ECONOMIC IMPACT OF VANDENBERG AIR FORCE BASE ON SANTA BARBARA AND SAN LUIS OBISPO COUNTIES

CALIFORNIA POLYTECHNIC STATE UNIVERSITY

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REACH

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Cyrus Ramezani, Professor of Finance, California Polytechnic State University
Stephen F. Hamilton, Professor of Economics, California Polytechnic State University
Alexander Lustig, Undergraduate Research Assistant, California Polytechnic State University
Spencer Rhode, Undergraduate Research Assistant, California Polytechnic State University

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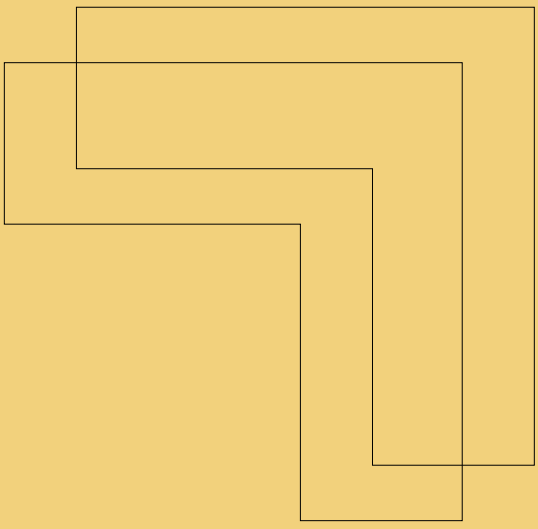
The opinions and conclusions expressed in this report are those of the authors and do not necessarily represent those of REACH, the Vandenberg Air Force Base staff, the County of Santa Barbara, and the City of Lompoc. Any errors or omissions are the sole responsibility of the authors. Please direct comments and suggestions to Dr. Cyrus Ramezani (cramezan@calpoly.edu).

SECTION 1

EXECUTIVE SUMMARY



1. EXECUTIVE SUMMARY

Vandenberg Air Force Base (VAFB) has provided economic opportunities for the residents of Santa Barbara and San Luis Obispo Counties and the rest of California since its creation in 1941. Today, VAFB's military and civilian population and the related contractors' workforce directly contribute to the economic development of this region through capital investment, employment, and defense contracting and indirectly by enhancing regional household expenditures and demand by local businesses. The base's retired military personnel and veterans mostly stay in the area and contribute to the local economy through their direct expenditures, as well as by contributing their valuable skills as employees for local industries and as small businesses owners. Moreover, expenditures by a sizable number of government and business visitors to the base and tourists attracted by frequent missile and rocket launches also contribute to the local economy. Collectively, the base's economic activities result in significant tax revenues, with large fiscal impact on the local and state governments.

To understand the overall economic role played by VAFB, this report estimates the base's current economic impact and its dynamic evolution over the next decade under two alternative scenarios. First, under a "Stand Still" scenario, we assume that the level of economic activity associated with VAFB is flat; that is, the size of the base's workforce (military and civilian), its dollars expenditures on operations and maintenance, awarded contracts, gross payments to retirees, and the number of tourists and government/business visitors to the base will remain at their 2020 level until 2030. Second, the report provides estimates of the economic impact of VAFB under various "envisioned growth" scenarios by accounting for anticipated military growth, proposed expansions of commercial missile, satellite and rocket launches as envisioned by REACH (*The Commercial Space Master Plan*), and potential infrastructure improvements being considered by the City of Lompoc.

Economic impact associated with various scenarios are calculated using modeling software from Regional Economic Models Inc. (REMI). Utilizing REMI's built-in forecasting capabilities, the study simulates the total economic impact of VAFB over the period 2020-2030, with and without the envisioned expansions in military and commercial space activities. To best understand the economic impact of VAFB, we report the following common indicators of economic health of the regions: Employment, Gross Domestic Product (GDP), Output, Personal Income, and Disposable Personal Income for Santa Barbara and San Luis Counties, as well as the rest of California. These indicators, their definitions and estimations are discussed in greater detail in the body of this report.

Overall, the REMI models confirm what is widely recognized in the adjacent communities: VAFB provides substantial positive economic benefits to the nearby counties and California as a whole.

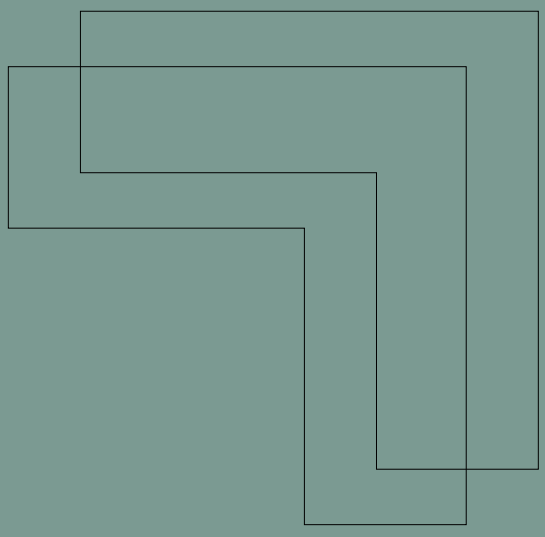
The Economic Impact of Vandenberg Air Force Base 2020-2030 Results for 2020 and the "Average" of calendar years 2020-2030 (inclusive)						
Stand Still Scenario						
	Santa Barbara		**San Luis Obispo**		**Rest of California**	
	2020	Average	2020	Average	2020	Average
Total Employment (Jobs)	15,071	13,497	832	674	4,502	4,245
Employment Multiplier	1.87	1.54	-	-	-	
Gross Domestic Product ($M)	2,628	2,847	113	111	723	820
Output ($M)	4,326	4,667	196	188	1,278	1,423
Personal Income ($ M)	1,332	1,557	108	115	451	539
Disposable Personal Income ($M)	1,149	1,362	90	99	379	464
Fiscal Impact						
Corporate Income Taxes ($M)	23.86	25.85	1.03	1.01	6.57	7.45
Personal Income Taxes ($M)	111.27	130.04	8.98	9.60	37.63	45.04
Retail Sales & Use Taxes ($M)	43.1	51.10	3.39	3.71	14.21	17.41
Property Taxes (PI, $M)	2.41	2.41	-	-	-	-
All Military and Commercial Developments Scenarios						
	2020	Average	2020	Average	2020	Average
Total Employment (Jobs)	15,071	15,348	832	791	4,502	4,760
Employment Multiplier	1.87	1.70	-	-	-	-
Gross Domestic Product ($M)	2,628	3,224	113	130	723	924
Output ($M)	4,326	5,282	196	221	1,278	1,603
Personal Income ($M)	1,332	1,751	108	134	451	606
Disposable Personal Income ($M)	1,149	1,529	90	115	379	521
Fiscal Impact						
Corporate Income Taxes ($M)	23.86	29.27	1.03	1.19	6.57	8.39
Personal Income Taxes ($M)	111.27	146.25	8.98	11.17	37.63	50.63
Retail Sales & Use Taxes ($M)	43.1	57.36	3.39	4.32	14.21	19.56
Property Taxes (PI, $M)	2.41	3.89	-	-	-	-

The base supplies quality jobs, stimulates the production of goods and services, and increases local incomes and overall expenditures on goods and services. The above table contains a brief overview of the noted aggregate economic indicators. The full report provides detailed analysis across different industry sectors and the fiscal impact on the local and state government revenues.

In 2020, VAFB contributed $3.464 billion to the GDP of Santa Barbara and San Luis Obispo Counties and the rest of the California economy, with a total economic output of $4.522 billion in overall economic output in the two counties. VAFB's current economic footprint and its anticipated future growth present enormous economic opportunities for local communities and the State. The base's contracting with the local businesses provides employment in a wide variety of industry sectors, while the military personnel and their families support local communities by creating demand for goods and services. In addition, the retired military pensions and other forms of compensation provide individuals and communities with a reliable source of income. The analysis undertaken in this report shows that the economic impact of VAFB on the surrounding communities and the State of California will grow over the next decade by the anticipated increase in military activity on the base, the potential infrastructure improvements in the City of Lompoc, and the proposed private-sector commercial space activities envisioned in *The Commercial Space Master Plan*.

SECTION 2

INTRODUCTION AND SCOPE OF THE STUDY



2. INTRODUCTION AND SCOPE OF THE STUDY

This study was commissioned by REACH Central Coast. The objective was to assess the economic impact of Vandenberg Air Force Base (VAFB) on the surrounding communities of Santa Barbara and San Luis Obispo Counties, as well as the rest of California. While VAFB is located in Santa Barbara County, its economic impact extends to California as whole and to San Luis Obispo County, where some of its vendors, contractors, military personnel and veterans reside.

The study is based on data for the fiscal year 2020 and employs REMI, which is a widely used regional economic model. The REMI model is a dynamic input-output model, which can determine the current and future impact of VAFB, given historical changes to the business cycle. The study will determine VAFB's impact on total output, employment and labor income and its fiscal implications for the surrounding communities. Results of the economic impact analysis are reported for each county and the rest of California. A similar study was undertaken in 2006, and to the extent possible, this report will present the key findings in parallel fashion so as to enable comparisons of VAFB's economic impact over time.

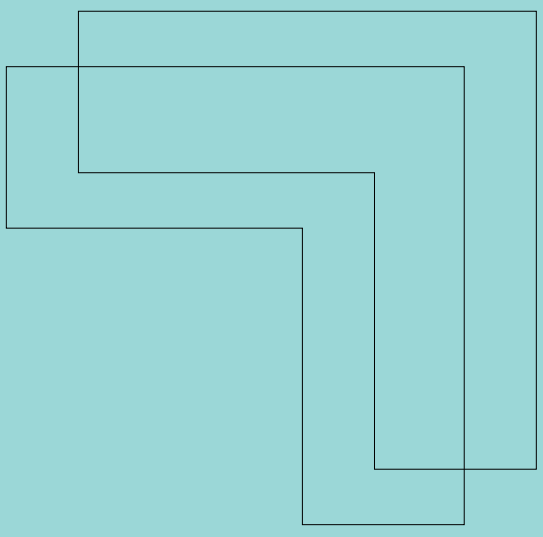
The data for this study were obtained from a number of sources. Information about the number of employees (military and federal civilians) and their dependents, the base's annual expenditures on operations and maintenance, expenditures on private contractors that serve the base, annual gross pay to retirees, and number of business and government visitors and tourists who visit the area, and anticipated expansions at the base were obtained from VAFB management.

Data on tax revenues, generated by economic activities associated with VAFB (property, sales, income taxes), were obtained from Santa Barbara County, San Luis Obispo County, other California government agencies, and REMI. Similarly, information about potential infrastructure improvements being considered were obtained from the City of Lompoc.

Finally, information regarding the future expansions of commercial satellite and rocket launches as envisioned in *The Commercial Space Master Plan* were obtained from REACH and Deloitte.

SECTION 3

VANDENBERG AIR FORCE BASE DESCRIPTION



3. VANDENBERG AIR FORCE BASE DESCRIPTION

Vandenberg Air Force Base (VAFB), located roughly halfway between San Francisco and Los Angeles, was established in 1941 as an Army base and transferred to the Air Force in 1957.[1] The base is bordered by the Pacific Ocean, the Santa Ynez Mountains, and the ranches of northern Santa Barbara County.

Map of Vandenberg Air Force Base

It occupies 99,604 acres and the area, while mostly rural, includes urbanized areas of offices, residences, support facilities, and the Western Launch and Test Range. The nearest community to the base is Lompoc, which has an estimated population of 43,600.[2]

VAFB is home to the 30th Space Wing, which manages the Department of Defense's space and missile testing base, with a mission of placing satellites into polar orbit using expendable and reusable rocket boosters.[3] The base contains the 381st Training Group (Air Education and Training Command), which trains space and missile operators. It is home to several important Department of Defense organizations, including the Missile Defense Agency (MDA) and the National Reconnaissance Office (NRO), and also plays an important role in operational test launch of unarmed Minuteman III intercontinental ballistic missiles. Furthermore, several defense contractors, including Lockheed Martin, Boeing, General Dynamics, Northrop Grumman, and Raytheon Technologies, carry major contracts and are tenants on the base.

Vandenberg Air Force Base Rocket Launch Facilities

Key Vandenberg Air Force Base Organizations and Private Sector Firms

In addition to its military space launch mission, VAFB also performs space launches for government space entities such as the National Aeronautics and Space Administration (NASA) and private space companies such as SpaceX. Commercial space activities at VAFB have been growing since the early 2000s. There are several companies with contracts to launch from VAFB. These include SpaceX, the United Launch Alliance (ULA) and Firefly.[4] Additionally, the base is recognized as the West Coast's premier rocket launch hub and has received interest from other private organizations to serve as a launch site for future space missions.

Currently, VAFB maintains the position as one of the most important military bases for rocket launches, playing an indispensable role in support of the newly created Space Force. The Space Force plans to continue to grow the number of launches from VAFB in the foreseeable future. To handle the growing launch demand, plans have been drawn up to expand the base's facilities so as to accommodate further commercial space launches. These commercial activities have attracted many engineering and high technology professionals to the area. Additionally, activities on VAFB draw thousands of visitors to the region annually, many of whom stay for extended time periods.[5]

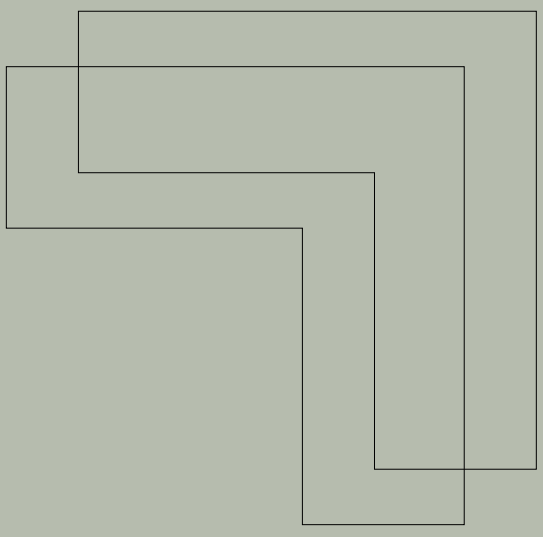
VAFB is one of the top employers in Santa Barbara County. The base currently employs 2,912 military personnel, 2,867 family members, 1,375 federal civilian employees, and 992 direct contractors and hundreds of sub-contractors, all of whom either live on or off the base. During the fiscal year, the gross payroll for the 30th Space Wing was $369.30 million, and annual operations and maintenance was more than $207.58 million. Furthermore, the base executed 852 contracts with a value of $134.93 million.[6] The base is a major contributor to Santa Barbara County's economy, along with the University of California-Santa Barbara (UCSB) and the county government.

Activities at Vandenberg Air Force Base

Activities at Vandenberg Air Force Base cont.

SECTION 4

REGIONAL ECONOMY AND DEMOGRAPHICS



4. REGIONAL ECONOMY AND DEMOGRAPHICS

In this section we present a brief overview of the economic and demographic characteristics of Santa Barbara county, which is home to VAFB, and neighboring San Luis Obispo County, where some of the base employees and contractors reside. The two counties have similar economic profiles, share significant commercial relations and have strong business ties. Some of the materials presented in this section are drawn from the 2018-Industry, Economic, and Workforce Research prepared for the Workforce Development Boards for these counties. This overview summarizes the demographic and employment information, with particular relevance to VAFB and the area's aerospace and defense industry.

4.1 SANTA BARBARA COUNTY

Demographics: Table SB1 below summarizes the most recent demographic information for Santa Barbara County. In 2018, the total population of the county was estimated to be 453,457, with Santa Maria, close to VAFB, being the largest city. Additionally, between 2010 and 2018, the population of Santa Maria grew by roughly 8%, the largest percent growth of any municipality in the county. Santa Maria is followed by Santa Barbara as the second largest city, which is located in the southern end of the county.[7] It is important to note that military retirees and veterans are an important group, representing 4.71% of the total population of the county.[8]

Table SB1. Population Estimates for Cities in Santa Barbara County 2011-2018

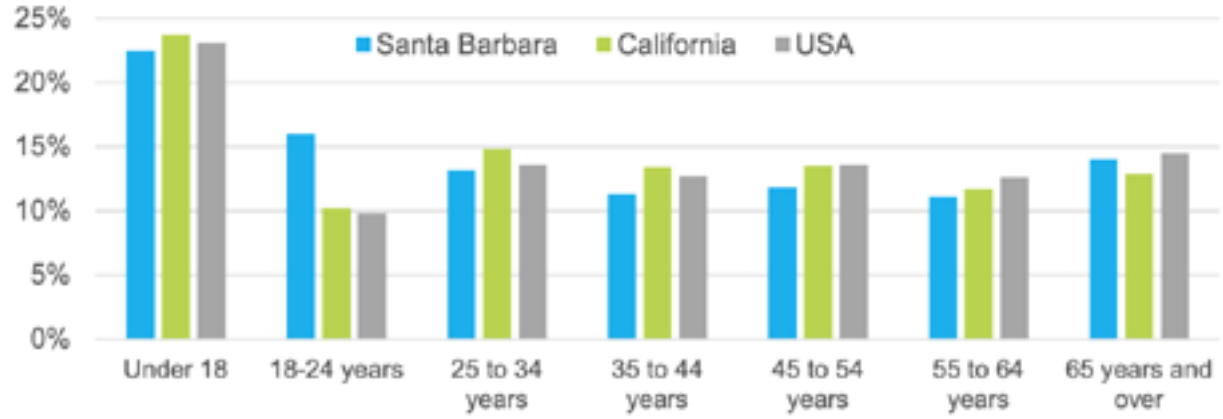
City	4/1/2010	1/1/2011	1/1/2012	1/1/2013	1/1/2014	1/1/2015	1/1/2016	1/1/2017	1/1/2018
Buellton	4,828	4,854	4,852	4,882	4,917	4,912	4,921	5,098	5,291
Carpinteria	13,044	12,990	13,029	13,134	13,510	13,580	13,705	13,697	13,704
Goleta	29,888	29,916	29,921	30,114	30,388	30,734	31,225	31,622	31,949
Guadalupe	7,080	7,059	7,089	7,142	7,205	7,254	7,302	7,341	7,604
Lompoc	42,434	42,153	43,085	43,253	43,969	44,169	44,027	43,881	43,599
Santa Barbara	88,410	89,146	90,103	91,458	92,552	93,777	94,290	94,244	94,807
Santa Maria	99,553	100,275	101,501	102,412	103,603	104,968	106,744	107,978	108,470
Solvang	5,245	5,296	5,307	5,331	5,393	5,420	5,460	5,653	5,771
Rest of County	133,413	132,711	133,307	135,347	136,975	138,173	139,399	140,511	142,262
County Total	**423,895**	**424,400**	**428,194**	**433,073**	**438,512**	**442,987**	**447,073**	**450,025**	**453,457**

Source: State of California, Department of Finance, https://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-4/2010-18/

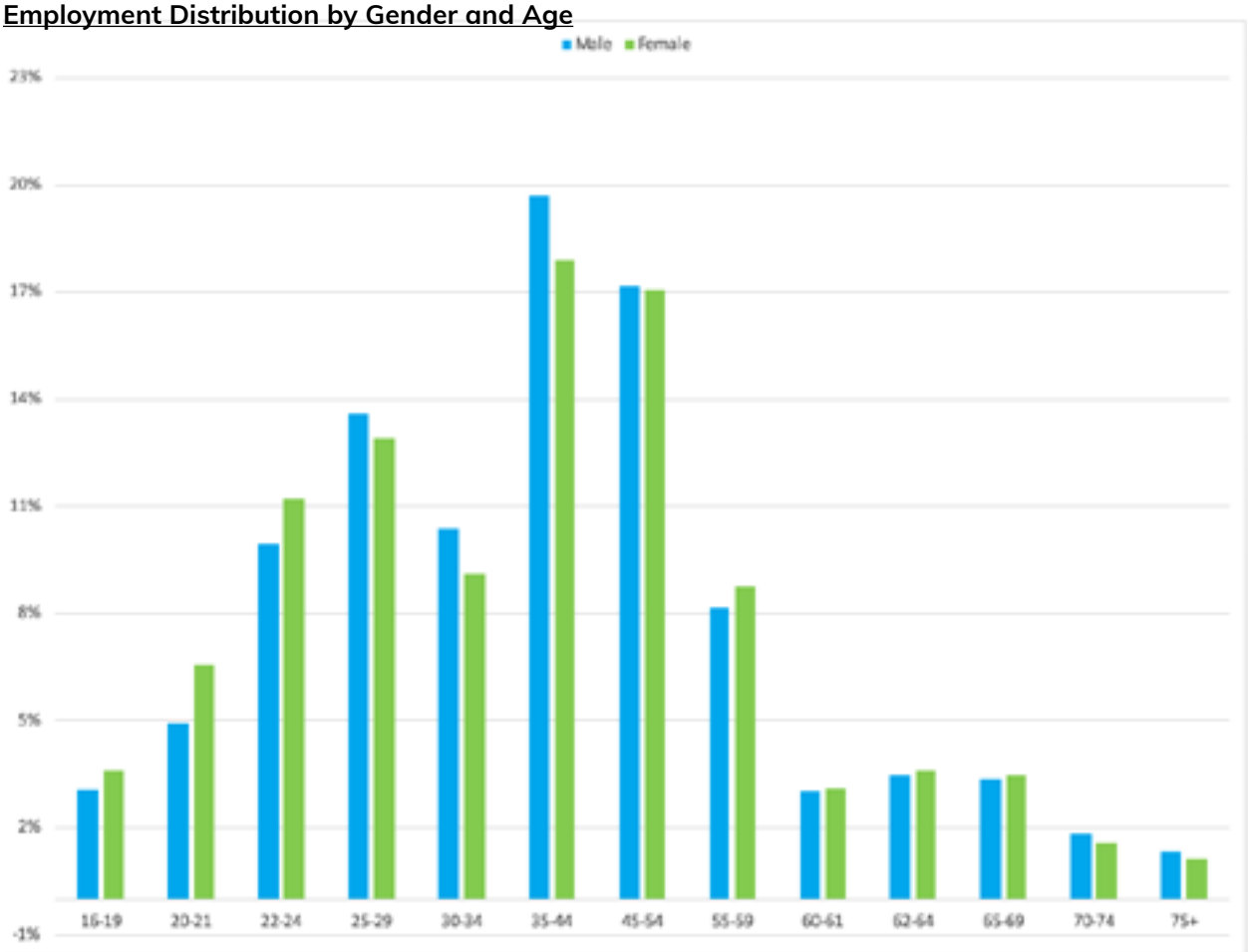
Age distribution is a key determinant of available labor supply for local businesses and a critical factor for regional economic development. The age distribution of Santa Barbara County is illustrated in Figure SB1. The figure shows that about 22% of the county's population is under the age of 18 (same as the national average). The county's population is younger than the national and the state averages (41% between the ages of 18 and 44).[9] This is clearly a positive aspect of the county's labor force and advantageous for further economic developments at VAFB.

Figure SB1. Age Distribution in Santa Barbara County

Age Distribution



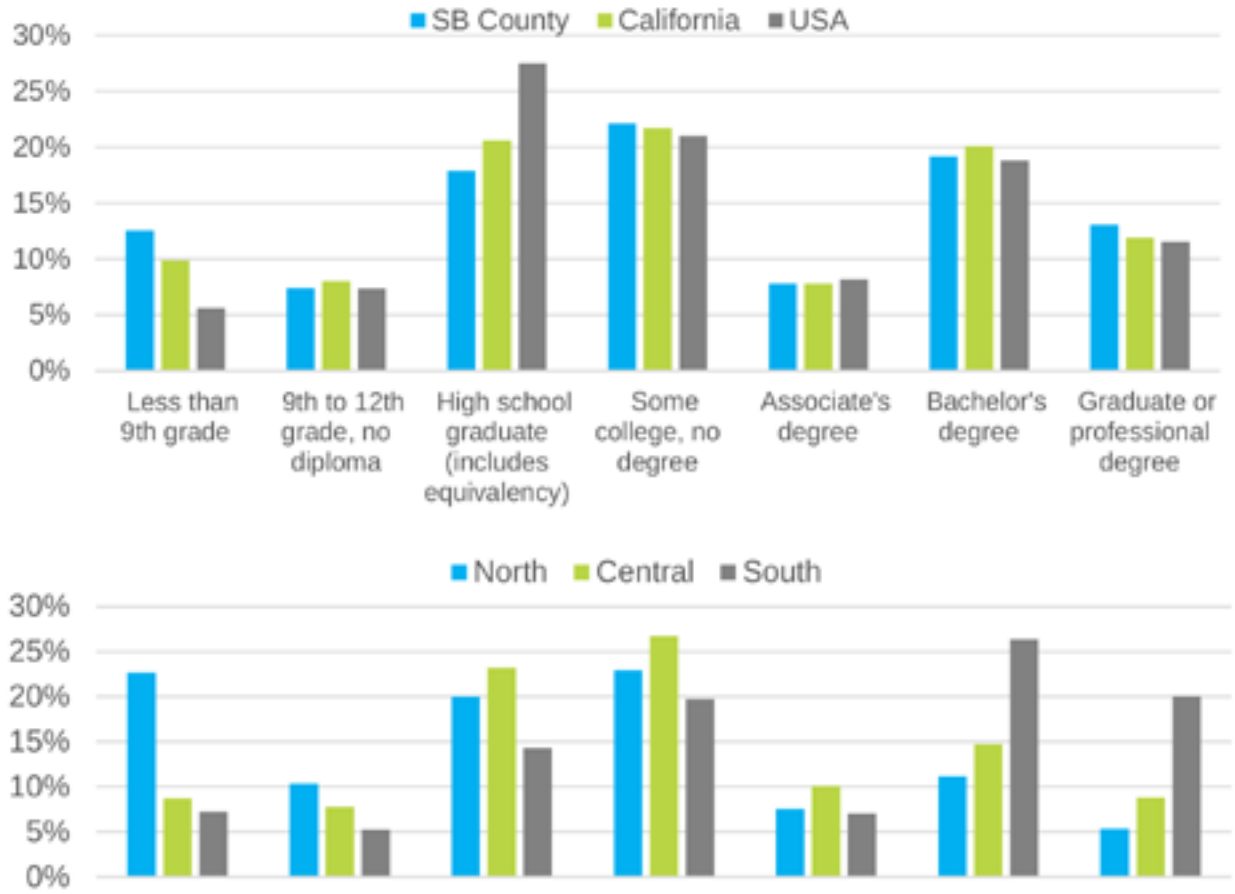
Employment Distribution by Gender and Age



Source: SB County BW Report, 2018.

Educational Attainment: Figure SB2 presents data on educational attainment of Santa Barbara County residents. Overall, approximately 38% of the county residents have a high-school diploma or less, 30% have some college or an associate degree, and 32% hold a bachelor's or higher degrees. Overall, the county's educational attainment levels are similar to the state and slightly better than the national average for those holding a bachelor's or higher degrees.

Figure SB2. Educational Attainment in Santa Barbara County, Population 25 Years and Older



Source: SB County BW Report, 2018.

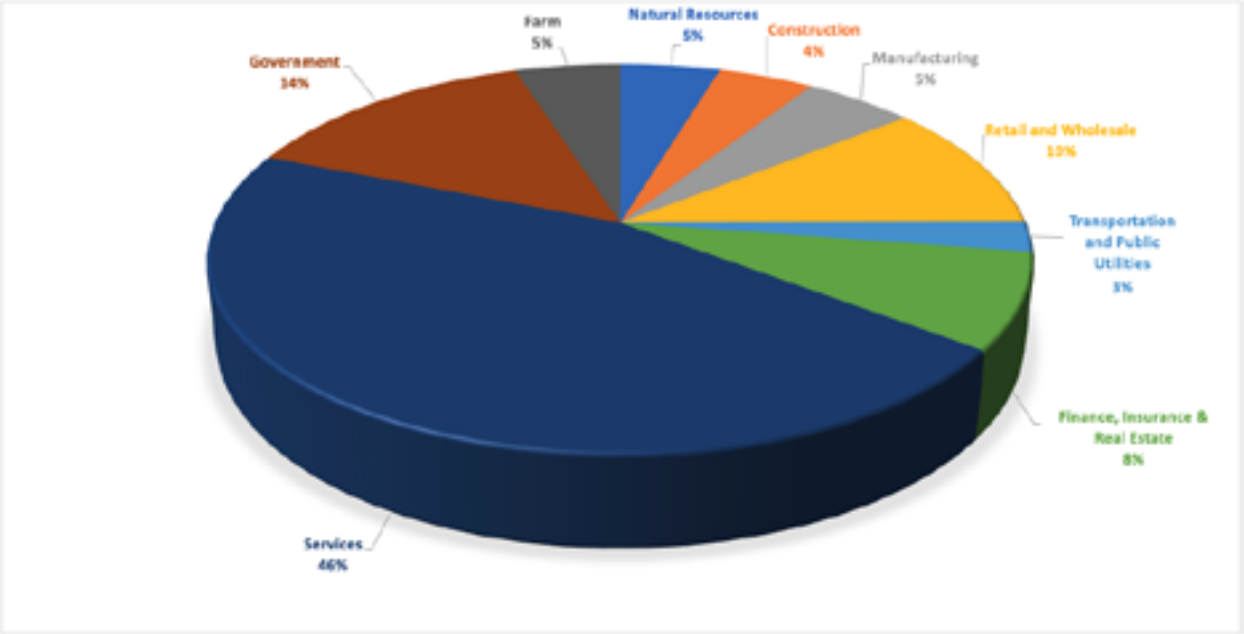
The lower panel of Figure SB2 shows the same data for the northern, central and southern parts of the county. The data shows that the county has a higher concentration of individuals with less than a high-school diploma and that the population is concentrated in the north and central areas. On the other end of the educational spectrum, the county has a higher number of individuals with bachelor's or graduate and professional degrees, most of whom reside in the southern areas of the county.

The central part of the county, which is home to VAFB, has the highest concentration of individuals with a high-school diploma and above. This is reflective of the workforce at the base and the role it

plays in providing good-paying and long-term jobs. This concentration of educated labor force is important for further economic development on VAFB.

Job Environment: As of 2019, there were a total of 291,191 jobs in Santa Barbara County. Of these, 4.55% were in farming, 81.86% were in the private sector, and 13.58% were in the public sector, including military and state and local government. The concentration of jobs in the county varies by region. The south region has 55%, the central 14%, and the north 31% of the total employment in the county.[10] As of June 2019, the county had an unemployment rate of 3.4% (Dec 2020: 7.6%).[11]

Figure SB3. Composition of Jobs in Santa Barbara County by Industry



Source: REMI Data, 2018.

As with the educational attainment, the three noted regions of the county differ by income and racial composition. It appears that the north and south regions of the county are driving much of the county's economic growth, while the central region, where VAFB is located, is lagging behind. The central area has an above average unemployment rate and has seen less than half the job growth rate of the north and south regions since 2010.[12] This may be attributed to stable employmentat VAFB, which is the principle employer in the area, and lack of private-sector job growth, both of which negatively impact the area's economy. Future expansion of commercial activities on VAFB can reduce the high unemployment in this region and significantly contribute to reducing income disparities within the county.

Table SB2 shows the occupational tiers in Santa Barbara County. The table also shows the median annual wage for each employment tier. As a recent BW Report (2018) shows, the overall job quality in the county is deteriorating.

Table SB2. Santa Barbara County Job Tiers and Median Income		
Tier 1	**Tier 2**	**Tier 3**
Occupations include managers, professional positions (lawyers, accountants, physicians), and high-skill technical occupations (scientists, programmers, engineers). These are typically higher-paying occupations.	Occupations include sales positions, teachers, librarians, office and administrative positions, as well as manufacturing operations and production occupations. These can be considered middle-skill, middle-wage positions.	Occupations include protective services, food service and retail, buildings and grounds keeping, and personal care positions. These are typically lower-paying occupations.
In Santa Barbara County, the median wage for a Tier 1 worker is $91,478 a year.	In Santa Barbara County, the median wage for a Tier 2 worker is $48,277 a year.	In Santa Barbara County, the median wage for the Tier 3 worker is $25,792 a year.

Source: SB County BW Report, 2018.

Table SB3 below shows the distribution of job tiers over the period 2010 through 2017. As these data show, since 2010 Tier 3 occupations, which represent more than half of all jobs in the county, have been growing at a faster pace than Tier 1 and Tier 2 jobs. As the proportion of higher-paying Tier 1 and Tier 2 jobs in the county declines, an increasing number of residents will have to travel farther to work or work more jobs to continue to live in the county. Clearly further expansion at VAFB can help alleviate such outcomes by creating Tier 1 and Tier 2 jobs.

Table SB3. Santa Barbara County Job Tiers (2010-17)			
Year	**Tier 1**	**Tier 2**	**Tier 3**
2010	20.1%	28.4%	51.5%
2011	20.1%	28.5%	51.4%
2012	19.9%	28.6%	51.5%
2013	19.8%	28.2%	52.0%
2014	19.4%	28.0%	52.6%
2015	19.6%	27.9%	52.5%
2016	19.7%	27.7%	52.6%
2017	19.8%	27.7%	52.5%

Source: SB County BW Report, 2018.

Table SB4 below shows the county's employment and income by industry cluster. As these data show, growth in the aerospace and defense sector has been stagnant over the recent years. This economic sector consists of all industries that manufacture and design instruments, aircraft, space vehicles and other engine components. While this sector includes military contractors, it does not include direct military personnel. As shown, the aerospace and defense industry cluster only consists of 2% of county employment, but has the fourth-highest per capita earnings. While the aerospace and defense cluster provides the fourth-highest per capita income in the county, it is still below the national average per capita income for that sector of $128,158. Future expansion of commercial activities on VAFB will likely lead to an upward adjustment to income in this sector, which offers long-term employment and will help reverse its stagnant growth rate.

Table SB4. Santa Barbara County Employment by Industry Clusters

Industry Clusters	2017 Employment	% of County	% Growth since 2010	Earnings per worker
Food, Beverage & Agriculture	23,282	11%	15%	$42,853
Healthcare	17,562	9%	22%	$78,907
Tourism & Hospitality	16,091	8%	17%	$31,935
Building & Design	12,897	6%	7%	$76,166
Business Services	$10,544	5%	-9%	$58,189
Information & Communications Technologies (ICT)	7,903	4%	47%	$128,894
Biotechnology & Related Devices	3,506	2%	54%	$114,809
Aerospace and Defense	3,199	2%	0%	$107,350
Energy & Environment	1,792	1%	-17%	$115,507

Source: SB County BW Report, 2018.

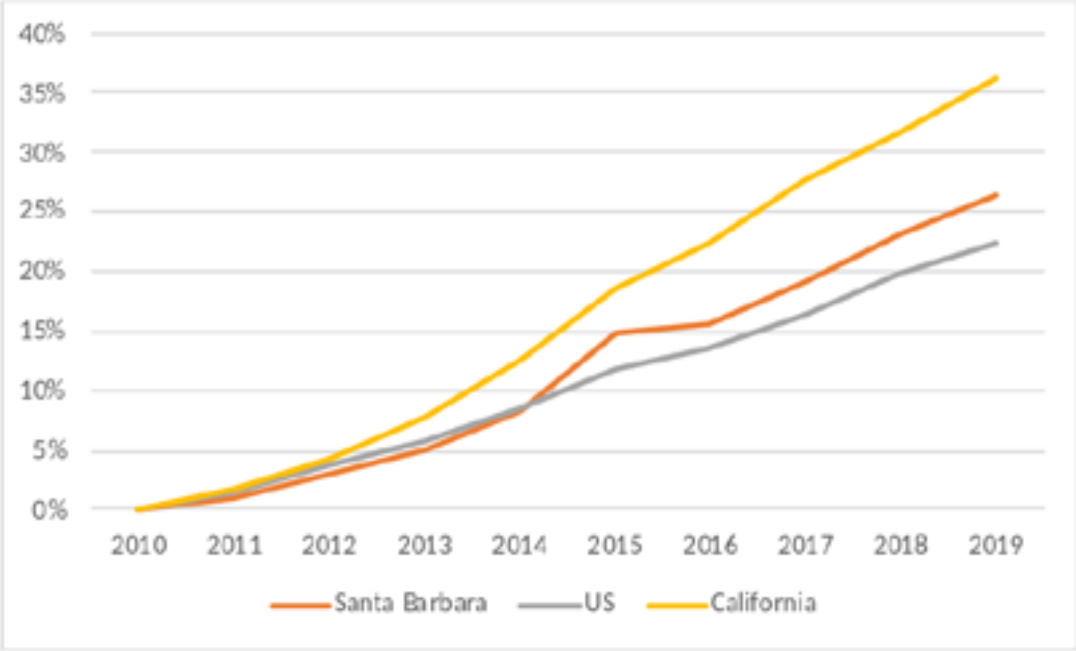
Table SB5 below shows the wages and typical level of education for each job within the aerospace and defense cluster in the county. Moreover, aerospace and defense occupations are mostly concentrated in Tier 1 (67%) and Tier 2 (32%) job categories. As such, these occupations typically require an education level between a high school diploma and a bachelor's degree. As Figure SB2 showed, there is a high concentration of high school graduate and higher degrees within the central region of the county. Hence further expansion of commercial activities at the base is feasible and will lead to hiring more Tier 1 and 2 employees.

Table SB5. Aerospace & Defense Jobs in Santa Barbara County		
Description	**Median Hourly Earnings**	**Typical Entry-Level Education**
Software Developers, Systems Software	$57.69	Bachelor's degree
Industrial Engineers	$49.56	Bachelor's degree
Electrical & Electronic Equipment Assemblers	$18.36	High school diploma or equivalent
Machinists	$20.53	High school diploma or equivalent
Electrical & Electronics Engineering Technicians	$28.26	Associate's degree

Source: SB County BW Report, 2018.

GDP and Household Income: The 2019 annual Gross Domestic Product for Santa Barbara County was $31.35 billion, which after adjusting for inflation had increased by 9.86% since 2017. Additionally, the per capita GDP for the county is roughly $70,2101. The county's GDP has grown 26.32% between 2010 and 2019. This growth is faster than the U.S. real GDP growth (22.39%), but slower than the overall California real GDP growth over the same period (36.15%). The county's median household income is $74,624 and the average per capita income is $36,039.[13] Figure SB4 shows the county's GDP growth in relation to the U.S. and California for the past 10 years.

Figure SB4. Santa Barbara County Cumulative GDP Growth



Source: U.S. Bureau of Economic Analysis.

The Role of VAFB in Santa Barbara County Economic Development: As Santa Barbara County continues to generate talent, specifically through UCSB and other local universities, this talent is often exported to other areas, with the county losing out on the benefit that retaining talents locally could bring. Specifically, the county is "exporting talent in high-skill, high-pay occupations in management, business, science, and arts and is importing workers in lower-pay service, sales and office, and production, transportation, and material moving occupations."[14]

VAFB plays a critical role in retaining high paying and long-term jobs in Santa Barbara County. These jobs generate significant income and contribute to the fiscal health of the county and the municipalities surrounding the base. Future commercial expansion at VAFB will ensure additional Tier 1 and 2 jobs are created and will give the county more opportunities to retain and attract high-skilled talent. VAFB's potential expansion will give the opportunity to spur further economic development for the central region, enabling that area to benefit from increased economic prosperity.

4.2 SAN LUIS OBISPO COUNTY

Demographics: Table SLO1 below summarizes the most recent demographic information for San Luis Obispo County. As of 2019, the total population of San Luis Obispo County is 283,111. Population growth in the county has been under 0.5% per year over the last decade. Over this period, the county's population grew by 3.82%. The Coastal sub-region has seen little population growth over the past seven years (2%), but the rest of the county has seen steady population growth. The population in the City of San Luis Obispo has increased the most, growing by about 5%. North and south county grew more consistently, increasing by 3.8% and 3.2% respectively.

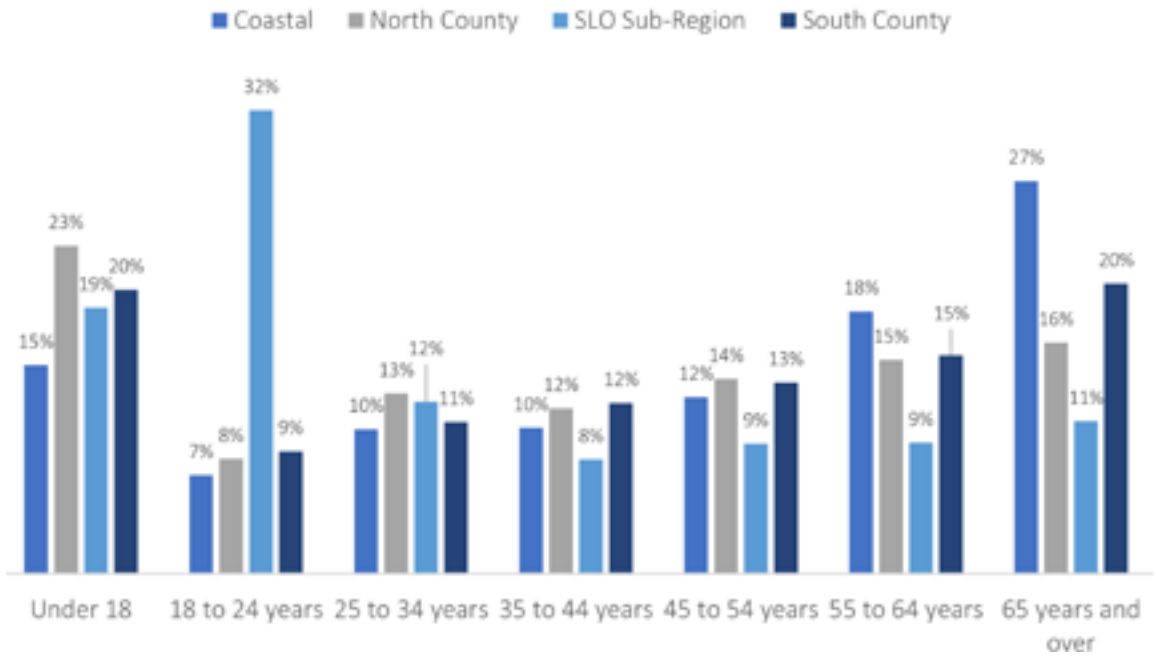
Table SLO1. Population Estimates for Cities in San Luis Obispo County 2011-2018

City	4/1/2010	1/1/2011	1/1/2012	1/1/2013	1/1/2014	1/1/2015	1/1/2016	1/1/2017	1/1/2018
Arroyo Grande	17,252	17,245	17,307	17,501	17,600	17,808	17,884	17,874	17,912
Atascadero	28,310	28,654	28,836	29,234	29,524	30,350	30,909	31,135	31,147
El Paso de Robles	29,793	30,129	30,505	30,930	31,160	31,314	31,349	31,562	31,559
Grover Beach	13,156	13,205	13,227	13,345	13,407	13,489	13,565	13,593	13,560
Morro Bay	10,234	10,325	10,297	10,380	10,420	10,442	10,499	10,516	10,503
Pismo Beach	7,655	7,667	7,746	7,840	7,912	8,015	8,150	8,209	8,233
San Luis Obispo	45,119	45,456	45,356	45,710	45,942	45,965	45,981	46,424	46,548
Rest of County	118,118	117,343	118,230	118,364	119,660	119,286	119,804	119,897	120,639
County Total	**269,637**	**270,024**	**271,504**	**273,304**	**275,625**	**276,669**	**278,141**	**279,210**	**280,101**

Source: State of California, Department of Finance, https://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-4/2010-18/

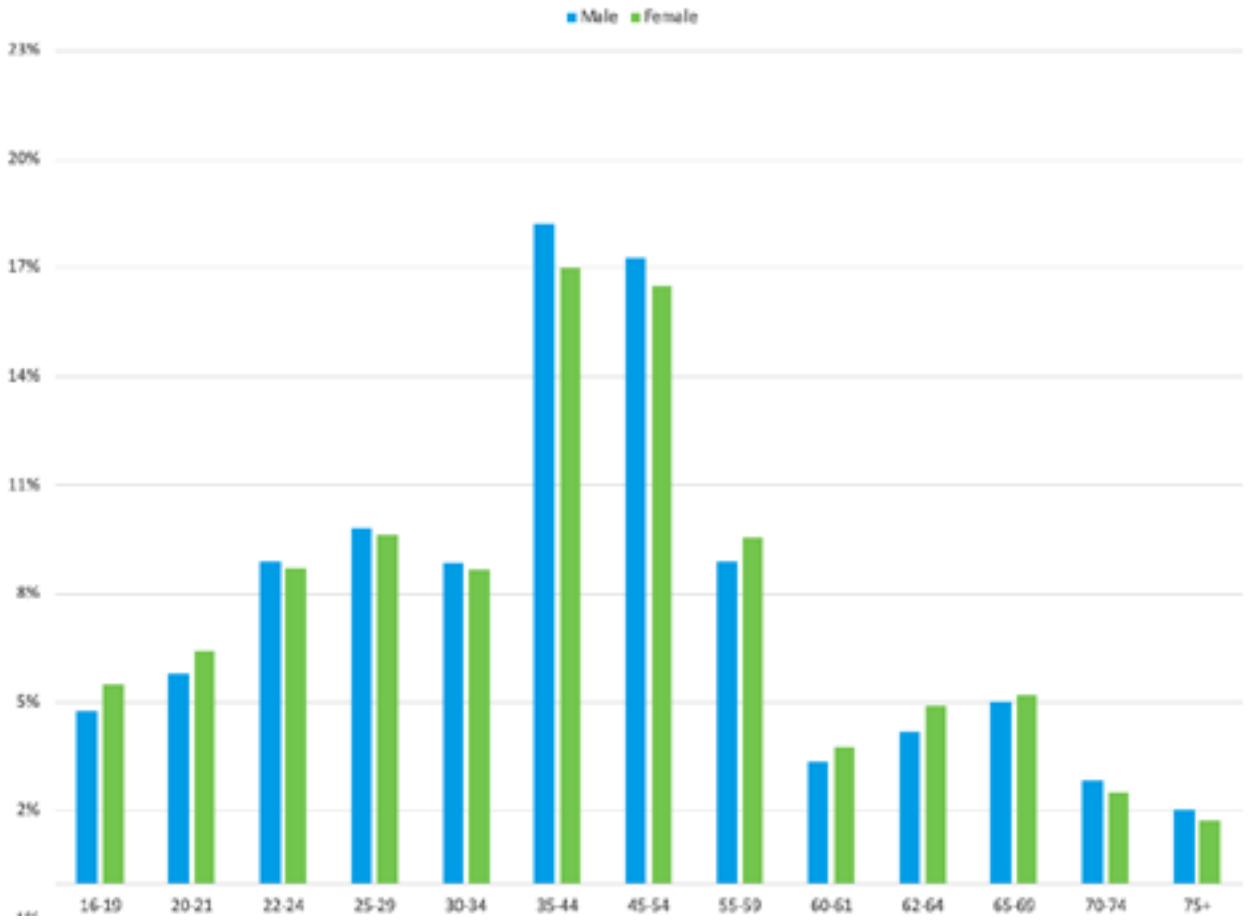
Figure SLO1 shows the age distribution in the county by sub-regions. Overall, a quarter (25%) of the county's population is 55 years and older. This older population is mostly concentrated in the Coastal area (45%), followed by the south (35%) and north (31%) areas. On the other hand, more than half (51%) of the City of San Luis Obispo residents are 24 years or younger. This is because California Polytechnic State University's students, faculty, and staff, and their families mostly reside within the city. Additionally, 20.9% of the county's population is over the age of 65, and 17.5% is under the age of 18.[15] It is important to note again that 5.92% of county residents are veterans. [16]

Figure SLO1. Age Distribution in San Luis Obispo County



Source: SLO County BW Report, 2018.

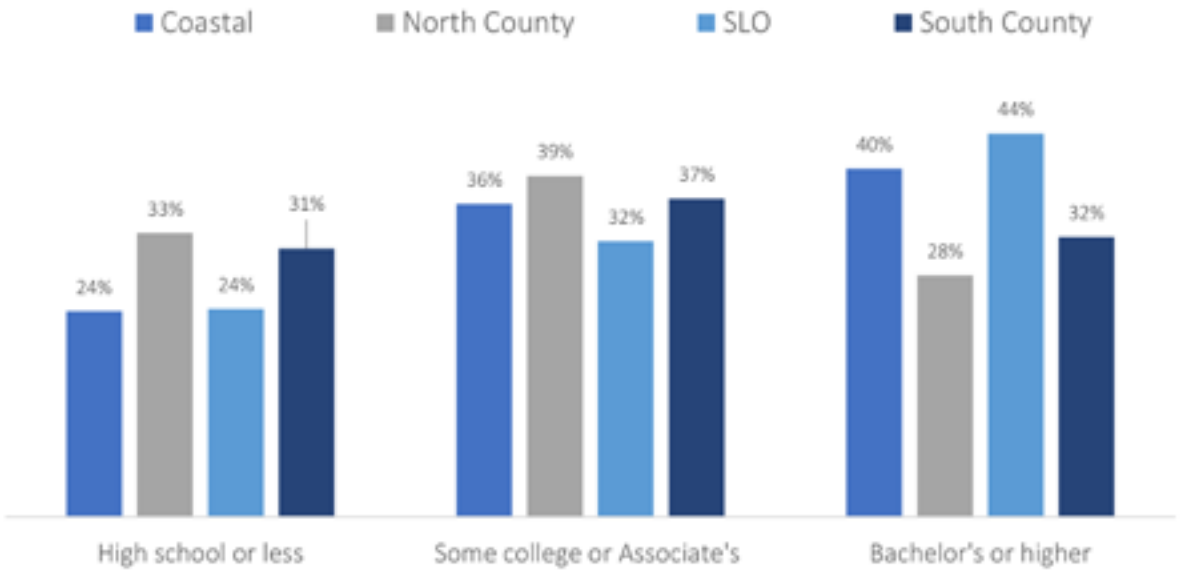
Figure SLO1 (cont.) Age Distribution in San Luis Obispo County
Employment Distribution by Gender and Age



Source: SLO County BW Report, 2018.

Educational Attainment: Educational attainment in San Luis Obispo County is relatively high, with 70% of residents having some college or higher degrees. In fact 40% of residents of the Coastal area and the City of San Luis Obispo have a bachelor's degree or higher.

Figure SLO2. Educational Attainment in San Luis Obispo County



Source: SLO County BW Report, 2018.

Job Environment: The county supports 178,476 total jobs (2.08% farm, 84.69% private nonfarm, and 13.23% in the public sector with the state and local government and the military). The average earnings is $56,409, which is lower than both the state ($78,217) and national ($66,029) average. Over the last decade, the county has experienced significant job growth. Overall, about 30,000 additional jobs were created in the county, representing a cumulative annual growth rate of 1.91% (total 21% over the period). This figure is larger than the U.S. total over the period (18%), but also smaller than that of the State of California (25%). The strong job growth in the county has led to comparatively low levels of unemployment. The county unemployment rate is usually below 3.0%, indicating a tight labor market.

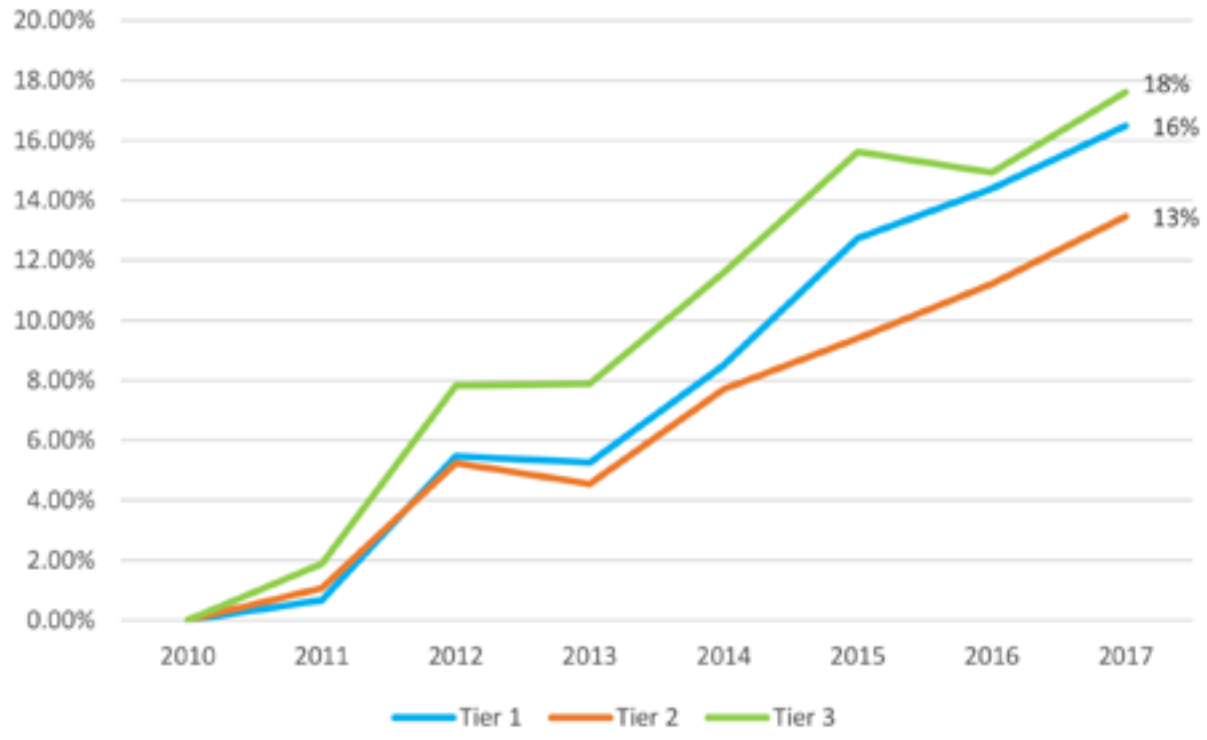
Table SLO2 below shows the occupational tiers in San Luis Obispo County. The table also shows the median annual wage for each employment tier. It appears that relative to neighboring counties, San Luis Obispo county has the lowest average income for workers in all three tiers. Moreover, as a recent BW Report (2018) shows, the overall job quality in the county is deteriorating.

Table SLO2. San Luis Obispo County Job Tiers and Median Income		
Tier 1	**Tier 2**	**Tier 3**
Occupations include managers, professional positions (lawyers, accountants, physicians), and high-skill technical occupations (scientists, programmers, engineers). These are typically higher-paying occupations.	Occupations include sales positions, teachers, librarians, office and administrative positions, as well as manufacturing operations and production occupations. These can be considered middle-skill, middle-wage positions.	Occupations include protective services, food service and retail, buildings and grounds keeping, and personal care positions. These are typically lower-paying occupations.
In San Luis Obispo County, the median wage for a Tier 1 worker is $80,413 a year.	In San Luis Obispo County, the median wage for a Tier 2 worker is $46,530 a year.	In San Luis Obispo County, the median wage for the Tier 3 worker is $27,730 a year.

Source: SLO County BW Report, 2018.

Figure SLO3 below shows the growth for each job tier over the period 2010 through 2017.

Figure SLO3. San Luis Obispo County Jobs Growth by Tiers (2010-17)

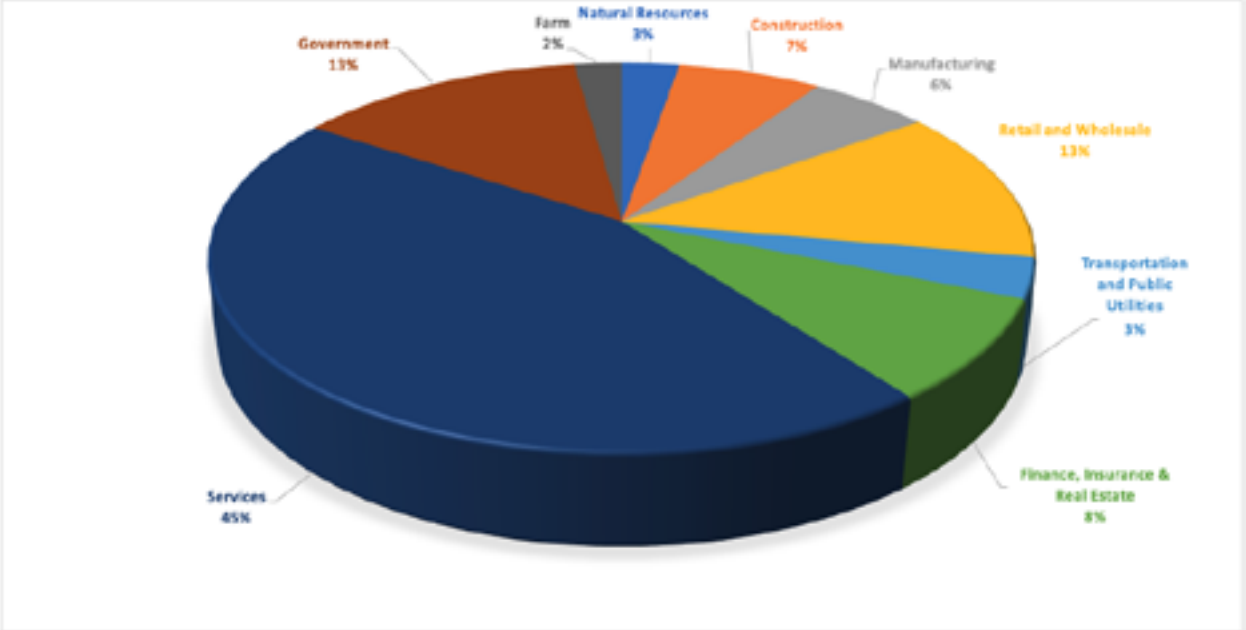


Source: SLO County BW Report, 2018.

As Figure SLO3 shows, since 2010 Tier 3 occupations, which represent a large portion of all jobs in the county, have been growing at a faster pace than Tier 1 and Tier 2 jobs. Again, as the proportion of higher-paying Tier 1 and Tier 2 jobs in the county declines, an increasing number of residents will have to travel farther to work or work more jobs to continue to live in the county. Clearly further expansion at VAFB can also help alleviate such outcomes in San Luis Obsipo County by creating additional Tier 1 and Tier 2 jobs.

Figure SLO4 below shows the composition of jobs by industry in San Luis Obispo county. We note that the county is very similar in this regard with neighboring Santa Barbara County. Moreover, the large number of low-paying jobs in the county reflects the presence of a large Tourism and Hospitality Industry. Other industry clusters providing the largest number of jobs in the county include Education & Knowledge Creation, and Healthcare. These three industries together account for 41% of all jobs in the county. Other industries that experienced significant growth since 2010 include Information & Communication Technologies (51%), Building & Design (41%), and Defense, Aerospace & Transportation Manufacturing (37%). The later industries are responsible for the growth of mid- to higher-wage jobs in the county, with average wages between $59,069 and $81,880.[17]

Figure SLO4. Composition of Jobs in San Luis Obispo County by Industry



Source: SLO County BW Report, 2018.

Table SLO3 below shows the key industry clusters within the county, along with their cumulative growth rate since 2010. The table shows that the Defense, Aerospace & Transportation Manufacturing (DATM) cluster has experienced the third-highest growth rate over the past decade. This sector employs 533 individuals, with average annual earnings of $59,069. The largest portion of DATM jobs are Tier 2 occupations (43%), followed by Tier 3 (38%), and Tier 1 (19%).

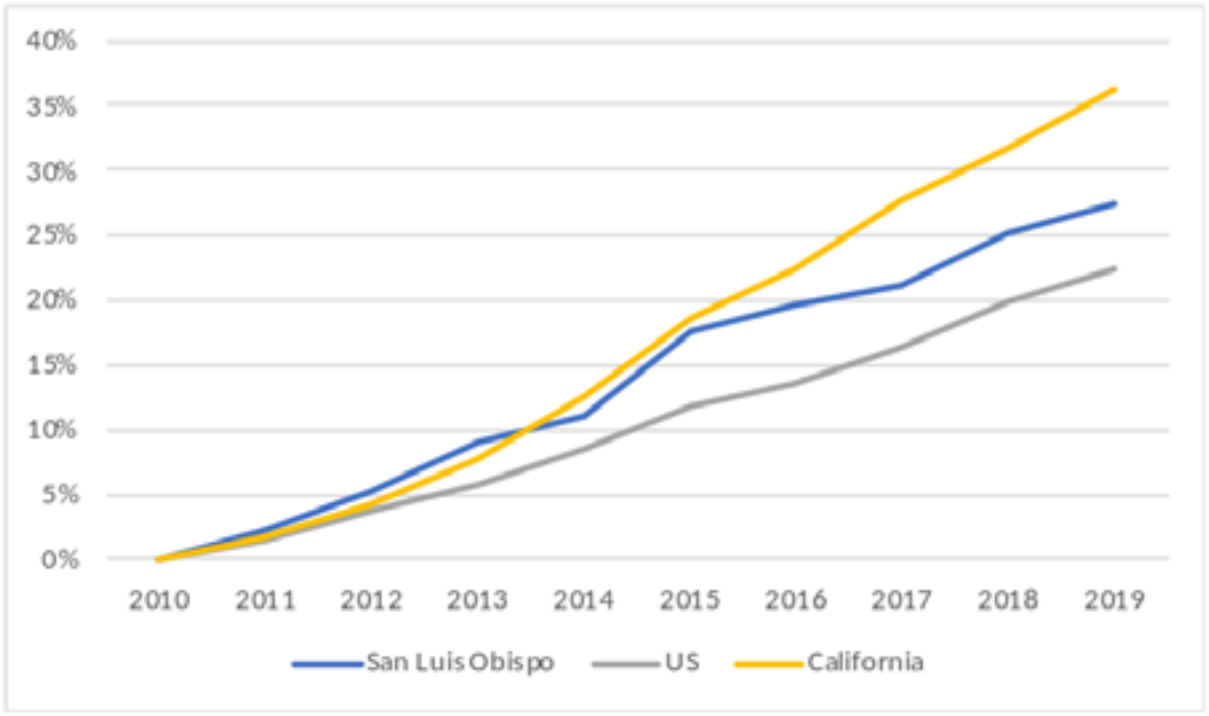
Table SLO3. San Luis Obispo County Employment by Industry Clusters

Industry Clusters	2017 Employment	% Growth since 2010
Energy	3,265	11%
Information & Communications Technologies (ICT)	2,666	51%
Biotechnology & Biomedical Devices (B&BD)	989	23%
Building & Design	7,861	41%
Healthcare	15,158	26%
Defense, Aerospace & Transportation Manufacturing	533	37%

Source: SLO County BW Report, 2018.

GDP and Household Income: In 2019, the gross domestic product for the county stood at $19.10 billion, representing roughly $67,340 per capita. Figure SLO4 shows the cumulative GDP growth for the county, the State of California, and the U.S. since 2010. Over the last decade, the county's real GDP grew by 27.45%, which is much larger than the U.S. real growth rate of 22.39% but lags behind California's real growth rate of 36.15% over that same period.

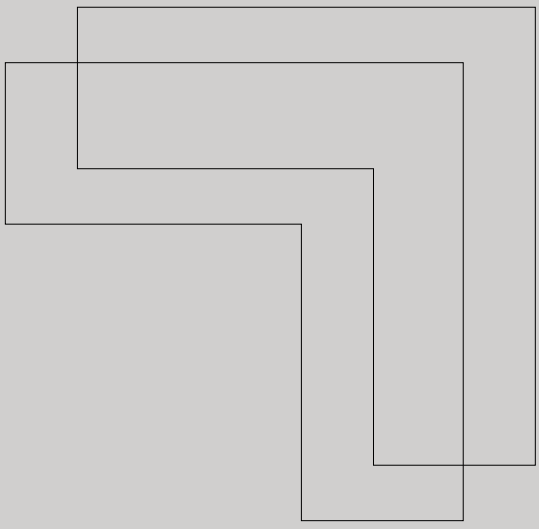
Figure SLO5. San Luis Obispo County Cumulative GDP Growth



Source: SLO County BW Report, 2018.

SECTION 5

ECONOMIC AND FISCAL IMPACT OF VAFB



5. ECONOMIC AND FISCAL IMPACT OF VAFB

It is standard practice to use an "input-output model" to assess the economic and fiscal impact of a military base. Such models takes economic activity on the base as "input" data and projects the current and future impact on "output" in surrounding economies. It is important that the model provides dynamic estimates of the output that are reflective of expected fluctuations in the business cycle and local labor markets and demographics, rather than being a static snapshot of the base's current impact.

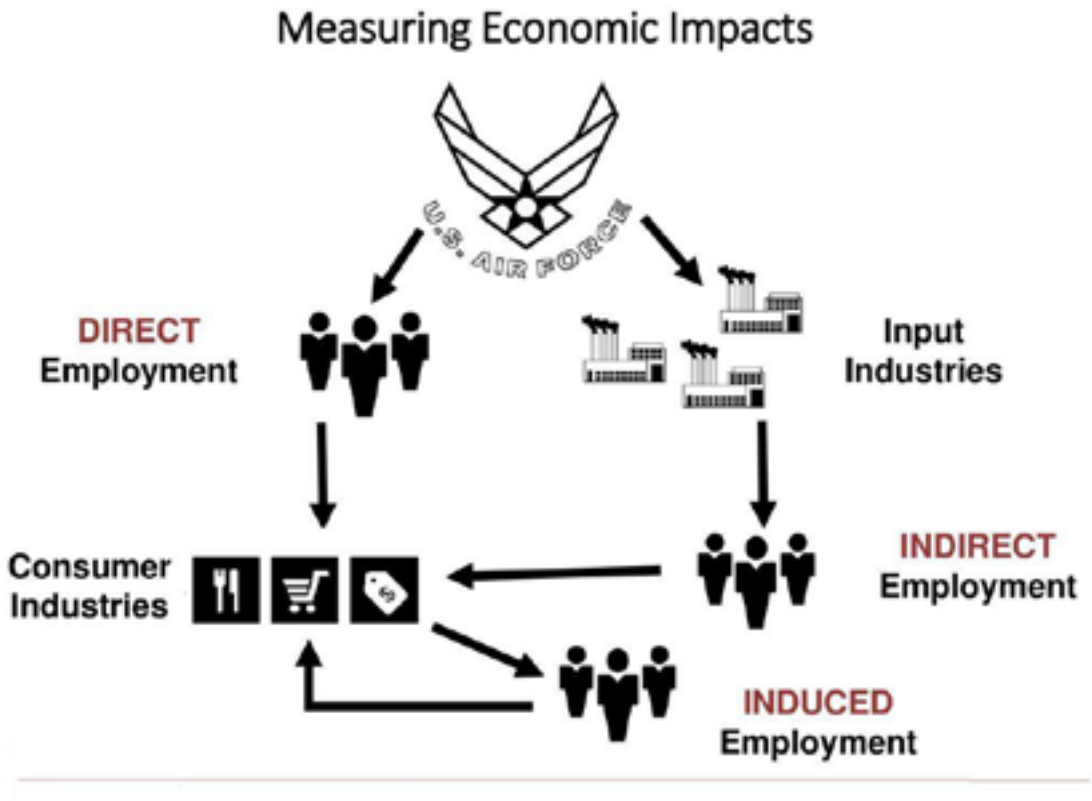
Figure EF1 below provides a schematic view of a generic military base economy and the measurement of its economic impact on surrounding communities. Panel A shows three types of economic activities associated with a base: The installation's footprint is measured by the number of military and civilian employees plus local expenditures on base that support operations and maintenance (O&M). Procurement measures the base's local expenditure on contractors for manufacturing, professional and technical services, and construction. Transfer payments capture the base's expenditures on retirement and veteran compensation.

Figure EF1-A. Understanding the Economic Impact of an Air Force Base

Source: Authors

Panel B shows that inputs are separated into two categories; direct on-base employment and procurement expenditures (input industries). On-base employment data is the total number of active duty military personnel, trainees and reserves, service contractors, and civilian employees (O&M). Expenditures by these economic agents results in increased demand for local consumer industries. Procurement includes the base expenditures on infrastructure projects, as well as projected expenditures by the base visitors and tourism spending. These expenditures generate direct local employment, which in turn leads to additional demand for consumer industries. The increased demand for consumer goods, in turn, leads to induced local employment and income.

Figure EF1-B. Understanding the Economic Impact of an Air Force Base



Source: Authors

Consistent with Panel B, the outputs from the model are typically segmented into direct, indirect, and induced impacts. Direct impacts are related to the current operations and future growth of the base, such as anticipated growth in the size of military and civilian employees, as well as planned facility enhancements and construction projects. Given the projected direct activity, the model will provide estimates of the indirect and induced impacts through secondary effects resulting from the base's economy. For example, when VAFB hires a construction company, it results in employment that is indirectly attributable to the base. The induced impact resulting from the hiring

of the construction company occurs when the construction firm and its suppliers hire additional employees and acquire additional supplies to complete the base project. While these jobs are created due to the infrastructure project on the base, the new employees are not working directly on the base project, hence the term "induced impact."

The majority of military base economic impact analyses that rely on input-output models are static. That means the economic impact is assessed at a point in time, and consequently expected structural, demographic and educational changes to the local economy, as well as the overall macroeconomic factors such as inflation, interest rates, and government expenditures, are not considered. For this analysis, we utilize a dynamic impact model that accounts for these factors and are therefore able to project the estimated economic impact of VAFB over time. This dynamic impact model will be based on expected future business cycle fluctuations that are consistent with historical economic and demographic trends for the regions under consideration.

In the next section we report estimates of direct, indirect and induced impacts for each county and the rest of California under two scenarios. First, under a "Stand Still" scenario, we assume that the level of economic activity associated with VAFB remains flat over the next decade; that is, the size of the base's workforce (military and civilian), its dollars expenditures on operations and maintenance, awarded contracts, gross payments to retirees, and the number of tourists and government/business visitors to the base will remain at their 2020 level until 2030. Second, we provide estimates of the economic impact of VAFB under various "envisioned growth" scenarios by accounting for anticipated military growth at the base, proposed expansions of commercial satellite and rocket launches as envisioned by REACH (*The Commercial Space Master Plan*), and potential infrastructure improvements being considered by the City of Lompoc.

We then estimate the fiscal impact of these developments in terms of corporate, personal income, sales, and property tax revenues generated under each scenario. It is important to note that corporate and personal income tax revenues accrue to the State of California, and sales and property tax revenues accrue to the counties under consideration. Before turning to the task of reporting our findings, we provide a brief overview of the modeling procedure used in this analysis.

5.1 ECONOMIC IMPACT MODEL

This study utilizes the Regional Economic Models Inc. Policy Insight Plus (REMI henceforth) model to estimate the current and future economic impact of VAFB on Santa Barbara and San Luis Obispo Counties and the rest of California. Utilizing VAFB's current employment and total compensation, planned capital investments, and ongoing operations and management expenditures, the model estimates the current and future economic impact of the base.

REMI is a structural economic forecasting and policy analysis model. It integrates input-output, computable general equilibrium (CGE), econometric, and economic geography methodologies. The model is dynamic, with forecasts and simulations generated on an annual basis and behavioral responses to wages, prices and other economic factors. The model consists of thousands of simultaneous equations with a structure that is relatively straightforward. The exact number of equations used varies depending on the extent of industry, demographic, demand and other detail in the model.

REMI is utilized by many public agencies, consulting firms, nonprofit organizations and local governments to simulate the economic impact of a variety of public and private capital investments, including infrastructure development, energy projects and military bases. The model provides output that quantifies the economic impact of a certain area of study, and for this report's sake, results are segmented on a county-wide basis into the number of jobs created, benefit to county GDP, and the general tax implications. These effects are further separated into direct, indirect and induced impacts. In construction of the model, REMI uses audited data from public agencies such as the U.S. Bureau of Economic Analysis and the Census Bureau as well as user inputted data to construct its larger model.

At the core of the REMI model (version 2.4.6) used for our analysis is the local economic and demographic forecasts and input-output coefficients for 70 local industry sectors. This includes the REMI economic and demographic baseline forecast for each county and the rest of California, which produces multi-year baseline forecast for these regions. The results associated with the two scenarios noted above are then compared to the baseline forecasts.

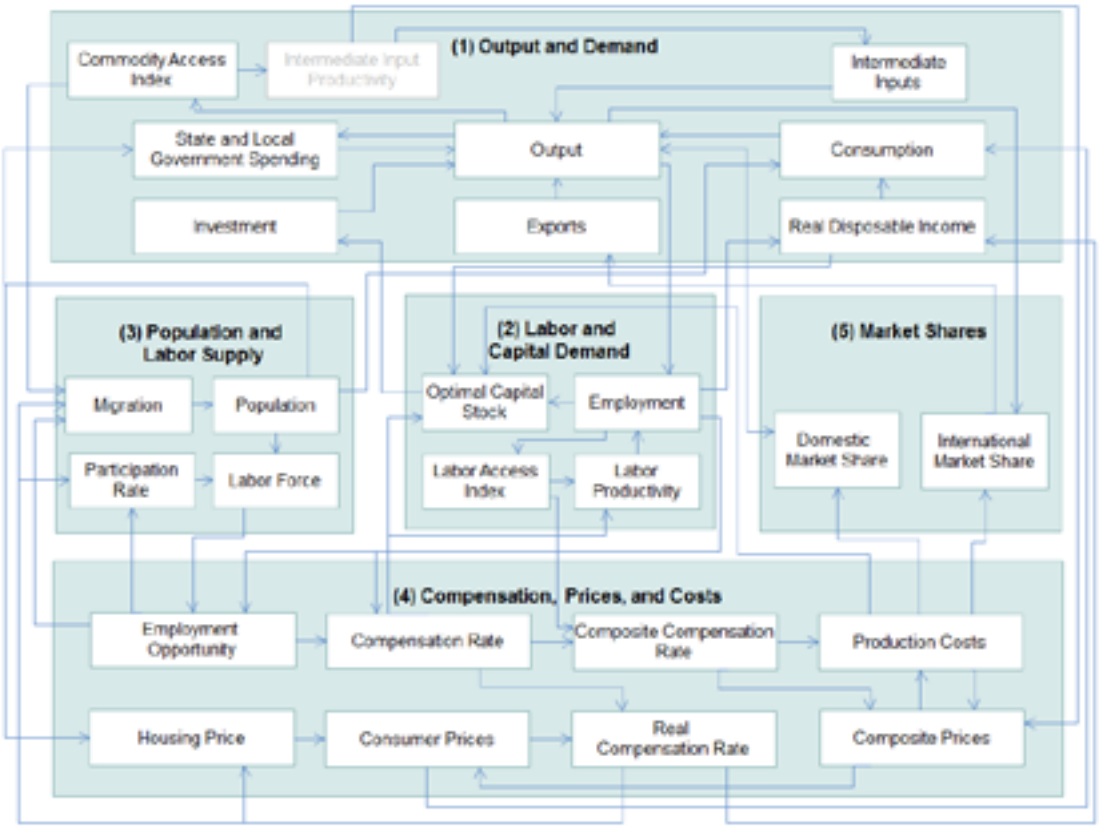
The industrial sectors in REMI are based on the North American Industry Classification System (NAICS). The input-output system is assembled using data from the Bureau of Economic Analysis (BEA), the Bureau of Labor Statistics (BLS), the Department of Energy (DOE), Department of Defense (DOD), the Census Bureau and other public sources.

The custom REMI model used to evaluate the economic impact of VAFB contains information for Santa Barbara and San Luis Obispo Counties and the rest of California as a whole. This configuration allows us to estimate the economic impacts for each county and to model spillover effects across both counties and the state.

The REMI model is based on two key underlying assumptions from mainstream economic theory: households maximize utility and producers maximize profits. In the model, businesses produce goods to sell to other firms, consumers, investors, governments and purchasers outside the region. The output is produced using labor, capital, fuel and intermediate inputs from other industries. The demand for labor, capital and fuel per unit of output depends on their relative costs, since an increase in the price of any one of these inputs leads to substitution away from that input to other inputs. The supply of labor in the model depends on the number of people in the region and the labor force participation rate. Economic migration also affects the population size. People will move into an area if the real after-tax wage rates are relatively high or if the likelihood of being employed increases in a region.

Supply and demand for labor in the model determine the wage rates. These wage rates, along with other prices and productivity, determine the cost of doing business for every industry in the model. An increase in costs would decrease the share of markets supplied by local firms. This market share, combined with the demand described above, determines the amount of local output. The model has several other feedback mechanisms. For example, changes in wages and employment impact income and consumption, while economic expansion changes investment and population growth impacts government spending.

Figure EF2. The Overall Structure of REMI-PI Model



Source: Regional Economic Models Inc., Policy Insight Plus, Version 2.4.6, 2020.

Figure EF2 is a pictorial representation of the REMI model. The overall structure of the model can be summarized in five major blocks: (1) Output and Demand, (2) Labor and Capital Demand, (3) Population and Labor Supply, (4) Compensation, Prices and Costs and (5) Market Shares. The blocks and their key interactions are shown in the figure. The Output and Demand block shows a business that sells to all the sectors of final demand as well as to other industries. The Labor and Capital Demand block shows how labor and capital requirements depend both on output and on their relative costs. The Population and Labor Supply block contribute to demand and wage determination. Economic migrants in turn respond to wages and other labor market conditions. Supply and demand interact in the Compensation, Price, and Costs block. Production costs determine market shares. Output depends on market shares and the components of demand.

The REMI model brings together all of the above elements to determine the value of each of the variables in the model for each year in the baseline forecast as well as for simulation purposes. The model includes all the inter-industry interactions that are included in input-output models in the Output bloc, but goes well beyond an input-output model by including the linkages among all of the other blocks shown in the figure.

To broaden the model in this way, it is necessary to estimate key relationships. This is accomplished by using extensive data sets covering all counties in the United States. These large data sets and three decades of research effort enable REMI to simultaneously maintain a theoretically sound model structure and build a model based on all the relevant data available.

Finally, the model has strong dynamic properties, which means that it forecasts not only what will happen but also when it will happen. This results in long-term predictions that have year-by-year change. Moreover, the long-term properties of general equilibrium models are preserved while maintaining accurate annual predictions and using estimates of key equations from primary data sources.

5.2 VAFB INPUTS: DIRECT ECONOMIC PROFILE

Table EF1 lists the current 2020 VAFB inputs and their projected levels over the next decade. The inputs associated with the installation's footprint are listed under the "Stand Still Scenario." These include the number of military and civilian employees, on-base expenditures that support operations and maintenance (O&M), local expenditure on contractors for professional and technical services including planned capital projects, expenditures on executed contracts, and expenditures by visitors and tourists to the base. Transfer payments to retirees and veterans are also included.

The second page of the table shows the inputs associated with the anticipated expansions to the base employment (military and civilian) as described by the base's leadership. Similarly, the City of Lompoc will likely undertake a number of infrastructure developments (roads, bridges and enhancements to the municipal facilities) to better serve VAFB. Finally, under the leadership of REACH, Deloitte has recently undertaken a major study, entitled *The Commercial Space Master Plan*, which proposes expansion of commercial satellite, missile and rocket launches at VAFB. Table A3 in the Appendix provides details of the envisioned expansions. The inputs associated with these plans appear in the last rows of Table EF1.

Table EF1. Vandenberg Air Force Base Inputs for the REMI Model 2020-2030											
Type	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Stand Still Scenario											
Federal Military Employment (Number)	2,912	2,912	2,912	2,912	2,912	2,912	2,912	2,912	2,912	2,912	2,912
Federal Civilian Employment (Number)	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375
Military Dependents (Age 0 - Age 17)	1,452	0	0	0	0	0	0	0	0	0	0
Military Dependents (Age 18 - Age 65)	859	0	0	0	0	0	0	0	0	0	0
Retirees and Veterans ($M)	83.12	83.12	83.12	83.12	83.12	83.12	83.12	83.12	83.12	83.12	83.12
Utilities (Elec., gas, water, sewage, $M)	13.66	13.66	13.66	13.66	13.66	13.66	13.66	13.66	13.66	13.66	13.66
Maintenance Services ($M)	7.82	7.82	7.82	7.82	7.82	7.82	7.82	7.82	7.82	7.82	7.82
Medical Employees ($M)	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27
Real Estate Services ($M)	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
Retail Expenditures ($M)	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45
Business Support Services ($M)	18.15	18.15	18.15	18.15	18.15	18.15	18.15	18.15	18.15	18.15	18.15
Travel and Entertainment ($M)	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98
Transportation Exp. ($M)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Telecom Service ($M)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Civil and Other Engineering Service ($M)	42.31	42.31	42.31	42.31	42.31	42.31	42.31	42.31	42.31	42.31	42.31
Planned Capital Projects ($M)	37.72	37.72	37.72	37.72	0	0	0	0	0	0	0
Contracts Executed ($M)	135	135	135	135	135	135	135	135	135	135	135
Tourist & Visitor Exp. ($M)	9.66	9.66	9.66	9.66	9.66	9.66	9.66	9.66	9.66	9.66	9.66

Source: VAFB, Deloitte, City of Lompoc, and Authors' Research.

Table EF1 cont. Vandenberg Air Force Base Inputs for the REMI Model Period 2020-2030

Type	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Anticipated VAFB Expansion Scenario											
VAFB Expansion (Military Employment)	0	0	0	0	0	500	500	500	500	500	500
VAFB Expansion (Civilian Employment)	0	0	0	0	0	200	200	200	200	200	200
Lompoc Infrastructure ($M)	0	0	0	50	75	125	0	0	0	0	0
Commercial Space Expansion Scenario											
Commercial Space Expansion (Employees)	0	75	75	125	235	370	595	595	595	595	595
Commercial Space Expansion ($M Construction)	0	0	19.95	39.89	59.84	79.79	0	0	0	0	0

Source: VAFB, Deloitte, City of Lompoc, and Authors' Research.

5.3 VAFB OUTPUTS: AVERAGE ANNUAL ECONOMIC IMPACT 2020-30

In this section we present the overall economic impact associated with various expansion scenarios (input presented in Table EF1). Utilizing REMI's built-in forecasting capabilities, we simulate the overall economic impact of VAFB over the period 2020-2030, under the Stand Still and alternative military and commercial space expansion scenarios envisioned. To best understand the economic impact of VAFB, we report the following common indicators of the economic health for Santa Barbara and San Luis Obispo Counties as well as the rest of California: Total Employment, regional Gross Domestic Product (GDP), Output, Personal Income, and Disposable Personal Income.

The economic impacts in this report represent the most conservative growth projections for VAFB.

Table EF2 reports the estimated average annual impacts over the period 2020-2030 (Tables A1 and A2 in Appendix A show similar estimates for each year). The middle three columns show the marginal impact of additional economic activities. The last column (+All) shows the impact of all the expansion scenarios given the inputs in Table EF1. It is important to reiterate that under the "Stand Still scenario," the economic footprint of VAFB over the next decade is assumed to remain constant. Moreover, the inputs associated with the future expansion scenarios are selected to be the lowest possible values. Hence, the economic impacts in this report represent the most conservative growth projections for VAFB.

Table EF2. Average Annual Economic Impact of VAFB Under Different Expansion Scenarios, 2020-2030

Category	Stand Still	+Military Expan.	+Lompoc	+ Com. Epan.	+All
Santa Barbara County					
Total Employment (Jobs)	13,497	14,402	13,648	14,291	15,348
Gross Domestic Product ($M)	2,847	3,077	2,868	2,974	3,224
Output ($M)	4,667	5,045	4,703	4,868	5,282
Personal Income ($M)	1,557	1,661	1,571	1,633	1,751
Disposable Personal Income ($M)	1,362	1,452	1,374	1,427	1,529
San Luis Obispo County					
Total Employment (Jobs)	674	716	697	725	791
Gross Domestic Product ($M)	111	119	114	119	130
Output ($M)	188	200	194	202	221
Personal Income ($M)	115	122	118	124	134
Disposable Personal Income ($M)	99	105	101	106	115
Rest of California					
Total Employment (Jobs)	4,245	4,517	4,291	4,442	4,760
Gross Domestic Product ($M)	820	877	829	859	924
Output ($M)	1,423	1,522	1,438	1,489	1,603
Personal Income ($M)	539	574	545	566	606
Disposable Personal Income ($M)	464	494	469	487	521

Source: Outputs from the REMI model.

5.4 VAFB OUTPUTS: DIRECT, INDIRECT, AND INDUCED EMPLOYMENT IMPACTS

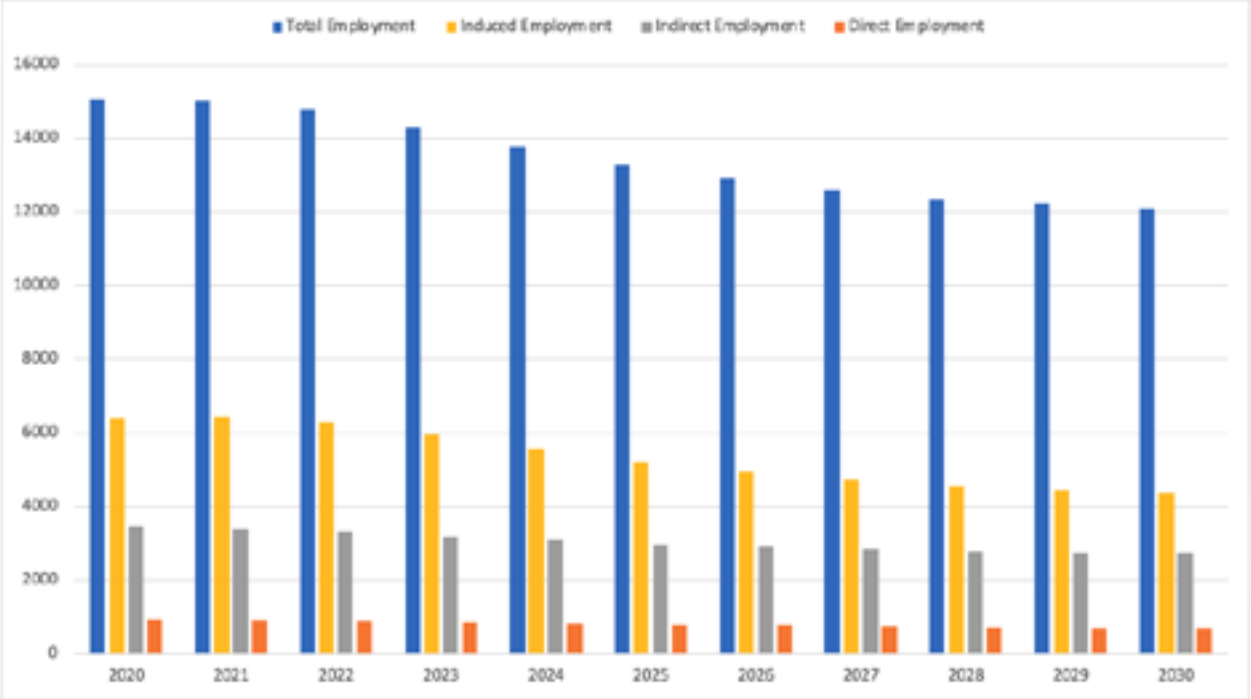
Next we present estimates of the direct, indirect and induced employment impacts of VAFB on the regions under consideration. Figures EF3, EF4 and EF6 below shows the total, direct, indirect and induced employment for Stand Still and All Developments scenarios over the period 2020-2030.

Note that under the Stand Still scenario, where the on-base head counts (military and civilian) and the dollar expenditures remain flat, the base's employment impact declines over time. This is due to the fact that within the REMI model, wages (labor productivity) and prices are rising over time, and consequently fewer individuals are employed given the fixed expenditures by the base. This trend, however, is mitigated with the expansion of military personnel on the base and the increase in commercial space activities, as envisioned in Table EF1.

It is important to also emphasize that over the last decade there has been a transition of some services (e.g., housing and water) away from the base and to the local economy. Additionally, as military health care access at the base clinic continues to decrease due to cuts in personnel/ supported specialties/etc. by the Department of Defense Health Services, the increased reliance on the local community for dependent, active duty and retiree health care will likely grow, even under the Stand Still scenario. Moreover, the base administration is considering further privatization of base services (e.g. power), which will also lead to increased economic impact on the local community. The timing and magnitude of these developments is difficult to predict and their impact is not built into the models presented above. Again, this omission implies a very conservative growth projections for VAFB.

Figure EF3. VAFB Impact on Employment in Santa Barbara County: Total, Direct, Indirect and Induced

Stand Still Scenario

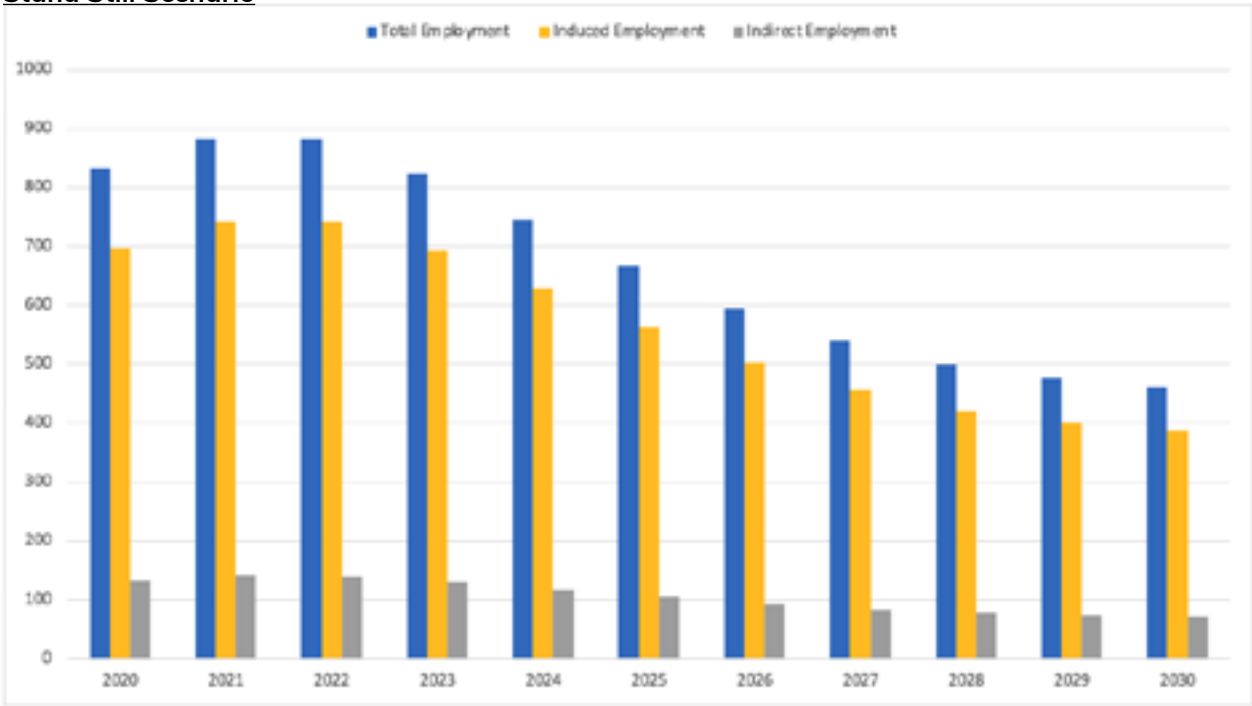


All Developments Scenarios

Source: REMI Output for 2020 through 2030.

Figure EF4. VAFB Impact on Employment in San Luis Obispo County: Total, Direct, Indirect and Induced

Stand Still Scenario



All Developments Scenarios

Source: REMI Output for 2020 through 2030.

Figure EF5. VAFB Impact on Employment on Rest of California: Total, Direct, Indirect and Induced

Stand Still Scenario

All Developments Scenarios

Source: REMI Output for 2020 through 2030.

Table EF3 below shows the breakdown of the total employment under the Stand Still and All Developments scenarios for each county and the rest of California for 2020 and the average over the period 2020-2030. Note that there are no direct employment impacts from VAFB on San Luis Obispo County and the rest of California since by assumption no part of the base's employment, annual O&M or contractor expenditures occur outside Santa Barbara County.

Anticipated military growth and the proposed increase in commercial space activities could result in 1,968 new jobs per year in Santa Barbara and SLO Counties.

Also note that the base's miltary and civilian actual head count (4,287), is not included in the Direct column for Santa Barbara County. The figure included in this column (948) is the "imputed direct" employment, estimated by REMI, which corresponds to the base's annual expenditures for O&M and all contractors serving the base.

Finally, it should be clear that the employment impact associated with anticipated military growth and the proposed increase in commercial space activities (missile, satellite and rocket launches) on the regional economies is very large, resulting in 1,968 (13.9% increase relative to Stand Still scenario) total new jobs per year, on average.

Table EF3. Total, Direct, Indirect, and Induced Employment Impact of VAFB 2020-2030
Results for 2020 and the "Average" of calendar years 2020-2030 (inclusive)

Stand Still Scenario								
	Total		**Direct**		**Indirect**		**Induced**	
	2020	Average	2020	Average	2020	Average	2020	Average
Santa Barbara	15,071	13,497	948	806	3,456	3.044	6,380	4,378
San Luis Obispo	832	674	0	0	135	106	697	567
Rest of California	4,502	4,245	0	0	1,347	1,220	3,155	3,025
All Military and Commercial Developments Scenarios								
	Total		**Direct**		**Indirect**		**Induced**	
	2020	Average	2020	Average	2020	Average	2020	Average
Santa Barbara	15,071	15,348	948	1,102	3,456	3,411	6,380	6,060
San Luis Obispo	832	791	0	0	135	123	697	662
Rest of California	4,502	4,760	0	0	1,347	1,360	3,155	3,375

5.5 VAFB OUTPUTS: EMPLOYMENT MULTIPLIERS 2020-2030

"Employment multiplier" is defined as the ratio of total employment to direct employment on the base (Table EF3 above). For example, an employment multiplier of 3.00 indicates that the creation of 1 direct new job on VAFB is expected to support 2 additional jobs in the local economy, for a total impact of 3 new jobs. Figure EF6 depicts how the multiplier effect causes the direct base employment to result in additional new jobs in the surrounding areas.

Figure EF6. Estimating Employment Multipliers

Source: Authors

There are several methods in the literature for calculating employment multipliers from the REMI output and each results in different estimates of this important indicator. To see the differences that could result, consider the data in Table EF3 (previous page). Recall that the base's actual military and civilian head count input for 2020 is 4,287. Also the "imputed direct" employment, corresponding to the base's annual expenditures for O&M and all contractors, was estimated by REMI to be 948 jobs. Hence the base's direct employment can be viewed as the federal military and civilian employees (4,287), or one may include the imputed direct employees to arrive at an estimate of 5,235 jobs on the base. Now using the broad multiplier definition given above, the base's employment multiplier can be either 3.51 (15,071/4,287), or 2.88 (15,071/5,235). Clearly, the higher multiplier value overlooks the fact that O&M and base contractor expenditures result in direct employment.

There is no clear consensus in the literature regarding the correct method to calculate employment multipliers. For this reason we report three different employment multipliers in Table EF4 below. The "Lower Bound" value is defined as the number of private-sector jobs created (15,071-5,235) divided by the number of direct jobs created by the base (5,235). The "Middles Values" is defined as number of private-sector jobs created (15,071-5,235) divided by the number of military and civilian employees working on the base (4,287). Finally, the "Upper Bound" is defined as total number of jobs created (15,071) divided by the number of direct jobs created by the base (5,235).

Using these definitions, Table EF4 reports the annual (2020-2030) and average employment multiplier estimates for the Stand Still and All Developments scenarios. It is important to note that the "Upper Bound" estimates are similar to the estimated multipliers reported for other military bases around the nation. Moreover, it is reasonable to consider the average of the "Upper Bound" value as the long-run estimate of VAFB employment multiplier.

Table EF4. Employment Multipliers for Santa Barbara County 2020-2030

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Average
Stand Still Scenario												
Lower Bound	1.87	1.87	1.82	1.74	1.64	1.56	1.50	1.45	1.41	1.39	1.37	1.54
Middle Values	2.29	2.27	2.20	2.08	1.96	1.86	1.77	1.70	1.65	1.62	1.59	1.83
Upper Bound	2.88	2.90	2.86	2.78	2.69	2.62	2.55	2.50	2.46	2.45	2.43	2.60
All Developments Scenarios												
Lower Bound	1.87	1.87	1.85	1.82	1.79	1.96	1.66	1.61	1.57	1.55	1.52	1.70
Middle Values	2.29	2.30	2.26	2.24	2.23	2.49	2.19	2.12	2.06	2.02	1.98	2.18
Upper Bound	2.88	2.88	2.87	2.85	2.80	3.10	2.76	2.72	2.67	2.65	2.63	2.78

Source: REMI Model

5.6 VAFB OUTPUTS: IMPACTS ON DIFFERENT INDUSTRIES

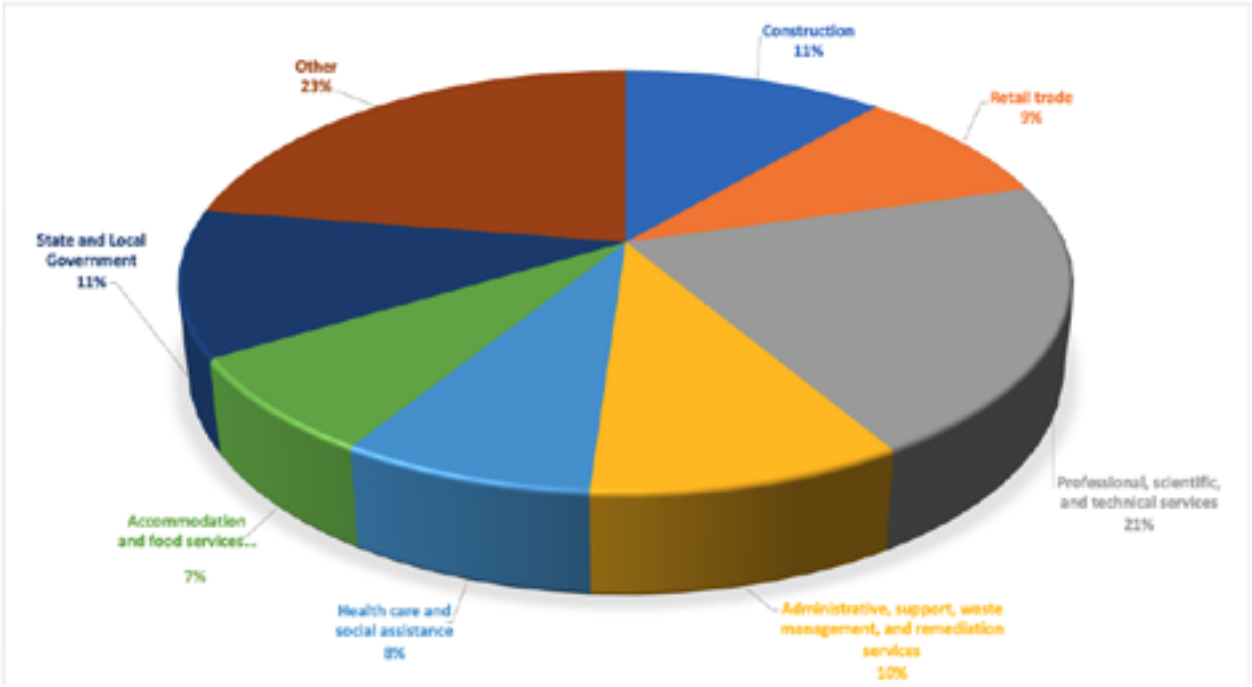
For purposes of this economic policy analysis, it is important to understand the impact of VAFB in terms of current employment and jobs created in different sectors of the local economy. For example, given the estimated total number of jobs associated with the presence of VAFB in Santa Barbara County (15,701), it is possible to arrive at the distribution of jobs within different sectors of the economy under both the Stand Still and All Developments scenarios. Similarly we can estimate the distribution of jobs by economic sector base on the estimated numbers of direct, indirect and induced jobs.

Figure EF7 below reports the impact of VAFB on the distribution of jobs in Santa Barbara County. The figure shows that under the Stand Still scenario, the base creates quality employment in key sectors such as construction, administrative service, and professional, scientific, and technical services. Furthermore, expansion of the economic activities resulting from the All Developments scenarios will further increase employment opportunities in these sectors within the central part of Santa Barbara County.

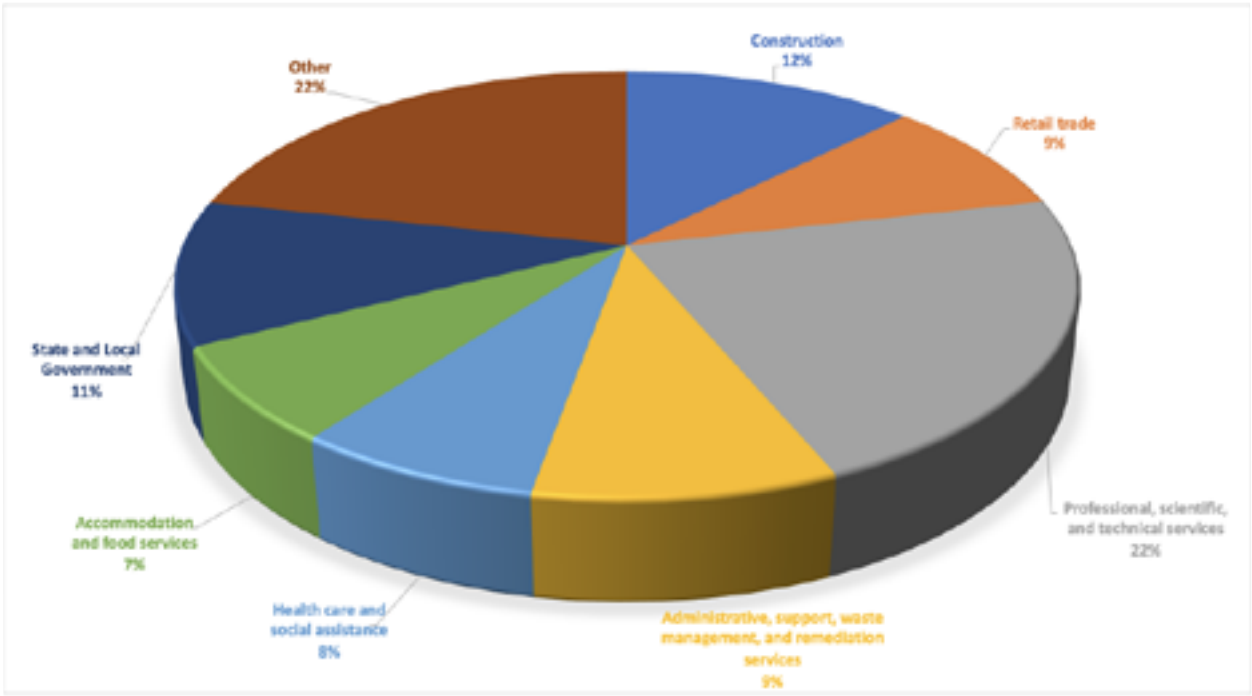
Figures EF8 and EF9 show similar results for the composition of direct and indirect jobs as well as the induced jobs created by the presence of VAFB in Santa Barbara County. These figures show that the economic benefits of VAFB extend to the local secondary and tertiary employment created by the base.

Figure EF7. The Composition of Total Jobs Created by VAFB in Santa Barbara County

Stand Still Scenario



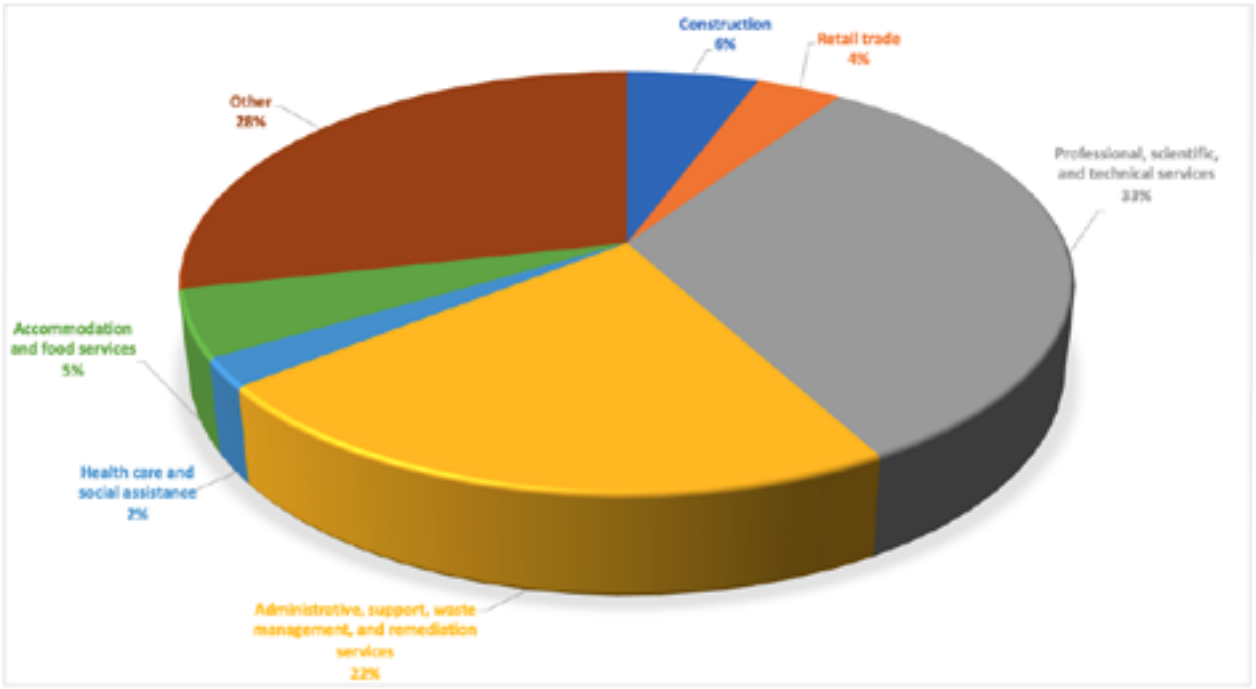
All Developments Scenarios



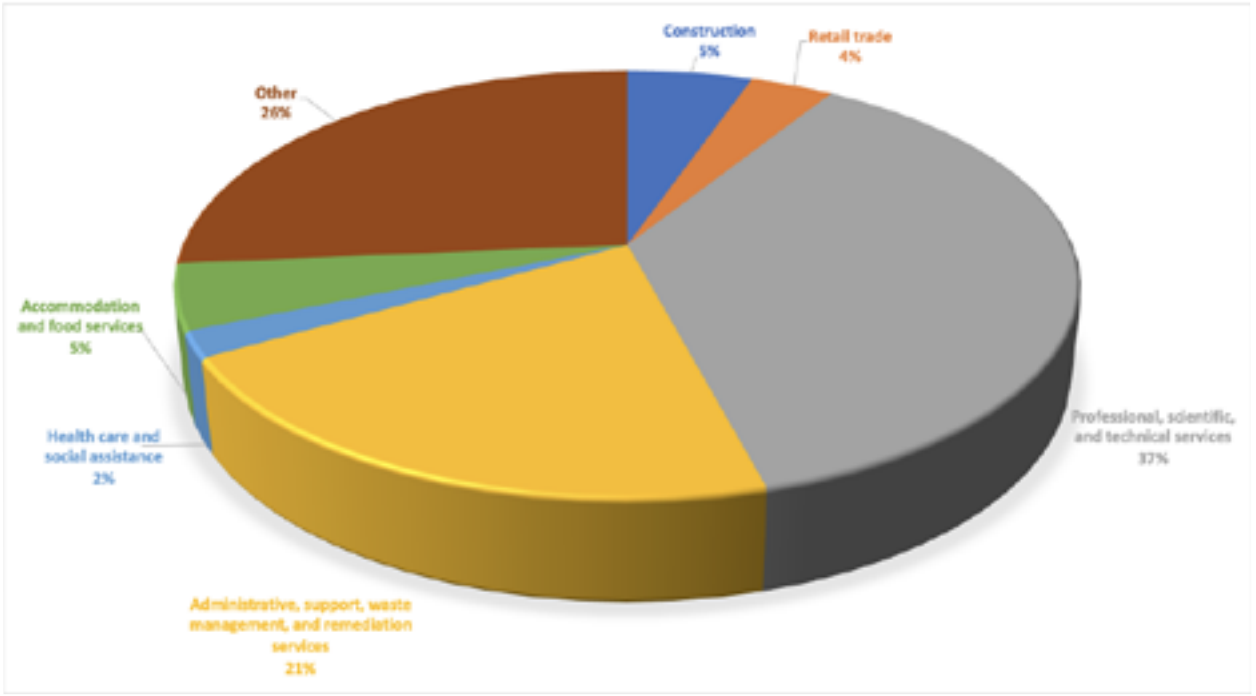
Source: REMI Output, Average of 2020-2030.

Figure EF8. The Composition of Direct & Indirect Jobs Created by VAFB in Santa Barbara County

Stand Still Scenario



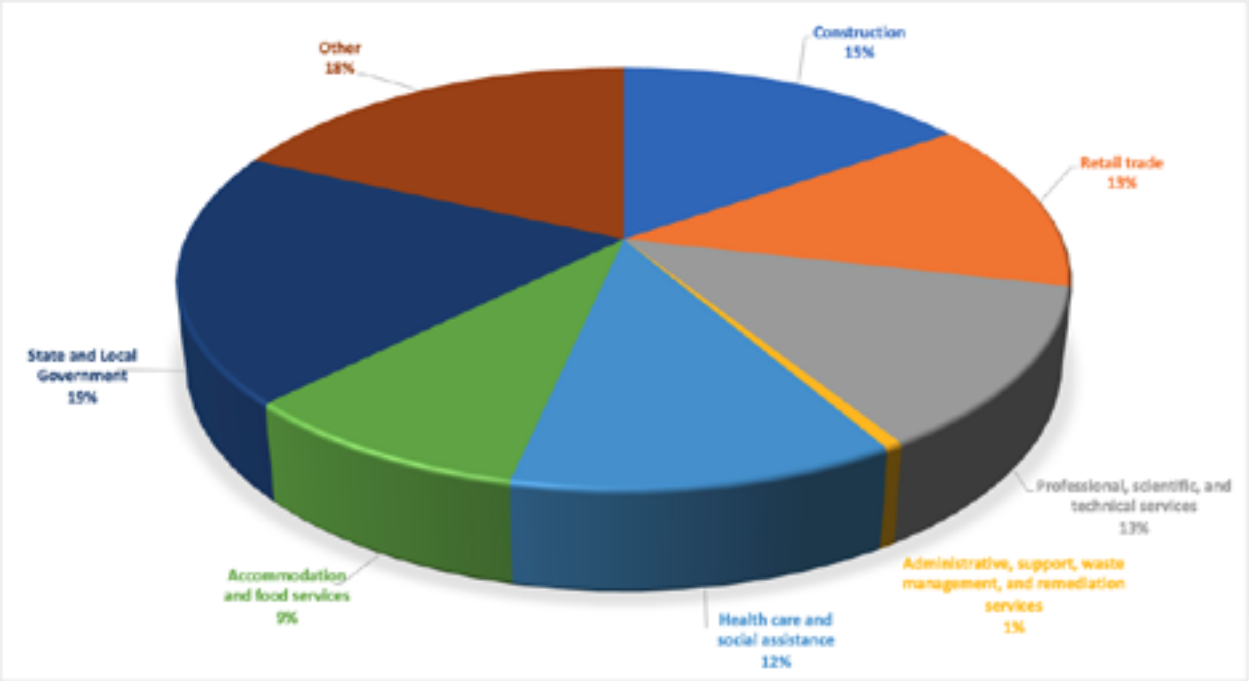
All Developments Scenarios



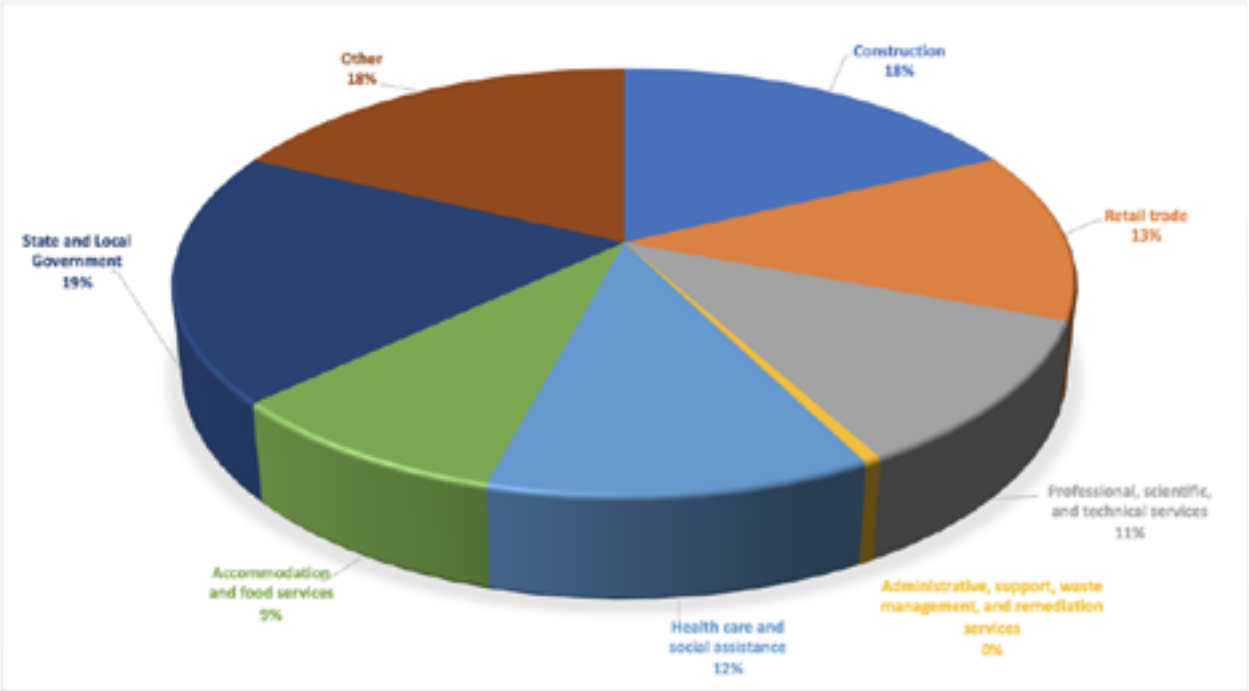
Source: REMI Output, Average of 2020-2030.

Figure EF9. The Composition of Induced Jobs Created by VAFB in Santa Barbara County

Stand Still Scenario



All Developments Scenarios



Source: REMI Output, Average of 2020-2030.

5.7 VAFB OUTPUTS: ESTIMATED FISCAL IMPACTS

The tax revenues generated by the activities on VAFB are of critical importance to the fiscal health of the surrounding communities and the State of California as a whole. The calculations presented in Table EF5 below are based on REMI forecasts of annual corporate income, personal income, and retail sales under each scenario. Tax revenues are calculated using the average of 2015-2017 California corporate income tax rate of 0.9078%, personal income tax rate of 8.3508%, retail sales & use tax rate of 3.7515%, and local property tax rate of 1.16%.

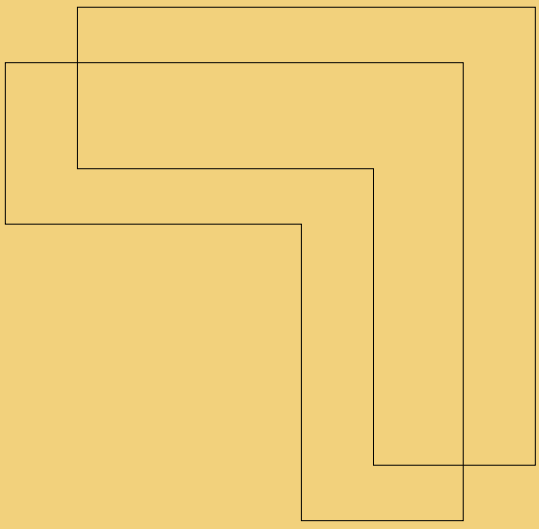
Table EF5. Annual Corporate, Personal Income, Retail Sales, and Property Tax Revenues ($M) 2020-2030

Stand Still Scenario											
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Santa Barbara County											
Corporate Income ($M)	23.86	25.02	25.41	25.61	25.7	25.78	25.92	26.16	26.45	26.95	27.48
Personal Income ($M)	111.27	115.73	120.52	124.35	127.19	130.11	133.01	136.21	139.96	143.74	148.32
Retail Sales & Use ($M)	43.1	45.7	47.71	49.18	50.33	51.52	52.31	53.22	54.75	56.21	58.02
Property Tax (PI, $M)	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41
San Luis Obispo County											
Corporate Income ($M)	1.03	1.16	1.2	1.18	1.11	1.03	0.95	0.89	0.85	0.83	0.83
Personal Income ($M)	8.98	9.6	10.11	10.25	10.09	9.84	9.56	9.35	9.24	9.23	9.33
Retail Sales & Use ($M)	3.39	3.71	3.93	3.99	3.93	3.84	3.71	3.6	3.57	3.56	3.61
Rest of California											
Corporate Income ($M)	6.57	7.29	7.57	7.64	7.62	7.52	7.44	7.43	7.45	7.62	7.77
Personal Income ($M)	37.63	41.28	43.41	44.73	45.35	45.59	45.85	46.36	47.12	48.37	49.72
Retail Sales & Use ($M)	14.21	15.98	16.87	17.39	17.65	17.78	17.76	17.85	18.18	18.67	19.21

Table EF5 cont. Annual Corporate, Personal Income, Retail Sales, and Property Tax Revenues ($M) 2020-2030											
All Developments Scenarios											
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Santa Barbara County											
Corporate Income ($M)	23.86	25.18	25.73	26.56	27.33	31.69	31.52	31.8	32.18	32.77	33.38
Personal Income ($M)	111.27	116.55	122.2	129.43	135.8	157.29	157.5	162.21	167.09	171.9	177.5
Retail Sales & Use ($M)	43.1	46.02	48.37	51.16	53.67	62.11	61.8	63.23	65.21	67.06	69.27
Property Taxes (PI, $M)	2.41	2.41	2.65	3.11	3.80	4.73	4.73	4.73	4.73	4.73	4.73
San Luis Obispo County											
Corporate Income ($M)	1.03	1.17	1.24	1.29	1.31	1.43	1.22	1.15	1.09	1.06	1.05
Personal Income ($M)	8.98	9.67	10.35	11.09	11.51	12.9	11.87	11.72	11.61	11.57	11.65
Retail Sales & Use ($M)	3.39	3.74	4.02	4.31	4.48	5.03	4.6	4.51	4.48	4.47	4.5
Rest of California											
Corporate Income ($M)	6.57	7.34	7.68	7.98	8.19	9.18	8.93	8.94	8.98	9.17	9.34
Personal Income ($M)	37.63	41.56	44.05	46.78	48.75	55.36	54.06	55.27	56.29	57.84	59.38
Retail Sales & Use ($M)	14.21	16.09	17.12	18.18	18.97	21.55	20.91	21.25	21.69	22.29	22.91

SECTION 6

SUMMARY AND CONCLUSIONS



6. SUMMARY AND CONCLUSIONS

To understand the overall economic role played by VAFB, this report estimated the base's current economic impact and its dynamic evolution over the next decade under two alternative scenarios.

VAFB supplies quality jobs, stimulates the production of goods and services, and increases local incomes and overall expenditures on goods and services.

First, under a Stand Still scenario, we assumed that the level of economic activity associated with VAFB stays flat; that is, the size of the base's workforce (military and civilian), its dollar expenditures on operations and maintenance, awarded contracts, gross payments to retirees, and the number of tourists and government-business visitors to the base will remain at their 2020 level until 2030. Second, the report provided estimates of the economic impact of VAFB under various All Developments scenarios by ac-counting for anticipated military growth, proposed expansions of commercial satellite, missile and rocket launches as envisioned by REACH ("The Commercial Space Master Plan"), and potential infrastructure improvements being considered by the City of Lompoc.

Economic impacts associated with various scenarios were calculated using modeling software from Regional Economic Models Inc. (REMI). Utilizing REMI's built-in forecasting capabilities, the study simulated the total economic impact of VAFB over the period 2020-2030, with and without the envisioned expansions in military and commercial space activities. To best understand the economic impact of VAFB, we reported the following common indicators of economic health of the regions: Employment, Gross Domestic Product (GDP), Output, Personal Income, and Disposable Personal Income for Santa Barbara and San Luis Obispo Counties as well as the rest of California.

Overall, the REMI models confirmed what is widely recognized in the adjacent communities: VAFB provides substantial positive economic benefits to the nearby counties and California as a whole. The base supplies quality jobs, stimulates the production of goods and services, and increases local incomes and overall expenditures on goods and services.

In summary, VAFB contributed $3.464 billion to the GDP of Santa Barbara, San Luis Obispo and the rest of California economy in 2020 (for additional details, see the table in Executive Summary on page 7). VAFB's current economic footprint and its anticipated future growth present enormous economic opportunities for local communities and the state. The base's contracting with local businesses provides employment in a wide variety of industry sectors, while the military personnel and their families support local communities by creating demand for goods and services. In addition, the retired military pensions and other forms of compensation provide individuals and communities with a reliable source of income. The analysis undertaken in this report showed that the economic impact of VAFB on the surrounding communities and the State of California will grow over the next decade by the anticipated increase in military activity on the base, the potential infrastructure improvements in the City of Lompoc, and the proposed private-sector commercial space activities envisioned in the *The Commercial Space Master Plan*.

NOTES

[1] For a brief history of VAFB see https://www.vandenberg.spaceforce.mil/About-Us/Fact-Sheets/Display/Article/338341/history-office/

[2] See Table SB1 below.

[3] See "Units," Vandenberg Air Force Base, accessed January 7, 2021, https://www.vandenberg.spaceforce.mil/Units/

[4] SpaceX and FIrefly have private investors but have not become public companies. ULA is a consortium between Lockheed-Martin and Boeing. Most recently, SpaceX, in partnership with NASA, completed a launch in November 2020. See "SpaceX launches Sentinel-6 satellite from VAFB," News, Vandenberg Air Force Base, accessed January 7, 2021, https://www.vandenberg.spaceforce.mil/News/Article-Display/Article/2423931/spacex-launches-sentinel/

[5] For 2021, more missiles, satellite and rocket launches are planned (at least 12 launches are planned). VAFB will likely be renamed the Vandenberg Space Force Base in near future. See https://lompocrecord.com/news/local/military/vandenberg/military-officials-plan-to-rename-van article_2db59a35-6e4e-5e35-ad7e-3aa84d24c33e.html

[6] Data taken from the "FY20 COMMANDER'S FACT CARD." See also "Vandenberg AFB In-Depth Overview," Vandenberg AFB, Military Installations, accessed January 7, 2021, https://installations.militaryonesource.mil/in-depth-overview/vandenberg-afb

[7] See "County Statistical Profile," County of Santa Barbara, accessed January 7, 2021, https://www.countyofsb.org/ceo/asset.c/2794

[8] U.S. Census Bureau, 2018.

[9] SB County BW Report, 2018.

[10] SB County BW Report, 2018.

[11] "Unemployment Rate in Santa Barbara, CA," U.S. Regional Data, FRED, 2018, https://fred.stlouisfed.org/series/CASANT1URN

[12] SB County BW Report, 2018.

[13] U.S. Census Bureau, 2018.

[14] SB County BW Report, 2018.

[15] SLO County BW Report, 2018.

[16] U.S. Census Bureau, 2018.

[17] SLO County BW Report, 2018.

APPENDIX A

Table A1. VAFB Economic Impact Under Stand Still Scenario, 2020-2030											
Type	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Santa Barbara County											
Total Employment (Jobs)	15,071	15,045	14,784	14,294	13,773	13,304	12,908	12,598	12,356	12,228	12,103
Gross Domestic Product ($M)	2,628	2,756	2,798	2,821	2,831	2,840	2,855	2,881	2,914	2,969	3,027
Output ($M)	4,326	4,534	4,603	4,637	4,650	4,660	4,680	4,716	4,762	4,842	4,929
Personal Income ($M)	1,332	1,386	1,443	1,489	1,523	1,558	1,593	1,631	1,676	1,721	1,776
Disposable Personal Income ($M)	1,149	1,218	1,272	1,311	1,342	1,373	1,394	1,419	1,460	1,498	1,546
San Luis Obispo County											
Total Employment (Jobs)	832	883	882	825	747	667	596	541	499	477	461
Gross Domestic Product ($M)	113	128	133	130	122	114	105	98	94	92	91
Output ($M)	196	219	227	221	207	192	177	165	156	153	151
Personal Income ($M)	108	115	121	123	121	118	114	112	111	110	112
Disposable Personal Income ($M)	90	99	105	106	105	102	99	96	95	95	96
Rest of California											
Total Employment (Jobs)	4,502	4,819	4,773	4,620	4,428	4,216	4,041	3,913	3,817	3,804	3,766
Gross Domestic Product ($M)	723	803	834	842	839	828	820	818	821	839	856
Output ($M)	1,278	1,412	1,459	1,468	1,459	1,436	1,417	1,410	1,410	1,438	1,466
Personal Income ($M)	451	494	520	536	543	546	549	555	564	579	595
Disposable Personal Income ($M)	379	426	450	463	471	474	473	476	485	498	512

Source: REMI Model

Table A2. VAFB Economic Impact Under All Commercial Developments Scenario, 2020-2030											
Type	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Santa Barbara County											
Total Employment (Jobs)	15,071	15,189	15,071	15,152	15,129	17,061	15,769	15,450	15,151	14,978	14,803
Gross Domestic Product ($M)	2,628	2,773	2,834	2,926	3,010	3,491	3,472	3,503	3,544	3,609	3,677
Output ($M)	4,326	4,561	4,662	4,816	4,953	5,745	5,681	5,725	5,782	5,875	5,974
Personal Income ($M)	1,332	1,396	1,463	1,550	1,626	1,884	1,886	1,942	2,001	2,058	2,126
Disposable Personal Income ($M)	1,149	1,227	1,289	1,364	1,431	1,656	1,647	1,686	1,738	1,788	1,846
San Luis Obispo County											
Total Employment (Jobs)	832	889	909	922	899	962	757	696	642	608	581
Gross Domestic Product ($M)	113	129	136	142	144	157	135	126	120	117	115
Output ($M)	196	221	233	243	245	267	226	211	200	195	191
Personal Income ($M)	108	116	124	133	138	154	142	140	139	139	140
Disposable Personal Income ($M)	90	100	107	115	119	134	123	120	119	119	120
Rest of California											
Total Employment (Jobs)	4,502	4,855	4,851	4,865	4,803	5,307	4,804	4,713	4,590	4,565	4,505
Gross Domestic Product ($M)	723	808	845	879	902	1,011	984	984	989	1,010	1,029
Output ($M)	1,278	1,421	1,480	1,534	1,569	1,758	1,701	1,698	1,701	1,732	1,761
Personal Income ($M)	451	498	528	560	584	663	647	662	674	693	711
Disposable Personal Income ($M)	379	429	456	484	506	574	557	566	578	594	611

Source: REMI Model

Table A3. Potential Infrastructure & Improvement Projects				
How-to-Play Impacts	**Where-to-Play Impacts**	**Infrastructure, Improvement or General Project Area**	**Stage**	**Source**
Grow Commercial Enterprises	**Launch services, logistics and downstream application markets**	**South Mission District ADP**: Create a "commercial zone" on SVAFB enabling commerical LSPs to lease land for building required administrative, storage, launch control or processing facilities.	Investment Ready	VAFB & 30th SW Spaceport of the Future document
		Additional findings: Consider ADP infrastructure and configurations to support non-LSPs such as those participating in logistics & downstream applications segments.	Investment Ready	Deloitte Industry Interviews
		Mission District Perimeter Security Fence Modification: SVAFB perimeter security system modification to place the new Mission District outside of the controlled security area, enables public accessibility.	Investment Ready	VAFB & 30th SW Spaceport of the Future document
		South Mission District ADP Coworking Facilities Development Plan: Develop a plan to build and lease shared office space within the commercial enterprise zone to support LSP's and downstram applications providers in an unclassified seeting .	Requires Assessment	VAFB & 30th SW Spaceport of the Future document
Grow Launch Services Providers and Launch CONOPS	**All Launch Classes & CONOPS**	**SVAFB Gate Enhancement**: To support a new vehicle security inspection state for LSPs. Potential plan to connect NVAFB to SVAFB via an overpass roadway and incorporate a second inspection state on SVAFB.	Investment Ready	VAFB & 30th SW Spaceport of the Future document
		GN2 ASU and Pipeline: Design and build a Gaseous Nitrogen (GN2) Air Separation Unit (ASU) associated storage area and pipeline on SVAFB to produce launch quality nitrogen.	Investment Ready	VAFB & 30th SW Spaceport of the Future document
	Heavy Launchers & Strategic CONOPS	**Boat dock refurbishment and upgrade**: Perform updates to the boat dock and build supporting components such as a sea wall to support sustain utilization of the dock for offloading heavy and ultra-heavy launch vehicle components.	Requires Assessment	Deloitte SME Interviews/ Indsutry Research
	Small Launch & ORS CONOPS	**Small Launch Vehicle Environmental Assessment/Launch & Landing Pads**: Develop a Small Launch Vehicle Programmatic EA to approve launch sites and launch rates. Resulting EA will save Small Launch providers a potential 2-year effort and costs.	Funded	VAFB & 30th SW Spaceport of the Future document
		SLC-8: transition SLC-8 into a government-facilitated launch pad for small LSPs launching government and commercial missions.	Partially Funded	VAFB & 30th SW Spaceport of the Future document

Source: The Commercial Space Master Plan, Deloitte.

Table A3 cont. Potential Infrastructure & Improvement Projects				
How-to-Play Impacts	**Where-to-Play Impacts**	**Infrastructure, Improvement or General Project Area**	**Stage**	**Source**
Grow Launch Services Providers and Launch CONOPS	**Small Launch & ORS CONOPS (cont).**	**Improve & Extend Utilities to new SVAFB sites:** Extend roads, sewer, utilities and communications to new SVAFB "greenfield: sites southeast of SLC-6/Boathouse to provide space for small launch service providers.	Investment Ready	VAFB & 30th SW Spaceport of the Future document
	ORS CONOPS by Small and Horizontal Launches[1]	**Create a leasable SCIF Payload Processing Facility**: For additional capacity for small and medium launch this is cost effective and can portentially support multiple users.	Requires Assessment	Deloitte Industry Interviews
		Hydrazine Storage and Fueling: Assess the current hydrazine storage capacity and invest in improvements to support USG use in small launcher payloads in support of the ORS mission.	Requires Assessment	Deloitte Industry Interviews
	Horizontal (Air Launch) CONOPS	**Revitalize VAFB Runway:** Perform necessary updates to the main runway and any associated ILS/ALS/PAPI equipment as necessary to support commercial utilization by horizontal launch vehicles/carrier aircraft. Potentially extend staffing of the air strip to increase base accessibility.	Requires Assessment	Deloitte SME Interviews/ Indsutry Research
		Runway Safety Assessment: Perform an EA and design study to assess human and installation safety requirement for horizontal launch operations operating out of KVBG.	Requires Assessment	Deloitte Industry Interviews
Support & Grow On-Base Operations and Activities	**Communications Infrastructure**	**Upgrade Telecommunications Infrastructure**: Lay new fiber optic cable to enhance network performance and speed.	Requires Assessment	Deloitte SME Interviews/ Indsutry Research
	Operational Infrastructure	**Revitalize the North Side Well**: Rehabilitate and restore old well infrastructure to provide additional water source for the base and surrounding activities.	Requires Assessment	Deloitte SME Interviews/ Indsutry Research
	Storage & Operations Infrastructure	**Dedicate space and facilities for commodities storage**: Set aside land for storage of flight-ready hardware and improve the roads/access options to reach stoge areas.	Requires Assessment	Deloitte SME & Industry Interviews/ Indsutry Research
Enabling Infrastructure	**Transportation**	**Improve rail trasite times to/from base**: Add additional transit optoins such as express trains from LAX/Union State on the Amtrak/CALTRANS Pacific Surfliner partnership.	Requires Assessment	Deloitte Industry Interviews
		Rail Freight Capability Upgrades: Improve the ability to receive space-qualified hardware and associated supporting systems inclusive of Conex boxes through rocket cores via rail from LA and other manufacturing centers.	Requires Assessment	Deloitte Industry Interviews

Source: The Commercial Space Master Plan, Deloitte.

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5. *Regional Economic Models, Inc. REMI PI+, Model Documentation and Explanation of Methodology*, www.remi.com.

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