a better measure of economic flow as they include "nonmarket" transactions (i.e., taxes and unemployment benefits);
- Multiplier Models are built directly from the region-specific SAMs, which reflect the region's unique structure;
- Trade Flows Method tracks regional purchases by estimating trade flows, allowing for more accurate capturing of indirect effects; and
- Data accessibility is cost effective and efficient.

For this study, we have utilized IMPLAN's input-output software to estimate the direct, indirect and induced effects of UAS integration in the NAS upon the local economy. The estimated economic impacts of this integration for each of the 50 states are provided in Appendix B.

## Data

The most common economic measures used in economic impact analysis are:

- Employment [broken down to include full-time equivalents (FTEs)];
- Annual labor income;
- Taxes; and
- Total output or revenue.

This analysis is based on the following data provided by our own forecasts for the 50 states from 2015 through 2025:

1) Total spending by agriculture and public safety in payroll, parts, and taxes;
2) Total direct employment by agriculture and public safety; and
3) State adjustment factors.

## Results

For this study, we used IMPLAN's input-output software to estimate the direct, indirect, induced and total effects of UAS integration on the economy of the state of Arizona. Because of the unique nature of manufacturing UAS and the specialized type of workers required, specific project payroll, parts, and taxes for agriculture and public safety were provided. Using the parts manufacturing distribution data in Table 7, we subtracted 4.10% (Arizona) from all values to get a distribution relative to Arizona. We then used this to modify the existing IMPLAN model for the rest of the states. Table 7 shows the adjustment factors to modify the multipliers for all states based on the Arizona multipliers that were derived from the IMPLAN's input output software.

Table 7: State Multiplier Adjustment Factors Based on State of Arizona's Multiplier

| State | Abbreviation | Adjustment Factors | State | Abbreviation | Adjustment Factors |
|---|---|---|---|---|---|
| Alabama | AL | -1.88% | Montana | MT | -3.99% |
| Alaska | AK | -3.96% | Nebraska | NE | -3.91% |
| Arizona | AZ | 0.00% | Nevada | NV | -3.80% |
| Arkansas | AR | -3.49% | New Hampshire | NH | -3.43% |
| California | CA | 11.48% | New Jersey | NJ | -2.11% |
| Colorado | CO | -2.34% | New Mexico | NM | -3.32% |
| Connecticut | CT | -0.15% | New York | NY | -0.80% |
| Delaware | DE | -3.97% | North Carolina | NC | -2.93% |
| Florida | FL | 0.64% | North Dakota | ND | -3.99% |
| Georgia | GA | -1.27% | Ohio | OH | -1.40% |
| Hawaii | HI | -3.85% | Oklahoma | OK | -3.29% |
| Idaho | ID | -3.88% | Oregon | OR | -3.47% |
| Illinois | IL | -2.54% | Pennsylvania | PA | -1.10% |
| Indiana | IN | -2.51% | Rhode Island | RI | -3.78% |
| Iowa | IA | -2.86% | South Carolina | SC | -3.34% |
| Kansas | KS | -0.56% | South Dakota | SD | -4.03% |
| Kentucky | KY | -3.42% | Tennessee | TN | -3.29% |
| Louisiana | LA | -2.45% | Texas | TX | 4.33% |
| Maine | ME | -3.28% | Utah | UT | -3.00% |
| Maryland | MD | -1.57% | Vermont | VT | -3.83% |
| Massachusetts | MA | -1.20% | Virginia | VA | -0.55% |
| Michigan | MI | -2.66% | Washington | WA | 4.92% |
| Minnesota | MN | -3.02% | West Virginia | WV | -3.74% |
| Mississippi | MS | -2.85% | Wisconsin | WI | -3.43% |
| Missouri | MO | -2.13% | Wyoming | WY | -4.06% |

## Total Economic and Employment Impacts of Agriculture Spending

Table 8 presents the estimated total economic and employment impacts of agriculture spending in all 50 states in 2015. The total economic impact in all 50 states is $2,096.5 million with total job creation of 21,565. The state with the largest economic and employment impacts is California with a total economic impact of about $366.9 million and creation of 3,774 new jobs. Following California are Washington, Texas, Florida and Arizona. The state with the least economic and employment impacts is Wyoming with an estimated $723,647 and creation of seven new jobs.

The average economic and employment impacts of agriculture spending per state are $41,929,742 and creation of 431 new jobs. The standard deviation of economic and employment impacts of agriculture spending are $61,565,404 and 633 new jobs. The large standard deviation indicates the wide variability (spread) of economic and employment impacts among states.

## Total Economic and Employment Impacts of Public Safety and Other Spending

Table 9 presents the estimated total economic and employment impacts in 2015 of public safety spending in all 50 states. Since the total spending for "other markets" is considered equivalent to the public safety estimates, these data are not repeated. The total economic impact of the public safety market in all 50 states is approximately $89.8 million with creation of 924 new jobs. As with agriculture spending, the state with the largest economic and employment impacts is California with a total of more than $15.7 million and creation of 162 new jobs. This is followed in descending order by the states of Washington, Texas, Florida and Arizona. The state of Wyoming has the least economic and employment impacts with $31,013 and no new jobs created.

The average economic and employment impacts of public safety spending per state are $1,796,989 and creation of 18 new jobs. The standard deviation of economic and employment impacts of public safety spending is $2,638,517 and creation of 27 new jobs. The large standard deviation again indicates the wide variability among states.

**Table 8: 2015 Total Economic & Employment Impacts of Agriculture Spending**

| State | Direct Spending | | | | State Total Multipliers | Total Economic Impact | Total Employment Impact |
|---|---|---|---|---|---|---|---|
| | Payroll | Parts | Taxes | Total | | | |
| Alabama | $9,317,676 | $13,976,514 | $372,707 | $23,666,897 | 1.9043 | $45,068,872 | 464 |
| Alaska | $611,763 | $917,644 | $0 | $1,529,406 | 1.8623 | $2,848,213 | 29 |
| Arizona | $17,225,796 | $25,838,695 | $396,882 | $43,461,373 | 1.9800 | $86,053,519 | 885 |
| Arkansas | $2,565,690 | $3,848,535 | $143,679 | $6,557,904 | 1.8718 | $12,275,085 | 126 |
| California | $65,438,414 | $98,157,622 | $2,094,029 | $165,690,065 | 2.2143 | $366,887,512 | 3,774 |
| Colorado | $7,416,208 | $11,124,313 | $274,696 | $18,815,217 | 1.8893 | $35,547,590 | 366 |
| Connecticut | $16,575,698 | $24,863,547 | $663,028 | $42,102,272 | 1.9598 | $82,512,034 | 849 |
| Delaware | $557,285 | $835,928 | $24,743 | $1,417,956 | 1.8594 | $2,636,547 | 27 |
| Florida | $19,927,882 | $29,891,823 | $0 | $49,819,705 | 1.9477 | $97,033,840 | 998 |
| Georgia | $11,882,156 | $17,823,233 | $570,343 | $30,275,732 | 1.9216 | $58,177,847 | 598 |
| Hawaii | $1,041,126 | $1,561,689 | $59,969 | $2,662,784 | 1.8604 | $4,953,844 | 51 |
| Idaho | $932,978 | $1,399,467 | $55,232 | $2,387,678 | 1.8602 | $4,441,558 | 46 |
| Illinois | $6,571,201 | $9,856,802 | $262,848 | $16,690,851 | 1.8750 | $31,295,346 | 322 |
| Indiana | $6,686,613 | $10,029,919 | $181,876 | $16,898,408 | 1.8850 | $31,853,499 | 328 |
| Iowa | $5,193,121 | $7,789,682 | $141,253 | $13,124,056 | 1.8589 | $24,396,309 | 251 |
| Kansas | $14,873,981 | $22,310,972 | $743,699 | $37,928,652 | 1.9792 | $75,068,387 | 772 |
| Kentucky | $2,877,624 | $4,316,437 | $138,126 | $7,332,187 | 1.8681 | $13,697,259 | 141 |
| Louisiana | $6,918,647 | $10,377,970 | $221,397 | $17,518,014 | 1.8684 | $32,730,657 | 337 |
| Maine | $3,444,594 | $5,166,891 | $192,897 | $8,804,383 | 1.8584 | $16,362,066 | 168 |
| Maryland | $10,645,314 | $15,967,971 | $404,522 | $27,017,806 | 1.9061 | $51,498,641 | 530 |
| Massachusetts | $12,175,124 | $18,262,685 | $516,225 | $30,954,034 | 1.9142 | $59,252,213 | 609 |
| Michigan | $6,060,323 | $9,090,485 | $210,899 | $15,361,707 | 1.8748 | $28,800,128 | 296 |
| Minnesota | $4,561,989 | $6,842,984 | $257,296 | $11,662,269 | 1.8677 | $21,781,620 | 224 |
| Mississippi | $5,268,583 | $7,902,874 | $168,595 | $13,340,052 | 1.8621 | $24,840,511 | 256 |
| Missouri | $8,276,550 | $12,414,825 | $264,850 | $20,956,224 | 1.9064 | $39,950,946 | 411 |
| Montana | $462,857 | $694,286 | $23,328 | $1,180,471 | 1.8589 | $2,194,378 | 23 |
| Nebraska | $807,478 | $1,211,217 | $33,074 | $2,051,770 | 1.8600 | $3,816,291 | 39 |
| Nevada | $1,255,001 | $1,882,501 | $0 | $3,137,502 | 1.8666 | $5,856,462 | 60 |
| New Hampshire | $2,817,497 | $4,226,246 | $0 | $7,043,743 | 1.8612 | $13,109,815 | 135 |
| New Jersey | $8,353,625 | $12,530,438 | $497,876 | $21,381,940 | 1.8883 | $40,375,517 | 415 |
| New Mexico | $3,271,880 | $4,907,821 | $112,553 | $8,292,254 | 1.8642 | $15,458,419 | 159 |
| New York | $13,878,051 | $20,817,077 | $716,107 | $35,411,235 | 1.9184 | $67,932,913 | 699 |
| North Carolina | $4,898,943 | $7,348,414 | $274,341 | $12,521,698 | 1.8711 | $23,429,348 | 241 |
| North Dakota | $453,576 | $680,364 | $10,233 | $1,144,172 | 1.8585 | $2,126,445 | 22 |
| Ohio | $11,362,400 | $17,043,599 | $372,687 | $28,778,686 | 1.9129 | $55,050,748 | 566 |
| Oklahoma | $3,410,294 | $5,115,440 | $143,232 | $8,668,966 | 1.8753 | $16,256,913 | 167 |
| Oregon | $2,632,274 | $3,948,411 | $63,175 | $6,643,859 | 1.8685 | $12,414,050 | 128 |
| Pennsylvania | $12,598,434 | $18,897,651 | $309,418 | $31,805,503 | 1.8964 | $60,315,956 | 620 |
| Rhode Island | $1,364,360 | $2,046,539 | $58,326 | $3,469,225 | 1.8638 | $6,465,942 | 67 |
| South Carolina | $3,185,523 | $4,778,285 | $178,389 | $8,142,198 | 1.8585 | $15,132,275 | 156 |
| South Dakota | $305,881 | $458,822 | $0 | $764,703 | 1.8673 | $1,427,930 | 15 |
| Tennessee | $3,390,117 | $5,085,175 | $0 | $8,475,292 | 2.0342 | $17,240,439 | 177 |
| Texas | $35,422,907 | $53,134,361 | $0 | $88,557,268 | 1.8834 | $166,788,758 | 1,716 |
| Utah | $4,636,240 | $6,954,360 | $185,450 | $11,776,049 | 1.8619 | $21,925,827 | 226 |
| Vermont | $1,150,888 | $1,726,333 | $71,815 | $2,949,036 | 1.8578 | $5,478,720 | 56 |
| Virginia | $14,907,071 | $22,360,607 | $685,725 | $37,953,403 | 1.8720 | $71,048,771 | 731 |
| Washington | $37,902,240 | $56,853,360 | $0 | $94,755,601 | 2.1250 | $201,355,651 | 2,071 |
| West Virginia | $1,504,791 | $2,257,186 | $72,230 | $3,834,206 | 1.8662 | $7,155,396 | 74 |
| Wisconsin | $2,825,568 | $4,238,352 | $146,930 | $7,210,850 | 1.8642 | $13,442,466 | 138 |
| Wyoming | $155,765 | $233,648 | $0 | $389,413 | 1.8583 | $723,647 | 7 |
| TOTAL | $420,000,000 | $630,000,000 | $12,314,681 | $1,062,314,681 | | $2,096,487,120 | 21,565 |
| Average | | | | | | $41,929,742 | 431 |
| STD | | | | | | $61,565,404 | 633 |

**Table 9: 2015 Total Economic & Employment Impacts of Public Safety Spending**

| State | Direct Spending | | | | State Total Multipliers | Total Economic Impact | Total Employment Impact |
|---|---|---|---|---|---|---|---|
| | Payroll | Parts | Taxes | Total | | | |
| Alabama | $399,329 | $598,993 | $15,973 | $1,014,296 | 1.9043 | $1,931,523 | 20 |
| Alaska | $26,218 | $39,328 | $0 | $65,546 | 1.8623 | $122,066 | 1 |
| Arizona | $738,248 | $1,107,373 | $17,009 | $1,862,630 | 1.9800 | $3,688,008 | 38 |
| Arkansas | $109,958 | $164,937 | $6,158 | $281,053 | 1.8718 | $526,075 | 5 |
| California | $2,804,503 | $4,206,755 | $89,744 | $7,101,003 | 2.2143 | $15,723,751 | 162 |
| Colorado | $317,838 | $476,756 | $11,773 | $806,366 | 1.8893 | $1,523,468 | 16 |
| Connecticut | $710,387 | $1,065,581 | $28,415 | $1,804,383 | 1.9598 | $3,536,230 | 36 |
| Delaware | $23,884 | $35,825 | $1,060 | $60,770 | 1.8594 | $112,995 | 1 |
| Florida | $854,052 | $1,281,078 | $0 | $2,135,130 | 1.9477 | $4,158,593 | 43 |
| Georgia | $509,235 | $763,853 | $24,443 | $1,297,531 | 1.9216 | $2,493,336 | 26 |
| Hawaii | $44,620 | $66,930 | $2,570 | $114,119 | 1.8604 | $212,308 | 2 |
| Idaho | $39,985 | $59,977 | $2,367 | $102,329 | 1.8602 | $190,353 | 2 |
| Illinois | $281,623 | $422,434 | $11,265 | $715,322 | 1.8750 | $1,341,229 | 14 |
| Indiana | $286,569 | $429,854 | $7,795 | $724,217 | 1.8850 | $1,365,150 | 14 |
| Iowa | $222,562 | $333,844 | $6,054 | $562,460 | 1.8589 | $1,045,556 | 11 |
| Kansas | $637,456 | $956,184 | $31,873 | $1,625,514 | 1.9792 | $3,217,217 | 33 |
| Kentucky | $123,327 | $184,990 | $5,920 | $314,237 | 1.8681 | $587,025 | 6 |
| Louisiana | $296,513 | $444,770 | $9,488 | $750,772 | 1.8684 | $1,402,742 | 14 |
| Maine | $147,625 | $221,438 | $8,267 | $377,331 | 1.8584 | $701,231 | 7 |
| Maryland | $456,228 | $684,342 | $17,337 | $1,157,906 | 1.9061 | $2,207,085 | 23 |
| Massachusetts | $521,791 | $782,687 | $22,124 | $1,326,601 | 1.9142 | $2,539,381 | 26 |
| Michigan | $259,728 | $389,592 | $9,039 | $658,359 | 1.8748 | $1,234,291 | 13 |
| Minnesota | $195,514 | $293,271 | $11,027 | $499,812 | 1.8677 | $933,498 | 10 |
| Mississippi | $225,796 | $338,695 | $7,225 | $571,717 | 1.8621 | $1,064,593 | 11 |
| Missouri | $354,709 | $532,064 | $11,351 | $898,124 | 1.9064 | $1,712,183 | 18 |
| Montana | $19,837 | $29,755 | $1,000 | $50,592 | 1.8589 | $94,045 | 1 |
| Nebraska | $34,606 | $51,909 | $1,417 | $87,933 | 1.8600 | $163,555 | 2 |
| Nevada | $53,786 | $80,679 | $0 | $134,464 | 1.8666 | $250,991 | 3 |
| New Hampshire | $120,750 | $181,125 | $0 | $301,875 | 1.8612 | $561,849 | 6 |
| New Jersey | $358,013 | $537,019 | $21,338 | $916,369 | 1.8883 | $1,730,379 | 18 |
| New Mexico | $140,223 | $210,335 | $4,824 | $355,382 | 1.8642 | $662,504 | 7 |
| New York | $594,774 | $892,160 | $30,690 | $1,517,624 | 1.9184 | $2,911,411 | 30 |
| North Carolina | $209,955 | $314,932 | $11,757 | $536,644 | 1.8711 | $1,004,115 | 10 |
| North Dakota | $19,439 | $29,158 | $439 | $49,036 | 1.8585 | $91,133 | 1 |
| Ohio | $486,960 | $730,440 | $15,972 | $1,233,372 | 1.9129 | $2,359,318 | 24 |
| Oklahoma | $146,155 | $219,233 | $6,139 | $371,527 | 1.8753 | $696,725 | 7 |
| Oregon | $112,812 | $169,218 | $2,707 | $284,737 | 1.8685 | $532,031 | 5 |
| Pennsylvania | $539,933 | $809,899 | $13,261 | $1,363,093 | 1.8964 | $2,584,970 | 27 |
| Rhode Island | $58,473 | $87,709 | $2,500 | $148,681 | 1.8638 | $277,112 | 3 |
| South Carolina | $136,522 | $204,784 | $7,645 | $348,951 | 1.8585 | $648,526 | 7 |
| South Dakota | $13,109 | $19,664 | $0 | $32,773 | 1.8673 | $61,197 | 1 |
| Tennessee | $145,291 | $217,936 | $0 | $363,227 | 2.0342 | $738,876 | 8 |
| Texas | $1,518,125 | $2,277,187 | $0 | $3,795,311 | 1.8834 | $7,148,090 | 74 |
| Utah | $198,696 | $298,044 | $7,948 | $504,688 | 1.8619 | $939,678 | 10 |
| Vermont | $49,324 | $73,986 | $3,078 | $126,387 | 1.8578 | $234,802 | 2 |
| Virginia | $638,874 | $958,312 | $29,388 | $1,626,574 | 1.8720 | $3,044,947 | 31 |
| Washington | $1,624,382 | $2,436,573 | $0 | $4,060,954 | 2.1250 | $8,629,528 | 89 |
| West Virginia | $64,491 | $96,737 | $3,096 | $164,323 | 1.8662 | $306,660 | 3 |
| Wisconsin | $121,096 | $181,644 | $6,297 | $309,036 | 1.8642 | $576,106 | 6 |
| Wyoming | $6,676 | $10,013 | $0 | $16,689 | 1.8583 | $31,013 | 0 |
| TOTAL | $18,000,000 | $27,000,000 | $527,772 | $45,527,772 | | $89,849,448 | 924 |
| Average | | | | | | $1,796,989 | 18 |
| STD | | | | | | $2,638,517 | 27 |
| MAX | | | | | | $15,723,751 | 162 |
| MIN | | | | | | $31,013 | 0 |

## Total Economic and Employment Impacts of Agriculture, Public Safety and Other Spending

Table 10 presents the estimated total economic and employment impacts of agriculture, public safety and other spending in 2015 all 50 states. The total economic impact of these markets in all 50 states is more than $2,276 million with total job creation of 23,413. The state with the largest economic and employment impact is California with a total of more than $398.3 million and creation of 4,097 new jobs. Following California in descending rank order are Washington, Texas, Florida and Arizona. In addition, the order of job creation was similar to estimated total economic impact. Wyoming has the least economic and employment impacts with $785,674 and eight new jobs created.

The average economic and employment impacts of agriculture, public safety and other spending per state are approximately $45.5 million and creation of 468 new jobs. The standard deviation of economic and employment impacts is approximately $66.8 million and 688 new jobs created. As with agriculture, public safety and other state estimates, there is a wide variability of economic and employment impacts and job creation among states.

**Table 10: 2015 Total Economic & Employment Impacts of Agriculture, Public Safety and Other Spending**

| State | Direct Spending | | | | State Total Multipliers | Total Economic Impact | Total Employment Impact |
|---|---|---|---|---|---|---|---|
| | Payroll | Parts | Taxes | Total | | | |
| Alabama | $10,116,334 | $15,174,501 | $404,653 | $25,695,488 | 1.9043 | $48,931,919 | 503 |
| Alaska | $664,199 | $996,299 | $0 | $1,660,498 | 1.8623 | $3,092,346 | 32 |
| Arizona | $18,702,293 | $28,053,440 | $430,901 | $47,186,634 | 1.9800 | $93,429,535 | 961 |
| Arkansas | $2,785,606 | $4,178,410 | $155,994 | $7,120,010 | 1.8718 | $13,327,235 | 137 |
| California | $71,047,421 | $106,571,132 | $2,273,517 | $179,892,071 | 2.2143 | $398,335,013 | 4,097 |
| Colorado | $8,051,883 | $12,077,825 | $298,242 | $20,427,950 | 1.8893 | $38,594,526 | 397 |
| Connecticut | $17,996,472 | $26,994,708 | $719,859 | $45,711,039 | 1.9598 | $89,584,494 | 921 |
| Delaware | $605,052 | $907,578 | $26,864 | $1,539,495 | 1.8594 | $2,862,537 | 29 |
| Florida | $21,635,986 | $32,453,979 | $0 | $54,089,966 | 1.9477 | $105,351,026 | 1,084 |
| Georgia | $12,900,626 | $19,350,939 | $619,230 | $32,870,795 | 1.9216 | $63,164,520 | 650 |
| Hawaii | $1,130,366 | $1,695,548 | $65,109 | $2,891,023 | 1.8604 | $5,378,459 | 55 |
| Idaho | $1,012,948 | $1,519,422 | $59,967 | $2,592,336 | 1.8602 | $4,822,263 | 50 |
| Illinois | $7,134,447 | $10,701,671 | $285,378 | $18,121,496 | 1.8750 | $33,977,804 | 350 |
| Indiana | $7,259,751 | $10,889,627 | $197,465 | $18,346,843 | 1.8850 | $34,583,799 | 356 |
| Iowa | $5,638,246 | $8,457,369 | $153,360 | $14,248,976 | 1.8589 | $26,487,421 | 272 |
| Kansas | $16,148,894 | $24,223,341 | $807,445 | $41,179,679 | 1.9792 | $81,502,821 | 838 |
| Kentucky | $3,124,278 | $4,686,417 | $149,965 | $7,960,660 | 1.8681 | $14,871,309 | 153 |
| Louisiana | $7,511,674 | $11,267,511 | $240,374 | $19,019,558 | 1.8684 | $35,536,142 | 366 |
| Maine | $3,739,845 | $5,609,768 | $209,431 | $9,559,045 | 1.8584 | $17,764,528 | 183 |
| Maryland | $11,557,769 | $17,336,654 | $439,195 | $29,333,618 | 1.9061 | $55,912,810 | 575 |
| Massachusetts | $13,218,706 | $19,828,059 | $560,473 | $33,607,237 | 1.9142 | $64,330,974 | 662 |
| Michigan | $6,579,779 | $9,869,669 | $228,976 | $16,678,425 | 1.8748 | $31,268,710 | 322 |
| Minnesota | $4,953,017 | $7,429,525 | $279,350 | $12,661,892 | 1.8677 | $23,648,616 | 243 |
| Mississippi | $5,720,176 | $8,580,264 | $183,046 | $14,483,485 | 1.8621 | $26,969,697 | 277 |
| Missouri | $8,985,968 | $13,478,953 | $287,551 | $22,752,472 | 1.9064 | $43,375,313 | 446 |
| Montana | $502,531 | $753,796 | $25,328 | $1,281,654 | 1.8589 | $2,382,467 | 25 |
| Nebraska | $876,691 | $1,315,036 | $35,909 | $2,227,636 | 1.8600 | $4,143,402 | 43 |
| Nevada | $1,362,572 | $2,043,859 | $0 | $3,406,431 | 1.8666 | $6,358,445 | 65 |
| New Hampshire | $3,058,997 | $4,588,496 | $0 | $7,647,493 | 1.8612 | $14,233,514 | 146 |
| New Jersey | $9,069,651 | $13,604,476 | $540,551 | $23,214,678 | 1.8883 | $43,836,276 | 451 |
| New Mexico | $3,552,327 | $5,328,491 | $122,200 | $9,003,018 | 1.8642 | $16,783,427 | 173 |
| New York | $15,067,598 | $22,601,397 | $777,488 | $38,446,484 | 1.9184 | $73,755,734 | 759 |
| North Carolina | $5,318,852 | $7,978,278 | $297,856 | $13,594,986 | 1.8711 | $25,437,578 | 262 |
| North Dakota | $492,454 | $738,681 | $11,110 | $1,242,244 | 1.8585 | $2,308,711 | 24 |
| Ohio | $12,336,320 | $18,504,479 | $404,631 | $31,245,430 | 1.9129 | $59,769,383 | 615 |
| Oklahoma | $3,702,605 | $5,553,907 | $155,509 | $9,412,021 | 1.8753 | $17,650,363 | 182 |
| Oregon | $2,857,897 | $4,286,846 | $68,590 | $7,213,333 | 1.8685 | $13,478,112 | 139 |
| Pennsylvania | $13,678,300 | $20,517,450 | $335,939 | $34,531,689 | 1.8964 | $65,485,895 | 674 |
| Rhode Island | $1,481,305 | $2,221,957 | $63,326 | $3,766,588 | 1.8638 | $7,020,166 | 72 |
| South Carolina | $3,458,568 | $5,187,852 | $193,680 | $8,840,100 | 1.8585 | $16,429,327 | 169 |
| South Dakota | $332,100 | $498,149 | $0 | $830,249 | 1.8673 | $1,550,324 | 16 |
| Tennessee | $3,680,698 | $5,521,047 | $0 | $9,201,746 | 2.0342 | $18,718,191 | 193 |
| Texas | $38,459,156 | $57,688,734 | $0 | $96,147,891 | 1.8834 | $181,084,937 | 1,863 |
| Utah | $5,033,632 | $7,550,448 | $201,345 | $12,785,425 | 1.8619 | $23,805,183 | 245 |
| Vermont | $1,249,536 | $1,874,304 | $77,971 | $3,201,811 | 1.8578 | $5,948,324 | 61 |
| Virginia | $16,184,820 | $24,277,230 | $744,502 | $41,206,552 | 1.8720 | $77,138,665 | 793 |
| Washington | $41,151,004 | $61,726,505 | $0 | $102,877,509 | 2.1250 | $218,614,707 | 2,249 |
| West Virginia | $1,633,773 | $2,450,659 | $78,421 | $4,162,853 | 1.8662 | $7,768,716 | 80 |
| Wisconsin | $3,067,760 | $4,601,640 | $159,524 | $7,828,923 | 1.8642 | $14,594,678 | 150 |
| Wyoming | $169,117 | $253,675 | $0 | $422,792 | 1.8583 | $785,674 | 8 |
| **TOTAL** | $456,000,000 | $684,000,000 | $13,370,225 | $1,153,370,225 | | $2,276,186,016 | 23,413 |
| Average | | | | | | $45,523,720 | 468 |
| STD | | | | | | $66,842,438 | 688 |
| MAX | | | | | | $398,335,013 | 4,097 |
| MIN | | | | | | $785,674 | 8 |

## Total Economic and Employment Impacts of Agriculture Direct Spending

Tables 11, 12 and 13 show the 2015 direct, indirect and induced impacts respectively, of agriculture spending. Table 11 presents the total economic and employment impacts of direct agriculture spending in all 50 states. The nationwide total economic impact is an estimated $1,058,841,630 with about 11,094 newly created jobs. The largest economic and employment impacts of direct agriculture spending is in California with total economic impact of more than $185,307,769 and creation of 1,942 new jobs. As before, the order of job creation was similar to overall economic impact. The state with least economic and employment impacts is Wyoming with $365,503 and four newly created jobs.

The average economic and employment impacts of direct agriculture spending per state are approximately $21,176,833 and an estimated 222 new jobs. The standard deviation of economic and employment impacts of direct agriculture spending is approximately $31,094,684 and new job creation of 326. This again reflects the wide spread of economic and employment impacts among states.

## Total Economic and Employment Impacts of Agriculture Indirect Spending

The total economic and employment impact of indirect agriculture spending in all 50 states is shown in Table 12. The nationwide total economic impact is approximately $487,060,836, with an estimated 5,103 new jobs. The largest economic and employment impacts of indirect agriculture spending is in the state of California with a total economic impact of approximately $85,230,970 and creation of 893 new jobs. The order of job creation was similar to overall economic impact. Wyoming has the least economic and employment impact with $168,110 and creation of two new jobs.

The average economic and employment impacts of indirect agriculture spending per state are $9,741,217 and creation of 102 jobs. The standard deviation of economic and employment impacts of indirect agriculture spending is $14,302,673 and job creation of 150. The large standard deviation indicates the wide variability of economic and employment impacts among states.

**Table 11: 2015 Direct Economic & Employment Impacts of Agriculture Spending**

| State | Direct Spending | | | | State Direct Multipliers | Direct Economic Impact | Direct Employment Impact |
|---|---|---|---|---|---|---|---|
| | Payroll | Parts | Taxes | Total | | | |
| Alabama | $9,317,676 | $13,976,514 | $372,707 | $23,666,897 | 0.9618 | $22,762,822 | 238 |
| Alaska | $611,763 | $917,644 | $0 | $1,529,406 | 0.9405 | $1,438,407 | 15 |
| Arizona | $17,225,796 | $25,838,695 | $396,882 | $43,461,373 | 1 | $43,461,373 | 455 |
| Arkansas | $2,565,690 | $3,848,535 | $143,679 | $6,557,904 | 0.9453 | $6,199,187 | 65 |
| California | $65,438,414 | $98,157,622 | $2,094,029 | $165,690,065 | 1.1184 | $185,307,769 | 1942 |
| Colorado | $7,416,208 | $11,124,313 | $274,696 | $18,815,217 | 0.9542 | $17,953,480 | 188 |
| Connecticut | $16,575,698 | $24,863,547 | $663,028 | $42,102,272 | 0.9898 | $41,672,829 | 437 |
| Delaware | $557,285 | $835,928 | $24,743 | $1,417,956 | 0.9391 | $1,331,602 | 14 |
| Florida | $19,927,882 | $29,891,823 | $0 | $49,819,705 | 0.9837 | $49,007,644 | 513 |
| Georgia | $11,882,156 | $17,823,233 | $570,343 | $30,275,732 | 0.9705 | $29,382,598 | 308 |
| Hawaii | $1,041,126 | $1,561,689 | $59,969 | $2,662,784 | 0.9396 | $2,501,952 | 26 |
| Idaho | $932,978 | $1,399,467 | $55,232 | $2,387,678 | 0.9395 | $2,243,223 | 24 |
| Illinois | $6,571,201 | $9,856,802 | $262,848 | $16,690,851 | 0.947 | $15,806,236 | 166 |
| Indiana | $6,686,613 | $10,029,919 | $181,876 | $16,898,408 | 0.952 | $16,087,285 | 169 |
| Iowa | $5,193,121 | $7,789,682 | $141,253 | $13,124,056 | 0.9388 | $12,320,864 | 129 |
| Kansas | $14,873,981 | $22,310,972 | $743,699 | $37,928,652 | 0.9996 | $37,913,480 | 397 |
| Kentucky | $2,877,624 | $4,316,437 | $138,126 | $7,332,187 | 0.9435 | $6,917,918 | 72 |
| Louisiana | $6,918,647 | $10,377,970 | $221,397 | $17,518,014 | 0.9436 | $16,529,998 | 173 |
| Maine | $3,444,594 | $5,166,891 | $192,897 | $8,804,383 | 0.9386 | $8,263,794 | 87 |
| Maryland | $10,645,314 | $15,967,971 | $404,522 | $27,017,806 | 0.9627 | $26,010,042 | 273 |
| Massachusetts | $12,175,124 | $18,262,685 | $516,225 | $30,954,034 | 0.9668 | $29,926,360 | 314 |
| Michigan | $6,060,323 | $9,090,485 | $210,899 | $15,361,707 | 0.9468 | $14,544,464 | 152 |
| Minnesota | $4,561,989 | $6,842,984 | $257,296 | $11,662,269 | 0.9433 | $11,001,018 | 115 |
| Mississippi | $5,268,583 | $7,902,874 | $168,595 | $13,340,052 | 0.9405 | $12,546,319 | 131 |
| Missouri | $8,276,550 | $12,414,825 | $264,850 | $20,956,224 | 0.9628 | $20,176,653 | 211 |
| Montana | $462,857 | $694,286 | $23,328 | $1,180,471 | 0.9388 | $1,108,226 | 12 |
| Nebraska | $807,478 | $1,211,217 | $33,074 | $2,051,770 | 0.9394 | $1,927,432 | 20 |
| Nevada | $1,255,001 | $1,882,501 | $0 | $3,137,502 | 0.9427 | $2,957,724 | 31 |
| New Hampshire | $2,817,497 | $4,226,246 | $0 | $7,043,743 | 0.94 | $6,621,119 | 69 |
| New Jersey | $8,353,625 | $12,530,438 | $497,876 | $21,381,940 | 0.9537 | $20,391,956 | 214 |
| New Mexico | $3,271,880 | $4,907,821 | $112,553 | $8,292,254 | 0.9415 | $7,807,157 | 82 |
| New York | $13,878,051 | $20,817,077 | $716,107 | $35,411,235 | 0.9689 | $34,309,946 | 359 |
| North Carolina | $4,898,943 | $7,348,414 | $274,341 | $12,521,698 | 0.945 | $11,833,004 | 124 |
| North Dakota | $453,576 | $680,364 | $10,233 | $1,144,172 | 0.9386 | $1,073,920 | 11 |
| Ohio | $11,362,400 | $17,043,599 | $372,687 | $28,778,686 | 0.9661 | $27,803,088 | 291 |
| Oklahoma | $3,410,294 | $5,115,440 | $143,232 | $8,668,966 | 0.9471 | $8,210,378 | 86 |
| Oregon | $2,632,274 | $3,948,411 | $63,175 | $6,643,859 | 0.9437 | $6,269,810 | 66 |
| Pennsylvania | $12,598,434 | $18,897,651 | $309,418 | $31,805,503 | 0.9578 | $30,463,311 | 319 |
| Rhode Island | $1,364,360 | $2,046,539 | $58,326 | $3,469,225 | 0.9413 | $3,265,582 | 34 |
| South Carolina | $3,185,523 | $4,778,285 | $178,389 | $8,142,198 | 0.9386 | $7,642,267 | 80 |
| South Dakota | $305,881 | $458,822 | $0 | $764,703 | 0.9431 | $721,192 | 8 |
| Tennessee | $3,390,117 | $5,085,175 | $0 | $8,475,292 | 1.0274 | $8,707,515 | 91 |
| Texas | $35,422,907 | $53,134,361 | $0 | $88,557,268 | 0.9512 | $84,235,673 | 883 |
| Utah | $4,636,240 | $6,954,360 | $185,450 | $11,776,049 | 0.9403 | $11,073,019 | 116 |
| Vermont | $1,150,888 | $1,726,333 | $71,815 | $2,949,036 | 0.9383 | $2,767,081 | 29 |
| Virginia | $14,907,071 | $22,360,607 | $685,725 | $37,953,403 | 0.9455 | $35,884,943 | 376 |
| Washington | $37,902,240 | $56,853,360 | $0 | $94,755,601 | 1.0732 | $101,691,710 | 1065 |
| West Virginia | $1,504,791 | $2,257,186 | $72,230 | $3,834,206 | 0.9425 | $3,613,739 | 38 |
| Wisconsin | $2,825,568 | $4,238,352 | $146,930 | $7,210,850 | 0.9415 | $6,789,015 | 71 |
| Wyoming | $155,765 | $233,648 | $0 | $389,413 | 0.9386 | $365,503 | 4 |
| **TOTAL** | $420,000,000 | $630,000,000 | $12,314,681 | $1,062,314,681 | | $1,058,841,630 | 11,094 |
| Average | | | | | | $21,176,833 | 222 |
| STD | | | | | | $31,094,684 | 326 |

**Table 12: 2015 Indirect Economic & Employment Impacts of Agriculture Spending**

| State | Direct Spending | | | | State Indirect Multipliers | Indirect Economic Impact | Indirect Employment Impact |
|---|---|---|---|---|---|---|---|
| | Payroll | Parts | Taxes | Total | | | |
| Alabama | $9,317,676 | $13,976,514 | $372,707 | $23,666,897 | 0.4424 | $10,470,235 | 110 |
| Alaska | $611,763 | $917,644 | $0 | $1,529,406 | 0.4327 | $661,774 | 7 |
| Arizona | $17,225,796 | $25,838,695 | $396,882 | $43,461,373 | 0.46 | $19,992,232 | 209 |
| Arkansas | $2,565,690 | $3,848,535 | $143,679 | $6,557,904 | 0.4349 | $2,852,032 | 30 |
| California | $65,438,414 | $98,157,622 | $2,094,029 | $165,690,065 | 0.5144 | $85,230,970 | 893 |
| Colorado | $7,416,208 | $11,124,313 | $274,696 | $18,815,217 | 0.4389 | $8,257,999 | 87 |
| Connecticut | $16,575,698 | $24,863,547 | $663,028 | $42,102,272 | 0.4553 | $19,169,165 | 201 |
| Delaware | $557,285 | $835,928 | $24,743 | $1,417,956 | 0.432 | $612,557 | 6 |
| Florida | $19,927,882 | $29,891,823 | $0 | $49,819,705 | 0.4525 | $22,543,417 | 236 |
| Georgia | $11,882,156 | $17,823,233 | $570,343 | $30,275,732 | 0.4464 | $13,515,087 | 142 |
| Hawaii | $1,041,126 | $1,561,689 | $59,969 | $2,662,784 | 0.4322 | $1,150,855 | 12 |
| Idaho | $932,978 | $1,399,467 | $55,232 | $2,387,678 | 0.4322 | $1,031,954 | 11 |
| Illinois | $6,571,201 | $9,856,802 | $262,848 | $16,690,851 | 0.4356 | $7,270,535 | 76 |
| Indiana | $6,686,613 | $10,029,919 | $181,876 | $16,898,408 | 0.4379 | $7,399,813 | 78 |
| Iowa | $5,193,121 | $7,789,682 | $141,253 | $13,124,056 | 0.4319 | $5,668,280 | 59 |
| Kansas | $14,873,981 | $22,310,972 | $743,699 | $37,928,652 | 0.4598 | $17,439,594 | 183 |
| Kentucky | $2,877,624 | $4,316,437 | $138,126 | $7,332,187 | 0.434 | $3,182,169 | 33 |
| Louisiana | $6,918,647 | $10,377,970 | $221,397 | $17,518,014 | 0.4341 | $7,604,570 | 80 |
| Maine | $3,444,594 | $5,166,891 | $192,897 | $8,804,383 | 0.4317 | $3,800,852 | 40 |
| Maryland | $10,645,314 | $15,967,971 | $404,522 | $27,017,806 | 0.4428 | $11,963,485 | 125 |
| Massachusetts | $12,175,124 | $18,262,685 | $516,225 | $30,954,034 | 0.4447 | $13,765,259 | 144 |
| Michigan | $6,060,323 | $9,090,485 | $210,899 | $15,361,707 | 0.4356 | $6,691,560 | 70 |
| Minnesota | $4,561,989 | $6,842,984 | $257,296 | $11,662,269 | 0.4339 | $5,060,258 | 53 |
| Mississippi | $5,268,583 | $7,902,874 | $168,595 | $13,340,052 | 0.4326 | $5,770,906 | 60 |
| Missouri | $8,276,550 | $12,414,825 | $264,850 | $20,956,224 | 0.4429 | $9,281,512 | 97 |
| Montana | $462,857 | $694,286 | $23,328 | $1,180,471 | 0.4319 | $509,846 | 5 |
| Nebraska | $807,478 | $1,211,217 | $33,074 | $2,051,770 | 0.4321 | $886,570 | 9 |
| Nevada | $1,255,001 | $1,882,501 | $0 | $3,137,502 | 0.4337 | $1,360,735 | 14 |
| New Hampshire | $2,817,497 | $4,226,246 | $0 | $7,043,743 | 0.4324 | $3,045,715 | 32 |
| New Jersey | $8,353,625 | $12,530,438 | $497,876 | $21,381,940 | 0.4387 | $9,380,257 | 98 |
| New Mexico | $3,271,880 | $4,907,821 | $112,553 | $8,292,254 | 0.4331 | $3,591,375 | 38 |
| New York | $13,878,051 | $20,817,077 | $716,107 | $35,411,235 | 0.4457 | $15,782,787 | 165 |
| North Carolina | $4,898,943 | $7,348,414 | $274,341 | $12,521,698 | 0.4347 | $5,443,182 | 57 |
| North Dakota | $453,576 | $680,364 | $10,233 | $1,144,172 | 0.4318 | $494,054 | 5 |
| Ohio | $11,362,400 | $17,043,599 | $372,687 | $28,778,686 | 0.4444 | $12,789,248 | 134 |
| Oklahoma | $3,410,294 | $5,115,440 | $143,232 | $8,668,966 | 0.4357 | $3,777,069 | 40 |
| Oregon | $2,632,274 | $3,948,411 | $63,175 | $6,643,859 | 0.4341 | $2,884,099 | 30 |
| Pennsylvania | $12,598,434 | $18,897,651 | $309,418 | $31,805,503 | 0.4406 | $14,013,505 | 147 |
| Rhode Island | $1,364,360 | $2,046,539 | $58,326 | $3,469,225 | 0.433 | $1,502,175 | 16 |
| South Carolina | $3,185,523 | $4,778,285 | $178,389 | $8,142,198 | 0.4318 | $3,515,801 | 37 |
| South Dakota | $305,881 | $458,822 | $0 | $764,703 | 0.4338 | $331,728 | 3 |
| Tennessee | $3,390,117 | $5,085,175 | $0 | $8,475,292 | 0.4726 | $4,005,423 | 42 |
| Texas | $35,422,907 | $53,134,361 | $0 | $88,557,268 | 0.4376 | $38,752,660 | 406 |
| Utah | $4,636,240 | $6,954,360 | $185,450 | $11,776,049 | 0.4326 | $5,094,319 | 53 |
| Vermont | $1,150,888 | $1,726,333 | $71,815 | $2,949,036 | 0.4316 | $1,272,804 | 13 |
| Virginia | $14,907,071 | $22,360,607 | $685,725 | $37,953,403 | 0.4349 | $16,505,935 | 173 |
| Washington | $37,902,240 | $56,853,360 | $0 | $94,755,601 | 0.4937 | $46,780,840 | 490 |
| West Virginia | $1,504,791 | $2,257,186 | $72,230 | $3,834,206 | 0.4336 | $1,662,512 | 17 |
| Wisconsin | $2,825,568 | $4,238,352 | $146,930 | $7,210,850 | 0.4331 | $3,123,019 | 33 |
| Wyoming | $155,765 | $233,648 | $0 | $389,413 | 0.4317 | $168,110 | 2 |
| **TOTAL** | $420,000,000 | $630,000,000 | $12,314,681 | $1,062,314,681 | | $487,060,836 | 5,103 |
| Average | | | | | | $9,741,217 | 102 |
| STD | | | | | | $14,302,673 | 150 |

## Total Economic and Employment Impacts of Agriculture Induced Spending

Table 13 presents the total economic and employment impacts of induced agriculture spending in 2015 in all 50 states. The estimated nationwide total economic impact is $550,584,654 with the creation of 5,770 new jobs. The largest economic and employment impacts of induced agriculture spending is in the state of California with a total economic impact of approximately $96,348,773 and creation of 1,010 new jobs. The order of job creation was similar to economic impact. The state of Wyoming has the least amount economic and employment impact with $190,034 and the creation of two new jobs. The average economic and employment impacts of induced agriculture spending per state are an estimated 11,011,693 and creation of 115 jobs. The standard deviation of economic and employment impacts of induced agriculture spending is approximately $16,168,047 and 169 jobs. There is wide variability in economic and employment impacts among states as is evidenced by the large standard deviation.

**Table 13: 2015 Induced Economic & Employment Impacts of Agriculture Spending**

| State | Direct Spending | | | | State Induced Multipliers | Induced Economic Impact | Induced Employment Impact |
|---|---|---|---|---|---|---|---|
| | Payroll | Parts | Taxes | Total | | | |
| Alabama | $9,317,676 | $13,976,514 | $372,707 | $23,666,897 | 0.5001 | $11,835,815 | 124 |
| Alaska | $611,763 | $917,644 | $0 | $1,529,406 | 0.4891 | $748,033 | 8 |
| Arizona | $17,225,796 | $25,838,695 | $396,882 | $43,461,373 | 0.52 | $22,599,914 | 237 |
| Arkansas | $2,565,690 | $3,848,535 | $143,679 | $6,557,904 | 0.4916 | $3,223,866 | 34 |
| California | $65,438,414 | $98,157,622 | $2,094,029 | $165,690,065 | 0.5815 | $96,348,773 | 1,010 |
| Colorado | $7,416,208 | $11,124,313 | $274,696 | $18,815,217 | 0.4962 | $9,336,111 | 98 |
| Connecticut | $16,575,698 | $24,863,547 | $663,028 | $42,102,272 | 0.5147 | $21,670,040 | 227 |
| Delaware | $557,285 | $835,928 | $24,743 | $1,417,956 | 0.4883 | $692,388 | 7 |
| Florida | $19,927,882 | $29,891,823 | $0 | $49,819,705 | 0.5115 | $25,482,779 | 267 |
| Georgia | $11,882,156 | $17,823,233 | $570,343 | $30,275,732 | 0.5047 | $15,280,162 | 160 |
| Hawaii | $1,041,126 | $1,561,689 | $59,969 | $2,662,784 | 0.4886 | $1,301,036 | 14 |
| Idaho | $932,978 | $1,399,467 | $55,232 | $2,387,678 | 0.4885 | $1,166,381 | 12 |
| Illinois | $6,571,201 | $9,856,802 | $262,848 | $16,690,851 | 0.4924 | $8,218,575 | 86 |
| Indiana | $6,686,613 | $10,029,919 | $181,876 | $16,898,408 | 0.4951 | $8,366,402 | 88 |
| Iowa | $5,193,121 | $7,789,682 | $141,253 | $13,124,056 | 0.4882 | $6,407,164 | 67 |
| Kansas | $14,873,981 | $22,310,972 | $743,699 | $37,928,652 | 0.5198 | $19,715,313 | 207 |
| Kentucky | $2,877,624 | $4,316,437 | $138,126 | $7,332,187 | 0.4906 | $3,597,171 | 38 |
| Louisiana | $6,918,647 | $10,377,970 | $221,397 | $17,518,014 | 0.4907 | $8,596,089 | 90 |
| Maine | $3,444,594 | $5,166,891 | $192,897 | $8,804,383 | 0.4881 | $4,297,419 | 45 |
| Maryland | $10,645,314 | $15,967,971 | $404,522 | $27,017,806 | 0.5006 | $13,525,114 | 142 |
| Massachusetts | $12,175,124 | $18,262,685 | $516,225 | $30,954,034 | 0.5027 | $15,560,593 | 163 |
| Michigan | $6,060,323 | $9,090,485 | $210,899 | $15,361,707 | 0.4924 | $7,564,104 | 79 |
| Minnesota | $4,561,989 | $6,842,984 | $257,296 | $11,662,269 | 0.4905 | $5,720,343 | 60 |
| Mississippi | $5,268,583 | $7,902,874 | $168,595 | $13,340,052 | 0.489 | $6,523,285 | 68 |
| Missouri | $8,276,550 | $12,414,825 | $264,850 | $20,956,224 | 0.5007 | $10,492,781 | 110 |
| Montana | $462,857 | $694,286 | $23,328 | $1,180,471 | 0.4882 | $576,306 | 6 |
| Nebraska | $807,478 | $1,211,217 | $33,074 | $2,051,770 | 0.4885 | $1,002,289 | 11 |
| Nevada | $1,255,001 | $1,882,501 | $0 | $3,137,502 | 0.4902 | $1,538,004 | 16 |
| New Hampshire | $2,817,497 | $4,226,246 | $0 | $7,043,743 | 0.4888 | $3,442,982 | 36 |
| New Jersey | $8,353,625 | $12,530,438 | $497,876 | $21,381,940 | 0.4959 | $10,603,304 | 111 |
| New Mexico | $3,271,880 | $4,907,821 | $112,553 | $8,292,254 | 0.4896 | $4,059,887 | 43 |
| New York | $13,878,051 | $20,817,077 | $716,107 | $35,411,235 | 0.5038 | $17,840,180 | 187 |
| North Carolina | $4,898,943 | $7,348,414 | $274,341 | $12,521,698 | 0.4914 | $6,153,162 | 64 |
| North Dakota | $453,576 | $680,364 | $10,233 | $1,144,172 | 0.4881 | $558,471 | 6 |
| Ohio | $11,362,400 | $17,043,599 | $372,687 | $28,778,686 | 0.5024 | $14,458,412 | 152 |
| Oklahoma | $3,410,294 | $5,115,440 | $143,232 | $8,668,966 | 0.4925 | $4,269,466 | 45 |
| Oregon | $2,632,274 | $3,948,411 | $63,175 | $6,643,859 | 0.4907 | $3,260,142 | 34 |
| Pennsylvania | $12,598,434 | $18,897,651 | $309,418 | $31,805,503 | 0.498 | $15,839,141 | 166 |
| Rhode Island | $1,364,360 | $2,046,539 | $58,326 | $3,469,225 | 0.4895 | $1,698,186 | 18 |
| South Carolina | $3,185,523 | $4,778,285 | $178,389 | $8,142,198 | 0.4881 | $3,974,207 | 42 |
| South Dakota | $305,881 | $458,822 | $0 | $764,703 | 0.4904 | $375,010 | 4 |
| Tennessee | $3,390,117 | $5,085,175 | $0 | $8,475,292 | 0.5342 | $4,527,501 | 47 |
| Texas | $35,422,907 | $53,134,361 | $0 | $88,557,268 | 0.4946 | $43,800,425 | 459 |
| Utah | $4,636,240 | $6,954,360 | $185,450 | $11,776,049 | 0.489 | $5,758,488 | 60 |
| Vermont | $1,150,888 | $1,726,333 | $71,815 | $2,949,036 | 0.4879 | $1,438,835 | 15 |
| Virginia | $14,907,071 | $22,360,607 | $685,725 | $37,953,403 | 0.4916 | $18,657,893 | 196 |
| Washington | $37,902,240 | $56,853,360 | $0 | $94,755,601 | 0.5581 | $52,883,101 | 554 |
| West Virginia | $1,504,791 | $2,257,186 | $72,230 | $3,834,206 | 0.4901 | $1,879,145 | 20 |
| Wisconsin | $2,825,568 | $4,238,352 | $146,930 | $7,210,850 | 0.4896 | $3,530,432 | 37 |
| Wyoming | $155,765 | $233,648 | $0 | $389,413 | 0.488 | $190,034 | 2 |
| **TOTAL** | $420,000,000 | $630,000,000 | $12,314,681 | $1,062,314,681 | | $550,584,654 | 5,770 |
| Average | | | | | | $11,011,693 | 115 |
| STD | | | | | | $16,168,047 | 169 |

## Total Economic and Employment Impacts of Public Safety and Other Direct Spending

Tables 14, 15, and 16 show the 2015 direct, indirect, and induced impacts respectively, of public safety spending. Since the impacts to "other" markets are equivalent to public safety, that data is not presented. Table 14 presents the total economic and employment impacts of direct public safety spending in all 50 states. The total economic impact is approximately $45,378,927 with a total job creation of 475. The largest economic and employment impacts of direct public safety spending is in the state of California with a total economic impact of $7,941,762 and creation of 83 new jobs. The state of Wyoming has the least economic and employment impacts among public safety direct spending with $15,664 and no new jobs created. The average economic and employment impacts of direct public safety spending per state are approximately $907,579 and creation of 10 new jobs. The standard deviation of economic and employment impacts of direct public safety spending are approximately $1,332,629 and new job creation of 14. The large standard deviation again indicates the variability of economic and employment impacts of direct public safety spending among states.

## Total Economic and Employment Impacts of Public Safety and Other Indirect Spending

The total economic and employment impact of indirect public safety spending in 2015 in all 50 states is shown in Table 15. The nationwide total economic impact is approximately $20,874,036 creation of an estimated 219 new jobs. The largest economic and employment impacts of indirect public safety spending is in the state of California with total economic impact of more than $3,652,756 and creation of 38 new jobs. Wyoming has the least economic and employment impacts with $7,205 and no new jobs created.

The economic and employment impacts of indirect public safety spending per state averages approximately $417,481 and creation of four new jobs. The standard deviation of economic and employment impacts of indirect public safety spending are $612,972 creation of six new jobs. As with public safety direct spending, there is a wide variability of economic and employment impacts among the states.

**Table 14: 2015 Direct Economic & Employment Impacts of Public Safety Spending**

| State | Direct Spending | | | | State Direct Multipliers | Direct Economic Impact | Direct Employment Impact |
|---|---|---|---|---|---|---|---|
| | Payroll | Parts | Taxes | Total | | | |
| Alabama | $399,329 | $598,993 | $15,973 | $1,014,296 | 0.9618 | $975,550 | 10 |
| Alaska | $26,218 | $39,328 | $0 | $65,546 | 0.9405 | $61,646 | 1 |
| Arizona | $738,248 | $1,107,373 | $17,009 | $1,862,630 | 1 | $1,862,630 | 20 |
| Arkansas | $109,958 | $164,937 | $6,158 | $281,053 | 0.9453 | $265,679 | 3 |
| California | $2,804,503 | $4,206,755 | $89,744 | $7,101,003 | 1.1184 | $7,941,762 | 83 |
| Colorado | $317,838 | $476,756 | $11,773 | $806,366 | 0.9542 | $769,435 | 8 |
| Connecticut | $710,387 | $1,065,581 | $28,415 | $1,804,383 | 0.9898 | $1,785,978 | 19 |
| Delaware | $23,884 | $35,825 | $1,060 | $60,770 | 0.9391 | $57,069 | 1 |
| Florida | $854,052 | $1,281,078 | $0 | $2,135,130 | 0.9837 | $2,100,328 | 22 |
| Georgia | $509,235 | $763,853 | $24,443 | $1,297,531 | 0.9705 | $1,259,254 | 13 |
| Hawaii | $44,620 | $66,930 | $2,570 | $114,119 | 0.9396 | $107,227 | 1 |
| Idaho | $39,985 | $59,977 | $2,367 | $102,329 | 0.9395 | $96,138 | 1 |
| Illinois | $281,623 | $422,434 | $11,265 | $715,322 | 0.947 | $677,410 | 7 |
| Indiana | $286,569 | $429,854 | $7,795 | $724,217 | 0.952 | $689,455 | 7 |
| Iowa | $222,562 | $333,844 | $6,054 | $562,460 | 0.9388 | $528,037 | 6 |
| Kansas | $637,456 | $956,184 | $31,873 | $1,625,514 | 0.9996 | $1,624,863 | 17 |
| Kentucky | $123,327 | $184,990 | $5,920 | $314,237 | 0.9435 | $296,482 | 3 |
| Louisiana | $296,513 | $444,770 | $9,488 | $750,772 | 0.9436 | $708,428 | 7 |
| Maine | $147,625 | $221,438 | $8,267 | $377,331 | 0.9386 | $354,163 | 4 |
| Maryland | $456,228 | $684,342 | $17,337 | $1,157,906 | 0.9627 | $1,114,716 | 12 |
| Massachusetts | $521,791 | $782,687 | $22,124 | $1,326,601 | 0.9668 | $1,282,558 | 13 |
| Michigan | $259,728 | $389,592 | $9,039 | $658,359 | 0.9468 | $623,334 | 7 |
| Minnesota | $195,514 | $293,271 | $11,027 | $499,812 | 0.9433 | $471,472 | 5 |
| Mississippi | $225,796 | $338,695 | $7,225 | $571,717 | 0.9405 | $537,699 | 6 |
| Missouri | $354,709 | $532,064 | $11,351 | $898,124 | 0.9628 | $864,714 | 9 |
| Montana | $19,837 | $29,755 | $1,000 | $50,592 | 0.9388 | $47,495 | 0 |
| Nebraska | $34,606 | $51,909 | $1,417 | $87,933 | 0.9394 | $82,604 | 1 |
| Nevada | $53,786 | $80,679 | $0 | $134,464 | 0.9427 | $126,760 | 1 |
| New Hampshire | $120,750 | $181,125 | $0 | $301,875 | 0.94 | $283,762 | 3 |
| New Jersey | $358,013 | $537,019 | $21,338 | $916,369 | 0.9537 | $873,941 | 9 |
| New Mexico | $140,223 | $210,335 | $4,824 | $355,382 | 0.9415 | $334,592 | 4 |
| New York | $594,774 | $892,160 | $30,690 | $1,517,624 | 0.9689 | $1,470,426 | 15 |
| North Carolina | $209,955 | $314,932 | $11,757 | $536,644 | 0.945 | $507,129 | 5 |
| North Dakota | $19,439 | $29,158 | $439 | $49,036 | 0.9386 | $46,025 | 0 |
| Ohio | $486,960 | $730,440 | $15,972 | $1,233,372 | 0.9661 | $1,191,561 | 12 |
| Oklahoma | $146,155 | $219,233 | $6,139 | $371,527 | 0.9471 | $351,873 | 4 |
| Oregon | $112,812 | $169,218 | $2,707 | $284,737 | 0.9437 | $268,706 | 3 |
| Pennsylvania | $539,933 | $809,899 | $13,261 | $1,363,093 | 0.9578 | $1,305,570 | 14 |
| Rhode Island | $58,473 | $87,709 | $2,500 | $148,681 | 0.9413 | $139,954 | 1 |
| South Carolina | $136,522 | $204,784 | $7,645 | $348,951 | 0.9386 | $327,526 | 3 |
| South Dakota | $13,109 | $19,664 | $0 | $32,773 | 0.9431 | $30,908 | 0 |
| Tennessee | $145,291 | $217,936 | $0 | $363,227 | 1.0274 | $373,179 | 4 |
| Texas | $1,518,125 | $2,277,187 | $0 | $3,795,311 | 0.9512 | $3,610,100 | 38 |
| Utah | $198,696 | $298,044 | $7,948 | $504,688 | 0.9403 | $474,558 | 5 |
| Vermont | $49,324 | $73,986 | $3,078 | $126,387 | 0.9383 | $118,589 | 1 |
| Virginia | $638,874 | $958,312 | $29,388 | $1,626,574 | 0.9455 | $1,537,926 | 16 |
| Washington | $1,624,382 | $2,436,573 | $0 | $4,060,954 | 1.0732 | $4,358,216 | 46 |
| West Virginia | $64,491 | $96,737 | $3,096 | $164,323 | 0.9425 | $154,875 | 2 |
| Wisconsin | $121,096 | $181,644 | $6,297 | $309,036 | 0.9415 | $290,958 | 3 |
| Wyoming | $6,676 | $10,013 | $0 | $16,689 | 0.9386 | $15,664 | 0 |
| **TOTAL** | $18,000,000 | $27,000,000 | $527,772 | $45,527,772 | | $45,378,927 | 475 |
| Average | | | | | | $907,579 | 10 |
| STD | | | | | | $1,332,629 | 14 |
| MAX | | | | | | $7,941,762 | 83 |
| MIN | | | | | | $15,664 | 0 |

**Table 15: 2015 Indirect Economic & Employment Impacts of Public Safety Spending**

| State | Direct Spending | | | | State Indirect Multipliers | Indirect Economic Impact | Indirect Employment Impact |
|---|---|---|---|---|---|---|---|
| | Payroll | Parts | Taxes | Total | | | |
| Alabama | $399,329 | $598,993 | $15,973 | $1,014,296 | 0.4424 | $448,724 | 5 |
| Alaska | $26,218 | $39,328 | $0 | $65,546 | 0.4327 | $28,362 | 0 |
| Arizona | $738,248 | $1,107,373 | $17,009 | $1,862,630 | 0.46 | $856,810 | 9 |
| Arkansas | $109,958 | $164,937 | $6,158 | $281,053 | 0.4349 | $122,230 | 1 |
| California | $2,804,503 | $4,206,755 | $89,744 | $7,101,003 | 0.5144 | $3,652,756 | 38 |
| Colorado | $317,838 | $476,756 | $11,773 | $806,366 | 0.4389 | $353,914 | 4 |
| Connecticut | $710,387 | $1,065,581 | $28,415 | $1,804,383 | 0.4553 | $821,536 | 9 |
| Delaware | $23,884 | $35,825 | $1,060 | $60,770 | 0.432 | $26,252 | 0 |
| Florida | $854,052 | $1,281,078 | $0 | $2,135,130 | 0.4525 | $966,146 | 10 |
| Georgia | $509,235 | $763,853 | $24,443 | $1,297,531 | 0.4464 | $579,218 | 6 |
| Hawaii | $44,620 | $66,930 | $2,570 | $114,119 | 0.4322 | $49,322 | 1 |
| Idaho | $39,985 | $59,977 | $2,367 | $102,329 | 0.4322 | $44,227 | 0 |
| Illinois | $281,623 | $422,434 | $11,265 | $715,322 | 0.4356 | $311,594 | 3 |
| Indiana | $286,569 | $429,854 | $7,795 | $724,217 | 0.4379 | $317,135 | 3 |
| Iowa | $222,562 | $333,844 | $6,054 | $562,460 | 0.4319 | $242,926 | 3 |
| Kansas | $637,456 | $956,184 | $31,873 | $1,625,514 | 0.4598 | $747,411 | 8 |
| Kentucky | $123,327 | $184,990 | $5,920 | $314,237 | 0.434 | $136,379 | 1 |
| Louisiana | $296,513 | $444,770 | $9,488 | $750,772 | 0.4341 | $325,910 | 3 |
| Maine | $147,625 | $221,438 | $8,267 | $377,331 | 0.4317 | $162,894 | 2 |
| Maryland | $456,228 | $684,342 | $17,337 | $1,157,906 | 0.4428 | $512,721 | 5 |
| Massachusetts | $521,791 | $782,687 | $22,124 | $1,326,601 | 0.4447 | $589,940 | 6 |
| Michigan | $259,728 | $389,592 | $9,039 | $658,359 | 0.4356 | $286,781 | 3 |
| Minnesota | $195,514 | $293,271 | $11,027 | $499,812 | 0.4339 | $216,868 | 2 |
| Mississippi | $225,796 | $338,695 | $7,225 | $571,717 | 0.4326 | $247,325 | 3 |
| Missouri | $354,709 | $532,064 | $11,351 | $898,124 | 0.4429 | $397,779 | 4 |
| Montana | $19,837 | $29,755 | $1,000 | $50,592 | 0.4319 | $21,851 | 0 |
| Nebraska | $34,606 | $51,909 | $1,417 | $87,933 | 0.4321 | $37,996 | 0 |
| Nevada | $53,786 | $80,679 | $0 | $134,464 | 0.4337 | $58,317 | 1 |
| New Hampshire | $120,750 | $181,125 | $0 | $301,875 | 0.4324 | $130,531 | 1 |
| New Jersey | $358,013 | $537,019 | $21,338 | $916,369 | 0.4387 | $402,011 | 4 |
| New Mexico | $140,223 | $210,335 | $4,824 | $355,382 | 0.4331 | $153,916 | 2 |
| New York | $594,774 | $892,160 | $30,690 | $1,517,624 | 0.4457 | $676,405 | 7 |
| North Carolina | $209,955 | $314,932 | $11,757 | $536,644 | 0.4347 | $233,279 | 2 |
| North Dakota | $19,439 | $29,158 | $439 | $49,036 | 0.4318 | $21,174 | 0 |
| Ohio | $486,960 | $730,440 | $15,972 | $1,233,372 | 0.4444 | $548,111 | 6 |
| Oklahoma | $146,155 | $219,233 | $6,139 | $371,527 | 0.4357 | $161,874 | 2 |
| Oregon | $112,812 | $169,218 | $2,707 | $284,737 | 0.4341 | $123,604 | 1 |
| Pennsylvania | $539,933 | $809,899 | $13,261 | $1,363,093 | 0.4406 | $600,579 | 6 |
| Rhode Island | $58,473 | $87,709 | $2,500 | $148,681 | 0.433 | $64,379 | 1 |
| South Carolina | $136,522 | $204,784 | $7,645 | $348,951 | 0.4318 | $150,677 | 2 |
| South Dakota | $13,109 | $19,664 | $0 | $32,773 | 0.4338 | $14,217 | 0 |
| Tennessee | $145,291 | $217,936 | $0 | $363,227 | 0.4726 | $171,661 | 2 |
| Texas | $1,518,125 | $2,277,187 | $0 | $3,795,311 | 0.4376 | $1,660,828 | 17 |
| Utah | $198,696 | $298,044 | $7,948 | $504,688 | 0.4326 | $218,328 | 2 |
| Vermont | $49,324 | $73,986 | $3,078 | $126,387 | 0.4316 | $54,549 | 1 |
| Virginia | $638,874 | $958,312 | $29,388 | $1,626,574 | 0.4349 | $707,397 | 7 |
| Washington | $1,624,382 | $2,436,573 | $0 | $4,060,954 | 0.4937 | $2,004,893 | 21 |
| West Virginia | $64,491 | $96,737 | $3,096 | $164,323 | 0.4336 | $71,251 | 1 |
| Wisconsin | $121,096 | $181,644 | $6,297 | $309,036 | 0.4331 | $133,844 | 1 |
| Wyoming | $6,676 | $10,013 | $0 | $16,689 | 0.4317 | $7,205 | 0 |
| **TOTAL** | $18,000,000 | $27,000,000 | $527,772 | $45,527,772 | | $20,874,036 | 219 |
| Average | | | | | | $417,481 | 4 |
| STD | | | | | | $612,972 | 6 |
| MAX | | | | | | $3,652,756 | 38 |
| MIN | | | | | | $7,205 | 0 |

## Total Economic and Employment Impacts of Public Safety and Other Induced Spending

Table 16 presents the total economic and employment impacts of induced public safety spending in 2015 in all 50 states. The total economic impact is estimated to be $23,596,485 with total new job creation of 247. The largest economic and employment impacts of induced public safety spending is in the state of California with a total economic impact of approximately $4,129,233 and creation of 43 new jobs. Following California are the states of Washington, Texas, Florida and Arizona. The order of job creation was similar to economic impact. The state with least economic and employment impacts is Wyoming with $8,144 and no new jobs created.

The average economic and employment impacts of induced public safety spending per state are an estimated $471,930 and creation of five jobs. The standard deviation of economic and employment impacts of induced public safety spending are approximately $692,916 and creation of seven new jobs. The large standard deviation indicates the wide variability of economic and employment impacts among states.

**Table 16: 2015 Induced Economic & Employment Impacts of Public Safety Spending**

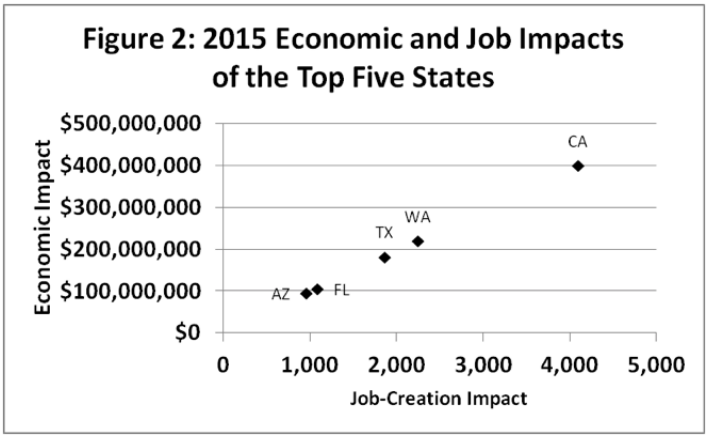
| State | Direct Spending | | | | State Induced Multipliers | Induced Economic Impact | Induced Employment Impact |
|---|---|---|---|---|---|---|---|
| | Payroll | Parts | Taxes | Total | | | |
| Alabama | $399,329 | $598,993 | $15,973 | $1,014,296 | 0.5001 | $507,249 | 5 |
| Alaska | $26,218 | $39,328 | $0 | $65,546 | 0.4891 | $32,059 | 0 |
| Arizona | $738,248 | $1,107,373 | $17,009 | $1,862,630 | 0.52 | $968,568 | 10 |
| Arkansas | $109,958 | $164,937 | $6,158 | $281,053 | 0.4916 | $138,166 | 1 |
| California | $2,804,503 | $4,206,755 | $89,744 | $7,101,003 | 0.5815 | $4,129,233 | 43 |
| Colorado | $317,838 | $476,756 | $11,773 | $806,366 | 0.4962 | $400,119 | 4 |
| Connecticut | $710,387 | $1,065,581 | $28,415 | $1,804,383 | 0.5147 | $928,716 | 10 |
| Delaware | $23,884 | $35,825 | $1,060 | $60,770 | 0.4883 | $29,674 | 0 |
| Florida | $854,052 | $1,281,078 | $0 | $2,135,130 | 0.5115 | $1,092,119 | 11 |
| Georgia | $509,235 | $763,853 | $24,443 | $1,297,531 | 0.5047 | $654,864 | 7 |
| Hawaii | $44,620 | $66,930 | $2,570 | $114,119 | 0.4886 | $55,759 | 1 |
| Idaho | $39,985 | $59,977 | $2,367 | $102,329 | 0.4885 | $49,988 | 1 |
| Illinois | $281,623 | $422,434 | $11,265 | $715,322 | 0.4924 | $352,225 | 4 |
| Indiana | $286,569 | $429,854 | $7,795 | $724,217 | 0.4951 | $358,560 | 4 |
| Iowa | $222,562 | $333,844 | $6,054 | $562,460 | 0.4882 | $274,593 | 3 |
| Kansas | $637,456 | $956,184 | $31,873 | $1,625,514 | 0.5198 | $844,942 | 9 |
| Kentucky | $123,327 | $184,990 | $5,920 | $314,237 | 0.4906 | $154,164 | 2 |
| Louisiana | $296,513 | $444,770 | $9,488 | $750,772 | 0.4907 | $368,404 | 4 |
| Maine | $147,625 | $221,438 | $8,267 | $377,331 | 0.4881 | $184,175 | 2 |
| Maryland | $456,228 | $684,342 | $17,337 | $1,157,906 | 0.5006 | $579,648 | 6 |
| Massachusetts | $521,791 | $782,687 | $22,124 | $1,326,601 | 0.5027 | $666,883 | 7 |
| Michigan | $259,728 | $389,592 | $9,039 | $658,359 | 0.4924 | $324,176 | 3 |
| Minnesota | $195,514 | $293,271 | $11,027 | $499,812 | 0.4905 | $245,158 | 3 |
| Mississippi | $225,796 | $338,695 | $7,225 | $571,717 | 0.489 | $279,569 | 3 |
| Missouri | $354,709 | $532,064 | $11,351 | $898,124 | 0.5007 | $449,691 | 5 |
| Montana | $19,837 | $29,755 | $1,000 | $50,592 | 0.4882 | $24,699 | 0 |
| Nebraska | $34,606 | $51,909 | $1,417 | $87,933 | 0.4885 | $42,955 | 0 |
| Nevada | $53,786 | $80,679 | $0 | $134,464 | 0.4902 | $65,914 | 1 |
| New Hampshire | $120,750 | $181,125 | $0 | $301,875 | 0.4888 | $147,556 | 2 |
| New Jersey | $358,013 | $537,019 | $21,338 | $916,369 | 0.4959 | $454,427 | 5 |
| New Mexico | $140,223 | $210,335 | $4,824 | $355,382 | 0.4896 | $173,995 | 2 |
| New York | $594,774 | $892,160 | $30,690 | $1,517,624 | 0.5038 | $764,579 | 8 |
| North Carolina | $209,955 | $314,932 | $11,757 | $536,644 | 0.4914 | $263,707 | 3 |
| North Dakota | $19,439 | $29,158 | $439 | $49,036 | 0.4881 | $23,934 | 0 |
| Ohio | $486,960 | $730,440 | $15,972 | $1,233,372 | 0.5024 | $619,646 | 6 |
| Oklahoma | $146,155 | $219,233 | $6,139 | $371,527 | 0.4925 | $182,977 | 2 |
| Oregon | $112,812 | $169,218 | $2,707 | $284,737 | 0.4907 | $139,720 | 1 |
| Pennsylvania | $539,933 | $809,899 | $13,261 | $1,363,093 | 0.498 | $678,820 | 7 |
| Rhode Island | $58,473 | $87,709 | $2,500 | $148,681 | 0.4895 | $72,779 | 1 |
| South Carolina | $136,522 | $204,784 | $7,645 | $348,951 | 0.4881 | $170,323 | 2 |
| South Dakota | $13,109 | $19,664 | $0 | $32,773 | 0.4904 | $16,072 | 0 |
| Tennessee | $145,291 | $217,936 | $0 | $363,227 | 0.5342 | $194,036 | 2 |
| Texas | $1,518,125 | $2,277,187 | $0 | $3,795,311 | 0.4946 | $1,877,161 | 20 |
| Utah | $198,696 | $298,044 | $7,948 | $504,688 | 0.489 | $246,792 | 3 |
| Vermont | $49,324 | $73,986 | $3,078 | $126,387 | 0.4879 | $61,664 | 1 |
| Virginia | $638,874 | $958,312 | $29,388 | $1,626,574 | 0.4916 | $799,624 | 8 |
| Washington | $1,624,382 | $2,436,573 | $0 | $4,060,954 | 0.5581 | $2,266,419 | 24 |
| West Virginia | $64,491 | $96,737 | $3,096 | $164,323 | 0.4901 | $80,535 | 1 |
| Wisconsin | $121,096 | $181,644 | $6,297 | $309,036 | 0.4896 | $151,304 | 2 |
| Wyoming | $6,676 | $10,013 | $0 | $16,689 | 0.488 | $8,144 | 0 |
| **TOTAL** | $18,000,000 | $27,000,000 | $527,772 | $45,527,772 | | $23,596,485 | 247 |
| Average | | | | | | $471,930 | 5 |
| STD | | | | | | $692,916 | 7 |
| MAX | | | | | | $4,129,233 | 43 |
| MIN | | | | | | $8,144 | 0 |

## Total Economic and Employment Impacts of UAS Development in the Top Five States

A comparison of the total economic and job creation impacts of UAS integration in the U.S. in the top five states is presented in Table 17. The orders of output and job multipliers are consistent with the order of the states in terms of direct spending. California is the number one state with the highest direct spending of $179,892,071 and the highest direct employment of 2,108, which resulted in the highest contribution to total economic impact of approximately $398,335,013 and total new job creation impact of approximately 4,097. In addition, California has the highest multipliers for job and output creation. Figure 2 graphically shows the total economic and job creation impacts of the top five states in the U.S.

**Table 17: 2015 Total Economic and Employment Impacts of UAS Development in the Top Five States**

| State | Direct jobs | Total job Creation Impact | Job multiplier | Direct spending | Total Economic impact | Output multiplier |
|---|---|---|---|---|---|---|
| California | 2108 | 4,097 | 1.94 | 179,892,071 | 398,335,013 | 2.21 |
| Washington | 1157 | 2,249 | 1.94 | 102,877,509 | 218,614,707 | 2.13 |
| Texas | 958 | 1,863 | 1.94 | 96,147,891 | 181,084,937 | 1.88 |
| Florida | 557 | 1,084 | 1.94 | 54,089,966 | 105,351,026 | 1.95 |
| Arizona | 494 | 961 | 1.94 | 47,186,634 | 93,429,535 | 1.98 |




## Total Economic and Employment Impacts of UAS Development in the United States From 2015-2025

UAS integration into the NAS will have tremendous economic and job creation impacts on the aerospace industry and aid in driving economic development in many states across the country. In today's economic environment, job creation will continue to be extremely important for the aerospace industry and the U.S. economy. Note that the economic impact of UAS integration will not stop with the primary UAS market. Similar to other industries, job growth will stretch into many additional sectors, and the economic growth in the aerospace industry will support the growth in many other businesses across multiple U.S. industries, including the hospitality and entertainment industries.

The total direct spending in UAS development and the total economic and employment impacts are expected to increase significantly in the next 11 years from 2015 through 2025, as seen in Table 18. The expected total direct spending in UAS development in 2015 is an estimated $1,153,370,225. This amount is expected to increase by 100% in 2016 to approximately $2,306,740,450. In 2017, total direct spending is expected to increase by 50% to an estimated $3,460,110,675. This rate of growth is expected to decrease in 2018 to approximately 5% with total spending of $3,633,116,209 and to level off at 5% between 2019 and 2025, with total spending in 2025 of 5,112,159,353.

**Table 18: Direct Spending and Employment in The U.S. from 2015-2025**

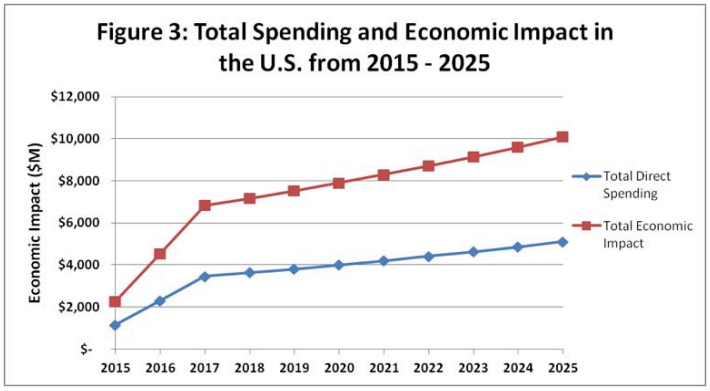
| Year | Total Direct Spending | Total Direct Employment | Percent Change Over Previous Year |
|---|---|---|---|
| 2015 | $ 1,153,370,225 | 11,400 | |
| 2016 | $ 2,306,740,450 | 22,800 | 100% |
| 2017 | $ 3,460,110,675 | 34,200 | 50% |
| 2018 | $ 3,633,116,209 | 35,910 | 5% |
| 2019 | $ 3,814,772,019 | 37,706 | 5% |
| 2020 | $ 4,005,510,620 | 39,591 | 5% |
| 2021 | $ 4,205,786,151 | 41,570 | 5% |
| 2022 | $ 4,416,075,459 | 43,649 | 5% |
| 2023 | $ 4,636,879,232 | 45,831 | 5% |
| 2024 | $ 4,868,723,193 | 48,123 | 5% |
| 2025 | $ 5,112,159,353 | 50,529 | 5% |

The expected total economic and employment impacts in the U.S. for UAS integration for the 11-year period from 2015 through 2025 is shown in Table 19. In 2015, the expected total economic and employment impacts are estimated to be $2,276,186,016 with creation of 23,413 jobs. These amounts are expected to increase by 100% in 2016 (from 2015) to approximately $4,552,372,033 in economic impact and job creation of 46,826. In 2017, the economic and employment impacts are expected to increase by approximately 50% to $6,828,558,049 and 70,240 jobs. This rate of growth is expected to decrease in 2018 to approximately 5% and level off at 5% through 2025. By 2025, the expected total economic impact is estimated to be $10,088,890,263 and total employment impact 103,776.

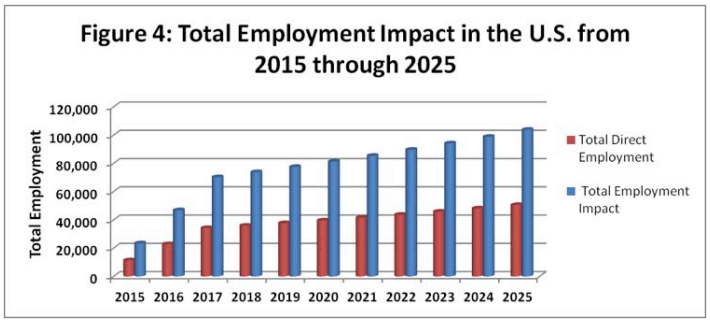
**Table 19: Economic & Employment Impacts in The U.S. from 2015-2025**

| Year | Total Direct Spending | Total Economic Impact | Total Employment Impact | Percent Change Over Previous Year |
|---|---|---|---|---|
| 2015 | $1,153,370,225 | $ 2,276,186,016 | 23,413 | |
| 2016 | $2,306,740,450 | $ 4,552,372,033 | 46,826 | 100% |
| 2017 | $3,460,110,675 | $ 6,828,558,049 | 70,240 | 50% |
| 2018 | $3,633,116,209 | $ 7,169,985,952 | 73,752 | 5% |
| 2019 | $3,814,772,019 | $ 7,528,485,249 | 77,439 | 5% |
| 2020 | $4,005,510,620 | $ 7,904,909,512 | 81,311 | 5% |
| 2021 | $4,205,786,151 | $ 8,300,154,987 | 85,377 | 5% |
| 2022 | $4,416,075,459 | $ 8,715,162,737 | 89,645 | 5% |
| 2023 | $4,636,879,232 | $ 9,150,920,874 | 94,128 | 5% |
| 2024 | $4,868,723,193 | $ 9,608,466,917 | 98,834 | 5% |
| 2025 | $5,112,159,353 | $10,088,890,263 | 103,776 | 5% |

Figure 3 graphically compares total spending and economic impacts from 2015 to 2025. There are high growth rates for both spending and total economic impact in the first three years (2015-2017) but both spending and total economic impact growth are expected to decrease to 5% in 2018 and level off at 5% through 2025.




Direct employment and total employment impact from 2015 to 2025 are compared in Figure 4. There are high growth rates for both direct and total employment impacts in the first three years (2015-2017) to approximately 100% and 50% in 2016 and 2017, respectively. The growth rate of both direct employment and total employment impacts are expected to decrease to 5% in 2018 and level off at 5% through 2025.




## Conclusion

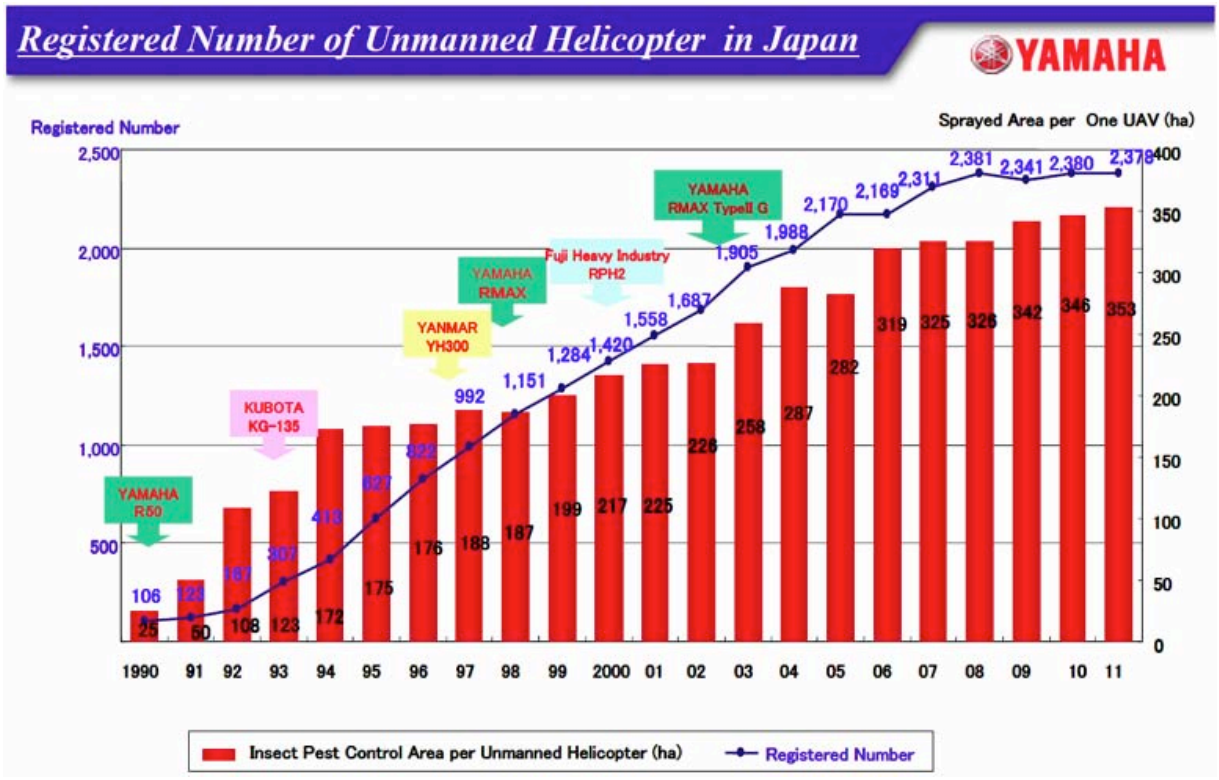
UAS integration into the NAS is expected to have enormous economic and job creation impacts in the United States. These impacts have been demonstrated to be due to direct, indirect and induced effects of total spending in UAS development. The results of these economic impacts are as follows:

During the 11-year period 2015-2025:

- UAS integration is expected to contribute $82.1 billion to the nation's economy by agriculture, public safety and other activities;
- 103,776 new jobs will be created, with 844,741 job years worked over the time period;
- UAS integration is expected to contribute $75.6 billion economic impact by agriculture, $3.2 billion by public safety and $3.2 billion by other activities;
- The manufacturing jobs created will be high paying ($40,000) and require technical baccalaureate degrees; and
- In the first three years, U.S. airspace integration will create more than 34,000 manufacturing jobs and more than 70,000 new jobs.

This study demonstrates the significant contribution of UAS integration to the economic growth and job creation in the aerospace industry and to the social and economic progress of the citizens in the United States.

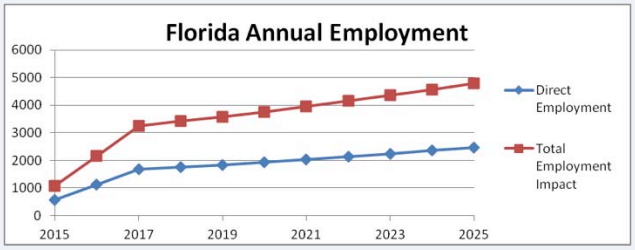
# Appendix A

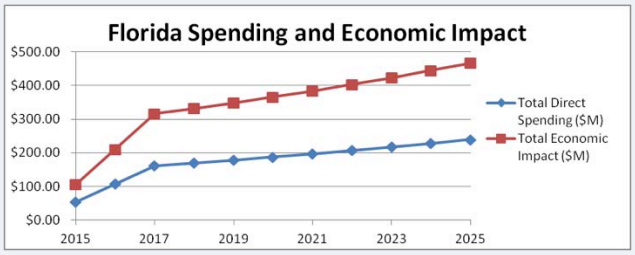



Sato, Akira (2011, October). Civil UAV Applications in Japan and Related Safety & Certification. Presented at the 1st Annual Agricultural UAS Conference: Precision Agriculture, Atlanta, GA.

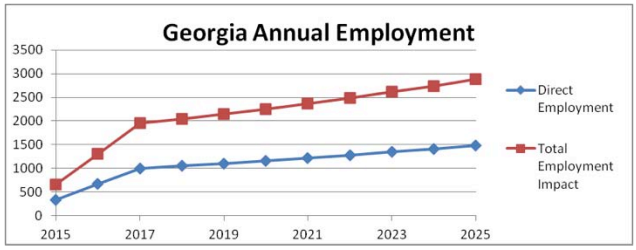
# Appendix B
# State Level Detailed Economic Impact

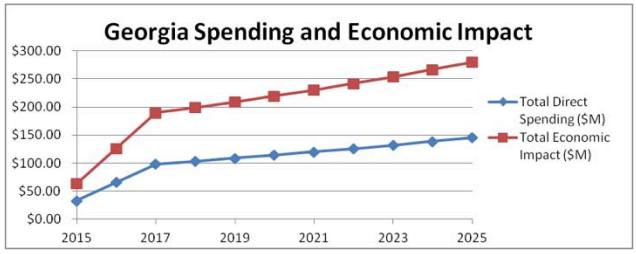
| Florida Economic Impact | | | | | | |
|---|---|---|---|---|---|---|
| Year | Direct Employment | Total Employment Impact | Total Direct Spending ($M) | Total Economic Impact ($M) | Total State Taxes ($K) | Percent Change Over Previous Year |
| 2015 | 557 | 1084 | $54.09 | $105.35 | $0.00 | |
| 2016 | 1115 | 2167 | $108.18 | $210.70 | $0.00 | 100% |
| 2017 | 1672 | 3251 | $162.27 | $316.05 | $0.00 | 50% |
| 2018 | 1756 | 3414 | $170.38 | $331.86 | $0.00 | 5% |
| 2019 | 1844 | 3584 | $178.90 | $348.45 | $0.00 | 5% |
| 2020 | 1936 | 3763 | $187.85 | $365.87 | $0.00 | 5% |
| 2021 | 2033 | 3952 | $197.24 | $384.16 | $0.00 | 5% |
| 2022 | 2135 | 4149 | $207.10 | $403.37 | $0.00 | 5% |
| 2023 | 2241 | 4357 | $217.46 | $423.54 | $0.00 | 5% |
| 2024 | 2353 | 4574 | $228.33 | $444.72 | $0.00 | 5% |
| 2025 | 2471 | 4803 | $239.75 | $466.95 | $0.00 | 5% |



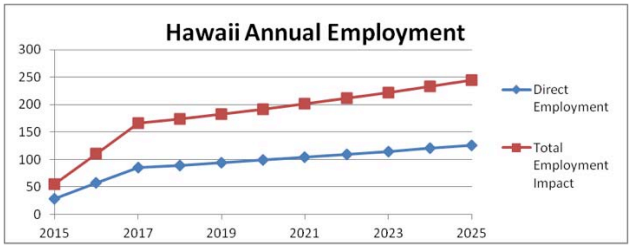



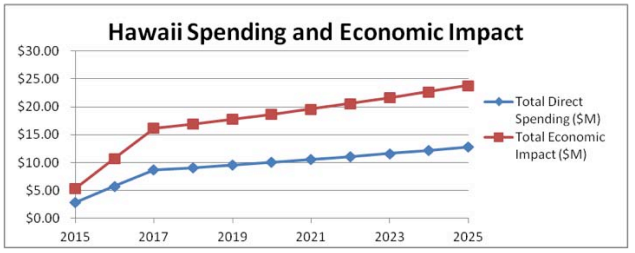

| Georgia Economic Impact | | | | | | |
|---|---|---|---|---|---|---|
| Year | Direct Employment | Total Employment Impact | Total Direct Spending ($M) | Total Economic Impact ($M) | Total State Taxes ($K) | Percent Change Over Previous Year |
| 2015 | 334 | 650 | $32.87 | $63.16 | $619.23 | |
| 2016 | 668 | 1299 | $65.74 | $126.33 | $1,238.46 | 100% |
| 2017 | 1003 | 1949 | $98.61 | $189.49 | $1,857.69 | 50% |
| 2018 | 1053 | 2047 | $103.54 | $198.97 | $1,950.57 | 5% |
| 2019 | 1106 | 2149 | $108.72 | $208.92 | $2,048.10 | 5% |
| 2020 | 1161 | 2256 | $114.16 | $219.36 | $2,150.51 | 5% |
| 2021 | 1219 | 2369 | $119.86 | $230.33 | $2,258.03 | 5% |
| 2022 | 1280 | 2488 | $125.86 | $241.85 | $2,370.94 | 5% |
| 2023 | 1344 | 2612 | $132.15 | $253.94 | $2,489.48 | 5% |
| 2024 | 1411 | 2743 | $138.76 | $266.64 | $2,613.96 | 5% |
| 2025 | 1481 | 2880 | $145.70 | $279.97 | $2,744.65 | 5% |



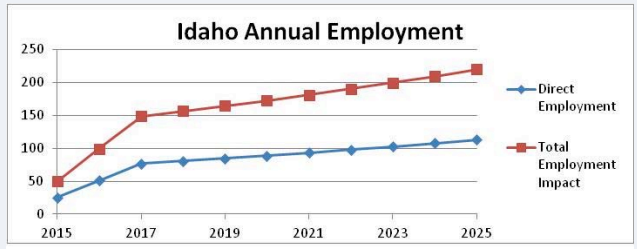



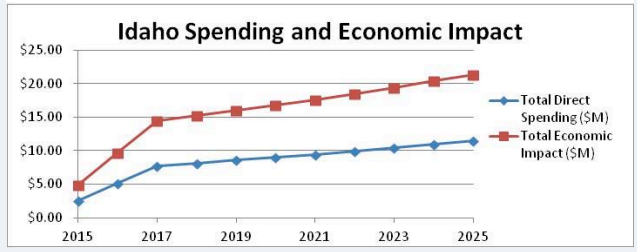

| Hawaii Economic Impact | | | | | | |
|---|---|---|---|---|---|---|
| Year | Direct Employment | Total Employment Impact | Total Direct Spending ($M) | Total Economic Impact ($M) | Total State Taxes ($K) | Percent Change Over Previous Year |
| 2015 | 28 | 55 | $2.89 | $5.38 | $65.11 | |
| 2016 | 57 | 111 | $5.78 | $10.76 | $130.22 | 100% |
| 2017 | 85 | 166 | $8.67 | $16.14 | $195.33 | 50% |
| 2018 | 90 | 174 | $9.11 | $16.94 | $205.09 | 5% |
| 2019 | 94 | 183 | $9.56 | $17.79 | $215.35 | 5% |
| 2020 | 99 | 192 | $10.04 | $18.68 | $226.12 | 5% |
| 2021 | 104 | 202 | $10.54 | $19.61 | $237.42 | 5% |
| 2022 | 109 | 212 | $11.07 | $20.59 | $249.29 | 5% |
| 2023 | 114 | 222 | $11.62 | $21.62 | $261.76 | 5% |
| 2024 | 120 | 234 | $12.20 | $22.70 | $274.84 | 5% |
| 2025 | 126 | 245 | $12.81 | $23.84 | $288.59 | 5% |




| Idaho Economic Impact | | | | | | |
|---|---|---|---|---|---|---|
| Year | Direct Employment | Total Employment Impact | Total Direct Spending ($M) | Total Economic Impact ($M) | Total State Taxes ($K) | Percent Change Over Previous Year |
| 2015 | 26 | 50 | $2.59 | $4.82 | $59.97 | |
| 2016 | 51 | 99 | $5.18 | $9.64 | $119.93 | 100% |
| 2017 | 77 | 149 | $7.78 | $14.47 | $179.90 | 50% |
| 2018 | 80 | 156 | $8.17 | $15.19 | $188.89 | 5% |
| 2019 | 84 | 164 | $8.57 | $15.95 | $198.34 | 5% |
| 2020 | 89 | 172 | $9.00 | $16.75 | $208.26 | 5% |
| 2021 | 93 | 181 | $9.45 | $17.58 | $218.67 | 5% |
| 2022 | 98 | 190 | $9.93 | $18.46 | $229.60 | 5% |
| 2023 | 103 | 199 | $10.42 | $19.39 | $241.08 | 5% |
| 2024 | 108 | 209 | $10.94 | $20.36 | $253.14 | 5% |
| 2025 | 113 | 220 | $11.49 | $21.37 | $265.79 | 5% |



**George R. Ariyoshi**
**999 Bishop Street, 23rd Floor**
**Honolulu, HI 96813**

**February 10, 2014**

TESTIMONY IN SUPPORT OF SB3053 - RELATING TO UNMANNED AERIAL SYSTEMS TEST SITES

Dear Members of the 27th State Legislature,

I strongly support the intent of this bill to provide funding to establish a chief operating officer, an administrative assistant, and an advisory board to oversee and manage unmanned aerial systems (UAS) test site operations in Hawaii.

Our State, in collaboration with Alaska and Oregon, was most fortunate to have been selected by the Federal Aviation Administration as one of six national sites to research and demonstrate diverse applications of UAS, with the goal of safely integrating these technologies into the national air space. This designation will also provide unique opportunities for our state to advance both civil and commercial applications of UAS technologies in ways that can substantially benefit our local economy, while concurrently developing standards and procedures that will enhance operational safety, as well as protect individual privacy.

As others testifying on this measure have noted, UAS can support a broad range of activities such as emergency search and rescue operations, air quality monitoring, disaster assessment and management, agricultural monitoring, wildlife management, watershed management, flood and pollution control, hazardous spills monitoring, and many other applications with direct and lasting benefits to local communities.

In comparison with other aviation-related surveillance technologies (e.g., winged aircraft, helicopters), UAS would afford low-cost operating scenarios with significantly reduced safety risks and environmental impacts. In addition, UAS operations in Hawaii will provide substantial opportunities to advance science, technology, engineering and math (STEM) programs for both K-12 and university students, as well as multiple commercial applications in remote sensing, aerial tracking systems, and command and control software that can significantly expand and diversify our industrial base.

UAS research and development represents an emerging $70 Billion industry that will help launch the next generation of aviation technologies. By establishing a dedicated team to oversee and manage these operations in Hawaii, we will be able to participate as both a major contributor to and beneficiary of this global enterprise.

I would also direct your attention to two documents that I am submitting with this testimony, including a report from the Association for Unmanned Vehicle Systems International (AUVSI) and an economic impact study undertaken by the McDowell Group, which further highlight the multiple benefits UAS technologies will bring to our nation in general and Hawaii in particular.

In summary, I would urge you pass SB3053 with the requested funding allocation, and would be happy to address any questions you may have concerning this recommendation. I can be reached by e-mail at kyahiku@wik.com , by phone at (808) 544-6765 or by fax at (808) 544-8398.

Thank you for the opportunity to testify on this bill.

Aloha,

George R. Ariyoshi

GRA:khy

**From:** mailinglist@capitol.hawaii.gov
**To:** WAM Testimony
**Cc:** losborn@dreamhammer.com
**Subject:** Submitted testimony for SB3053 on Feb 25, 2014 09:25AM
**Date:** Monday, February 24, 2014 7:37:00 AM

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**SB3053**
Submitted on: 2/24/2014
Testimony for WAM on Feb 25, 2014 09:25AM in Conference Room 211

| Submitted By | Organization | Testifier Position | Present at Hearing |
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| Larry Osborn | Individual | Comments Only | No |

Comments: I support SB3053. Recently the Federal Aviation Agency (FAA) announced the selection of six sites from among more than two dozen applicants to serve as test ranges to "allow the agency to develop research findings and operational experiences to help ensure the safe integration of UAS (unmanned aircraft systems) into the nation's airspace..." Today UAS cannot routinely fly in the U. S. national airspace (NAS) and their use by our government agencies is severely limited because of this. Commercial use of UAS in the NAS is prohibited except for training and research. The Association for Unmanned Vehicle Systems International (AUVSI) estimates that it costs the American economy $27M a day for every day that UAS are not integrated into the NAS. Moreover, the same study predicts that integration of UAS into the NAS will create more than 34,000 manufacturing jobs and more than 70,000 new jobs in the first three years. The economic benefit to Hawaii alone is projected to be $194M in the next ten years. Alaska leads the nation in the use of UAS. They are used to count wildlife, study fisheries, inspect pipelines, and monitor the environment. In Hawaii similar opportunities exist. In addition to those mentioned above, UAS applications in the future in Hawaii will likely include precision agriculture, identification and eradication of invasive species, cinematography, search and rescue, law enforcement, harbor security, and disaster response. The list will grow as they can be safely operated in our airspace. Every dollar allocated by our legislature in support of the FAA test site effort has the potential to multiply, bringing jobs and economic benefit directly to the people of Hawaii. Our local schools that deliver STEM education programs to our children are preparing the workforce now. Hawaii is teamed with Alaska and Oregon as part of what has been named the Pan-Pacific Test Site, one of the six officially designated FAA Test Sites. As early as six months from now UAS (in addition to those already being operated locally by military and civil agencies) may begin operating in Hawaii skies in support of the airspace integration effort. It is only natural that questions need to be answered about noise, safety, and personal privacy as we prepare to host this activity in our state. The unmanned aircraft supporting airspace integration will operate initially in restricted airspace over sparsely populated areas, or over the open ocean. As confidence is gained in the reliability of the vehicles, their control systems, and the procedures developed to ensure safe operations in controlled airspace, they may be seen along defined airways or approach corridors to our airports, where you now see

manned military, commercial and private aircraft. UAS will not be flying in our residential neighborhoods. Thus it is extremely unlikely that the testing contemplated by the FAA and commercial interests in Hawaiian airspace will even be discernible to the public. With the proliferation of UAS technology and the ease with which it can be employed, comes the possibility of misuse. Because of this our state legislature is contemplating several laws to protect the privacy of individuals. Some public advocacy groups are concerned that the proposed legislation does not go far enough, while others representing law enforcement argue that they will be restricted from effectively discharging their responsibilities. The right balance in privacy legislation can be found in a set of guidelines developed by the Aerospace States Association (ASA) a bi-partisan organization of Lieutenant Governors and state appointed delegates formed to promote a state-based perspective in federal aerospace policy development. In constructing these guidelines, ASA polled such diverse groups as the American Civil Liberties Union (ACLU), The Electronic Privacy Information Center (EPIC), the Association for Unmanned Vehicle Systems International (AUVSI), an industry association Academia and legal experts were also consulted. UAS integration into the NAS will usher in an exciting future featuring new products, services, jobs, and economic growth. The FAA Test Site initiative will ensure Hawaii is a full participant in this important new industry if supported and resourced appropriately by the State of Hawaii.

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February 23, 2014

Members of the 27th Hawaii State Legislature:

I, Reid Noguchi, would like to submit testimony in favor of SB 3053 RELATING TO UNMANNED AERIAL SYSTEMS TEST SITES.

As a leader in the aerospace industry in Hawaii, I strongly support this bill to fund and staff a team that is dedicated to assuring that the State positions itself as one of the Nation's most viable and opportune locations for unmanned aerial system (UAS) testing. Although having succeed in being designated one of six FAA-approved UAS test sites in the country, there is still a significant effort ahead to capitalize on this unique and long-term opportunity. Each of the six FAA test sites are now in competition amongst each other to capitalize on their designation by being the first to start UAS operations, by offering discriminating and compelling reasons to use their sites, and to jump start the establishment of a thriving and self-sustaining industry that will create a wide spectrum of jobs and educational opportunities. For our State to get ahead of the competition and not lose this opportunity, it is imperative that we quickly establish a staff with sufficient authority and funding to make this happen.

There are many contributions to the significant economic benefits to establish the State as a national resource for UAS testing. Being a part of the defense/aerospace industry in Hawaii, I can speak to the challenges that face us with shrinking DoD budgets. With less funding available, there is more competition, and with that an inherent need to identify, establish, and leverage geographic discriminators to improve the chances of being awarded federally funded work in Hawaii. With the established military ranges, like the Pacific Missile Range Facility and Pohakuloa, and the strong support of our military leadership we have a compelling case that initial UAS testing can be done quickly with existing resources. However, the charter of the FAA test sites includes addressing standards and policies extending to operational testing in civil airspace. In this context, there is significant work that must be done to make it simple and cost effective for the existing and emerging UAS industries to select Hawaii as their testing location of choice. If not, they will take their capabilities to other States, who will then start growing and improving their infrastructure, further reducing their operating costs, and giving them an even stronger edge in supporting future UAS business. Hawaii can be in that position if we establish and support a team to bring that to reality.

From the industry perspective, the potential impact to the economy and workforce in Hawaii is significant.

Jobs directly created with a UAS testing site include:

- Test range management and administration
- Test range marketing, community outreach, and STEM education
- Test range maintenance and inspection
- Range safety personnel
- Unmanned aerial vehicle (UAV) maintenance
- UAV safety inspections
- UAV control station maintenance (including Information Technology services)
- Payload calibration and repair
- UAS usage auditing for law enforcement

Derivative jobs that would be created once UAS testing starts to establish itself as a viable UAS industry include:

- UAV maintenance and repair training
- Data processing and analysis services
- UAS data collection services
- UAS parcel delivery services
- UAS private security services
- UAS services for Department of Transportation, Department of Land and Natural Resources, Public Utilities, Police Department, Fire Department
- UAS aerial photography/filmography services
- Small UAV manufacturing
- Sensor/payload development and manufacturing
- Sensor/payload software development
- Research and development (air vehicles, ground control stations, communications data links, sensors/payloads, processing software, multi-vehicle cooperation, etc.)

In addition to the immediate economic benefits directly related to operating a UAS test site and the derivative industry that will build upon constant usage of that site, there will also be a longer-term and broader positive impact in the community. Creation of a significant number of high technology jobs in the State could also lead to the establishment of new college degree programs in Hawaii for UAS-related fields. This would then serve to provide a pipeline for future generations of our workforce and alleviate the current-day challenges to find qualified technologists that are willing to move to Hawaii and have longevity in the State.

There are a wide diversity of benefits to the State of Hawaii to establish itself as a prime national competitor for UAS testing, of which only a few are mentioned here. These, by themselves, are compelling reasons why the State should invest in making sure that we capitalize on our designation as an FAA test site. However, there are just as compelling reasons why it would be looked unfavorably by our partners (Alaska and Oregon), by the nation and the FAA, and even the people of Hawaii if we do not pass this bill.

If we did not invest in a qualified and dedicated team to establish ourselves as a UAS test site,

our tri-State partners, Alaska and Oregon, may be discouraged by Hawaii's lack of commitment and support. This might lead them to restructure their operational framework to rely less on Hawaii to mitigate the risk of not having sufficient resources when they're needed. This could result in a reduced level of activity in Hawaii.

Similarly, the States who were not selected by the FAA, as well as the FAA themselves, would question our State's commitment to the national UAS strategy and why we proposed being a key part of it. While this may not have a direct impact on the level of UAS activity in Hawaii, it may make the necessary coordination between Hawaii and the FAA more difficult and prolong regulatory approvals and agreements.

Lastly, one key aspect about UAS testing in Hawaii is regarding public privacy and safety. While these issues will undoubtedly be addressed over the duration of this program, it will be imperative to remain responsive to the communities opinions and concerns, and to do so in a concerted and timely manner. This can only be effectively done with resources that are dedicated to the task and not spread thin with other responsibilities. A lack of responsiveness here may cause unrest in the community and lead to unnecessary setbacks or obstacles in the State's effort to be first and strongest amongst the six test ranges.

In summary, this opportunity provided to us by the FAA to be one of six designated UAS test ranges is one that has significant near-term and long-term benefits to the State, its workforce, and its community. These benefits, however, are only a potential unless we proactively compete against and distinguish ourselves from the other five sites, we mirror the commitment of our tri-State partners, and are responsive and forthcoming to the people of Hawaii along the way. To be successful in this unique opportunity, I strongly support this bill.

Reid Noguchi
Hawaii Aerospace Advisory Committee