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SPACEPORT AMERICA®

# SPACEPORT AMERICA

# Economic & Fiscal Impact Analyses

January 2020

The space industry has seen tremendous changes since its inception in the 1950s evolving from government-run civilian and military agencies to what it has become today: an emerging and fast-growing commercial industry supporting a wide range of academic, military, and commercial objectives. This shift toward the commercialization of space, often referred to as New Space, or Space 2.0, is reshaping the world's aerospace industry.

## SPACEPORT AMERICA

Spaceport America, the world's first purpose-built commercial spaceport, was created with the specific intent of supporting the ever-changing and expanding space industry. The Spaceport represents a significant investment by New Mexico in establishing a foothold in this emergent space enterprise.

Located on 18,000 acres in the south-central desert of New Mexico, Spaceport America is next to White Sands Missile Range. The economies of Sierra and Doña Ana counties are most proximate to the Spaceport, but the scope of economic and fiscal impacts are far-reaching. The return on this investment could be transformative, with new economic growth and enrichment of education an express part of its mission.

SPACEPORT AMERICA®

## ECONOMIC & FISCAL IMPACT ANALYSES

### SCOPE OF ENGAGEMENT

Moss Adams was contracted by the New Mexico Spaceport Authority to provide a comprehensive economic impact analysis of Spaceport America in the context of the evolving commercial space industry. It involves both an analysis of current impacts and a growth forecast with multiple potential development trajectories.

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### KEY FINDINGS

Key findings from the report include:

New Mexico's investment in Spaceport America has already achieved a **positive return on investment.**

Spaceport America is forecast to generate **$956 million in direct, indirect, and induced economic impact** from FY2016 through FY2024.

Spaceport America generated **$33 million in direct economic impact in FY2019,** not including indirect and induced economic impacts.

The report identified **150 jobs in the space industry** generating economic impacts in FY2019, and is expected to grow to **516 jobs by FY2029** under the Baseline Scenario.

Spaceport America is in a **leading position to compete with other spaceports** in the rapidly growing commercial space sector.

## STRUCTURE OF REPORT

This report is composed of six primary sections:

SECTION SIX

## Technical Appendices



### PUBLIC SPACEPORT DEVELOPMENT: A COMMENT

Like other commercial spaceports, Spaceport America has largely relied on public funding in its initial development and expansion of operational activities—a circumstance that harkens to public facilities developed to support commercial aircraft transportation in the last half of the 20th century.

Public support for the commercial space industry is broad—recognizing the profitable commercialization of space, including location of private space operations and technology development associated with a robust private and government space industry activities. Indeed, it is necessary for commercially viable spaceports to first develop a base capability—in the form of infrastructure, services, and personnel—to support private customers and cultivate their potential competencies.

In roughly a decade, Spaceport America has developed substantial infrastructure and attracted numerous commercial customers. Increased operational activities will require significant expansion of facilities and services. Spaceport America's journey toward realizing its commercial development potential has support in the affected communities. As will be discussed in this report, the regional economy is already beginning to reap significant economic and education enrichment benefits.

SECTION ONE

# 1 The Space Industry

## 1.1 NEW SPACE, OR SPACE 2.0

Seven decades ago at the height of the Cold War, the United States and the former Soviet Union were locked in a space race, which saw a major turning point on July 20, 1969, when Neil Armstrong and Buzz Aldrin walked on the surface of the moon. During this time, the space race was significantly driven by science, defense, and government civil interests. Over the years, other purposes such as commercial satellite telecommunications and earth-observing high resolution imagery became more relevant in space ventures, paving the way for Space 2.0.

Today, there are thousands of satellites orbiting the globe providing a multitude of technological benefits. According to the United Nations Office for Outer Space Affairs, 9,091 objects have been launched into space, of which, 5,498 are still in orbit above the earth.[1] New technologies, combined with the adventurous spirit of entrepreneurs, have opened the door to new possibilities in space exploration. Commercial space exploration has become an economic market in its own right.

1 United Nations Office of Outer Space Affairs, Online Index of Objects Launched Into Outer Space, accessed January 18, 2020, https://www.unoosa.org/oosa/osoindex/search-ng.jspx?lf_id.

## In this economic analysis, we explore the historic development and unique capabilities of New Mexico's Spaceport investment, and assess the returns which may be obtained from its Space 2.0 opportunities.

A recent analysis of the space sector reports that in 2018 worldwide expenditures in the commercial space market were estimated to be $415 billion.[2] Since the year 2000, more than $21.8 billion has been invested in space start-up companies, with 2018 seeing a record $3.2 billion.[3] Sixteen of the world's richest billionaires have significant space-related investments. The key participants in this race are a group of private enterprises and government agencies such as the National Aeronautics and Space Administration (NASA) and Department of Defense (DOD). New private-public joint ventures combine the capital of private investors with the expertise of government agencies with more than 60 years of experience in space exploration.[4]

As an example, Lockheed Martin and Boeing combined their respective launch operations into a new entity, United Launch Alliance (ULA), to take advantage of economies of scale for the benefit of their NASA and DOD customers, with a focus on government launches. Another example is the partnership between Airbus and Safran, which focuses on commercial spaceflight. Tech giants Facebook and Google have independently pursued projects of their own, focused generally on connecting marginalized populations. SpaceX is taking the commercial space development to new heights by spearheading plans to colonize Mars. They are designing reusable first-stage boosters to significantly lower the costs of space launching services. The plans to send humans to Mars are still years away from completion, but this ambitious goal serves to exemplify the innovative thinking behind the Space 2.0 explorations.

The commercial space market opportunities are not only related to firms delivering space launch services, but also exist in the earth-bound enterprises developing technology, manufacturing, and science research. Microbiological sciences and semiconductor wafer processing, for example, have demonstrated tremendous economic potential in commercial space applications such as unmanned satellites. Developing the industrial base capacity to facilitate the technology innovation, manufacturing, and personnel supporting these economic endeavors is a huge component of the emerging opportunities.

Spaceport America stands at the threshold of this potential. In this economic analysis, we explore the historic development and unique capabilities of New Mexico's spaceport investment and assess the returns which may be obtained from its Space 2.0 opportunities. We investigate factors that can impact these opportunities and attempt to give focus to the capabilities required to achieve the economic potential of Spaceport America.

ABBREVIATIONS

**NASA:** National Aeronautics and Space Administration

**DOD:** Department of Defense

TERMINOLOGY

**New Mexico Spaceport Authority (NMSA):** The government entitiy administratively attached to the New Mexico Economic Development Department that has fiscal responsible for operations and planning.

**Spaceport America (Spaceport):** The physical facility administered by NMSA.

The lower-case term spaceport is a more general reference to the types of activities—educational, employment, construction—associated with space-related operations or businesses.

2 The Space Foundation, "The Space Report Reveals 2018 Global Space Economy Exceeded $400 Billion for the First Time," press release, July 15, 2019, accessed November 14, 2019, https://www.spacefoundation.org/2019/07/15/the-space-report-reveals-2018-global-space-economy-exceeded-400-billion-for-the-first-time/.

3 Bryce Space and Technology, Start-Up Space: Update on Investment in Commercial Space Ventures, 2019, p.14, accessed November 12, 2019, https://www.brycetech.com/reports.html. (Bryce, 2019).

4 "To Infinity and Beyond–Global Space Primer," Bank of America Merrill Lynch, October 30, 2017, p.1. (Merrill Lynch, 2017).

# 1.2 PERSPECTIVES ON OPPORTUNITIES

It is important to begin this investigation with a perspective on the opportunities Spaceport America may be able to engage.

## 1.2.1 Commercial Opportunities

The Congressional Research Service (CRS) reported that of the $323 billion of global spending on space activities in 2016, nearly 40% was generated by commercial space products and services, and 37% by commercial infrastructure and support industries. Focusing on the government component of this spending, the US government—including national security agencies and NASA—accounted for about 14% of global spending; and government spending by other countries was responsible for the remaining 10%.

The CRS also reported that, in 2015, global satellite manufacturing revenues were $6 billion; launches booked $2.6 billion in revenue, and ground stations—the largest part of the commercial space infrastructure—generated more than $100 billion in revenue, largely from geolocation and navigation equipment.[5]

Current estimates of worldwide expenditures on commercial space enterprises exceed $400 billion per year, with common expectations these annual expenditures will exceed $2 trillion in the next several decades.[6]

One of the fastest-growing components of this industry is the manufacturing and deployment of small, low-cost satellites. According to the CRS:

> *A renewed interest in low-cost satellites, some of which are small enough to be held in one hand, is prompting a range of start-ups and providing new accessibility to space by educational institutions, small businesses, and individual researchers.*[7]

Commercial satellite payloads are generally launched by private providers, and the payloads themselves are increasingly likely to be owned by private entities. Of the 884 US-owned satellites currently in orbit in April 2019, 523 were launched for commercial reasons.[8]

Besides satellites, current market opportunities are dominated by commercial launches and insurance. Space insurance is a fairly new development and includes coverage of various phases of the launch process including prelaunch hardware transportation, the launch itself, and satellites in-orbit.[9]

It is anticipated that several primary entities will continue to dominate spending: national space agencies, such as NASA and the European Space Agency (ESA); military programs, such as the US Air Force; and incumbent commercial aerospace, defense contractors, and joint ventures, such as United Launch Alliance and Arianespace. Private companies and commercial space players such as SpaceX and Blue Origin will likely play a growing role, as will a number of unproven moonshot projects such as space tourism, intercity rocket and hypersonic travel, asteroid mining, and deep space and interstellar exploration.[10]

5 Bill Canis, Commercial Space Industry Launches a New Phase, Congressional Research Service, Report 7-5700, Washington, DC, December 12, 2016. (CRS, 2016).
6 Bryce, 2019.
7 CRS, 2016, p.2.
8 Union of Concerned Scientists, UCS Satellite Database, accessed October 12, 2019, https://www.ucsusa.org/nuclear-weapons/space-weapons/satellite-database#.
9 Jackie Wattles, "Why On Earth Would a Company Offer Insurance for Space Travel?," CNN Business, September 15, 2018, accessed November 4, 2019, https://money.cnn.com/2018/09/15/technology/business/space-insurance-industry/index.html.
10 Merrill Lynch, 2017, p. 1.

The most well-known private space firms in the United States are SpaceX, Blue Origin, and Virgin Galactic. All three firms are working to open space travel and commerce to individuals and institutions outside of government organizations.

Since inception in 2002, SpaceX has established itself as the first commercial organization to deliver cargo to the International Space Station (ISS) and has successfully recovered booster rockets for future use. Founded in 2000, Blue Origin's mission is to enable private human access to space in a low-cost and reliable manner. Virgin Galactic has the most immediate potential to provide a commercial space tourism company, with near-term deployment of a reusable spacecraft that is based at New Mexico's Spaceport America.

The military application of space technologies is an extremely large component of the available commercial opportunities. Extensive science and technology private-public partnerships have emerged, and the involvement of the national laboratories in space-related research and deployment activities serves to anchor much of the US government program activities—activities that have a very special relationship to the state of New Mexico.

The evolution of this market is fraught with risks, but worldwide annual expenditures exceeding trillions of dollars are consistently forecasted in the next decades.

## 1.2.2 Government-Related Opportunities

Government entities such as DOD's Defense Advanced Research Projects Agency (DARPA) and NASA are major players in the space industry and play a critical role in determining how commercial spaceports develop.

There are a variety of government programs aimed at involving both commercial spaceports and commercial aerospace companies. Entities such as the US Air Force and NASA have grown increasingly interested in commercial launch services because they tend to be cheaper and more convenient than traditional launches. In 2019, NASA released its plan to open the ISS to commercial clients:

> *The plan, announced at an event at the Nasdaq stock exchange in New York, is the latest push by NASA to encourage both increased commercial use of the ISS while building up a supply of commercial facilities that could eventually succeed the station.*[11]

This is part of a larger NASA initiative to partner with commercial companies that can support its missions in the near future.

### 1.2.2.1 OVERVIEW OF MAJOR GOVERNMENT SPACE LAUNCH INITIATIVES

There are a number of government-led space launch programs that are relevant for Spaceport America and its current and potential clients. The Defense Innovation Unit (DIU) is a DOD organization—military and civilian staffed—founded to assist the military to make faster use of emerging technologies, offering recurring research and development funding to private entities working on problems relevant to national security.

Particularly relevant for the commercial space industry are the DIU's Rapid Agile Launch Initiative (RALI) and assorted microsatellite programs.[12] SpinLaunch, one of Spaceport America's customers, is currently participating in the RALI program.

DARPA's Experimental Spaceplane program is similarly trying to achieve fast and low-cost access to space with its new class of hypersonic aircraft.[13] The

ABBREVIATIONS

**CRS:** Congressional Research Service

**DARPA:** Defense Advanced Research Projects Agency

**DIU:** Defense Innovation Unit

**ESA:** European Space Agency

**RALI:** Rapid Agile Launch Initiative

11 Jeff Foust, "NASA Releases ISS Commercialization Plan," SpaceNews, June 7, 2019, accessed November 13, 2019, https://spacenews.com/nasa-releases-iss-commercialization-plan/.

12 These initiatives emerged specifically out of the growing threat of attacks on satellite communication infrastructure and the need for a fast, cost-efficient response to compromises to orbiting infrastructure.

13 Hypersonic capabilities are generally defined as exceeding five times the speed of sound.

program objective is to provide orbital launch capability with days' notice by using a reusable spaceplane that carries an expendable second stage on its back. The DARPA Launch Challenge is a two-stage competition that tests qualified teams on their ability to successfully and efficiently launch payloads to orbit on extremely short notice. However, only one team remains in this competition with a first launch to take place in early 2020.[14]

There are also two DARPA/US Air Force Hypersonic Weapons concepts programs: Tactical Boost Glide Systems and the Hypersonic Air-Breathing Weapon Concept. NASA, too, has pushed toward public-private collaboration, introducing several new solicitations for project and prototype proposals from the private sector.[15] More detailed descriptions of each program are provided in Appendix A.

Across the industry, public-private partnerships are becoming increasingly common as government entities such as NASA and the military recognize the potential for significant cost reduction and increased agility resulting from partnering with commercial space companies.

## 1.3 COMMERCIAL SPACEPORTS

The role of the US government as the primary sponsor of spaceport development has evolved, and simultaneously the role of commercial space technology developers has emerged, resulting in significant enabling legislation tied to commercial space infrastructure development being passed in federal, state, and local jurisdictions.[16] Indeed, as in New Mexico, public funding has been made available for spaceport development.

Spaceport America is currently one of 12 Federal Aviation Administration (FAA)-licensed spaceports in the United States. Figure 1 includes a list of each spaceport, its operator, location, license expiration date, and if it has vertical launch capabilities (VLC) and horizontal launch capabilities (HLC).

14 The competition provides a $10 million prize that will be awarded if two successful low earth orbit launches can be completed within several weeks of each other from two different launch sites. The launch sites are now limited to coastal vertical launch facilities, but until October 2019, had also included Virgin Orbit, a horizontal launch technology competitor. "DARPA Updates Competitor Field for Flexible, Responsive Launch to Orbit," Defense Advanced Research Projects Agency, press release, October, 22, 2019, accessed October 24, 2019, https://www.darpa.mil/news-events/2019-10-22.

15 Utilizing Public-Private Partnerships to Advance Tipping Point Technologies, NASA Space Technology Mission Directorate, updated May 29, 2018, accessed October 21, 2019, https://nspires.nasaprs.com/external/solicitations/summary!init.do?solId=%7b2526CB35-BBC9-BE00-E54A-F965B85401FE%7d.

16 Infrastructure for spaceport development includes vertical and horizontal capabilities, mission control towers, hangars, fuel loading and storage areas, payload integrations and processing facilities, emergency and safety facilities, and a variety of other support facilities. See Janet K. Tinoco and Chunyan Yu, Emerging Business Models for Commercial Spaceports: Current Trends from the US Perspective, Embry-Riddle Aeronautical University, October 13, 2016, accessed October 14, 2019, https://commons.erau.edu/publication/1166.

FIGURE 1: FAA-Licensed Commercial Spaceports
United States

| OPERATOR | SITE | STATE | LIC. EXPIRES | VLC | HLC |
|---|---|---|---|---|---|
| **Midland International Airport** | Midland International Airport | TX | Sept. 14, 2024 | ⊗ | ✓ |
| **Mojave Air & Space Port** | Mojave Air & Space Port | CA | June 16, 2024 | ⊗ | ✓ |
| **New Mexico Spaceport Authority** | Spaceport America | NM | Dec. 14, 2023 | ✓ | ✓ |
| **Space Florida** | Cape Canaveral Spaceport & Shuttle Landing Facility | FL | Nov. 7, 2023 | ⊗ | ✓ |
| **Space Florida** | Cape Canaveral Air Force Station | FL | June 30, 2023 | ✓ | ⊗ |
| **Alaska Aerospace Corporation** | Pacific Spaceport Complex Alaska | AK | Sept. 23, 2023 | ✓ | ⊗ |
| **Adams County** | Colorado Air & Space Port | CO | Aug. 16, 2023 | ⊗ | ✓ |
| **Virginia Commercial Space Flight Authority** | Mid-Atlantic Regional Spaceport | VA | Dec. 18, 2022 | ✓ | ⊗ |
| **Harris Corporation** | California Spaceport | CA | Sept. 18, 2021 | ✓ | ⊗ |
| **Oklahoma Space Industry Development Authority** | Oklahoma Air and Space Ports | OK | June 11, 2021 | ⊗ | ✓ |
| **Houston Airport System** | Ellington Airport | TX | June 25, 2020 | ⊗ | ✓ |
| **Jacksonville Aviation Authority** | Cecil Field | FL | Jan. 10, 2020 | ⊗ | ✓ |

**Virginia Commercial Space Flight Authority, Cape Canaveral Spaceport, and Alaska Aerospace Corporation are the only spaceports to have successfully launched to orbit.*

One of the unique features of Spaceport America is its remote location, which allows for safer horizontal and vertical launches. Of the 12 FAA-licensed spaceports, only six have HLC: Midland International Airport, Oklahoma Air and Space Ports, Ellington Airport, Cecil Field, Colorado Air & Spaceport, and Mojave Air & Spaceport. Of those six, three are located near or directly adjacent to major commercial airports.

Vertical launch systems are currently the most common technology for space launch, and because vertical launching requires a significant area of clearance due to the unpredictability of the exact landing location of the booster stage, being directly adjacent to a commercial airport makes it unlikely that any of those spaceports will be able to launch vertically with the current technology. Only two of the 12 licensed spaceports have both HLC and VLC: Space Florida, which includes Cape Canaveral Spaceport and Shuttle Landing Facility and Cape Canaveral Air Force Station, and Spaceport America.

The remaining four licensed spaceports presently support only vertical launches. Currently, four US spaceports are capable of launching to orbit: Pacific Spaceport Complex Alaska, Mid-Atlantic Regional Spaceport, Cape Canaveral Spaceport and Shuttle Landing Facility, and Cape Canaveral Air Force Station.[17]

17 Currently, orbital launch is constrained by technology requiring rocket booster stages that must be dropped on the way to orbit. SpaceX is perfecting controlled, recoverable booster rocket technology, and this or other technology development such as single-stage launch to orbit may open access to inland vertical orbital launch.

SECTION TWO

2

# Overview of Spaceport America

*This section provides a historical foundation of Spaceport America and places it in context of the larger space industry, including a discussion of the purpose and scope of its operations.*

# 2.1 HISTORICAL SUMMARY

The development of Spaceport America can be traced to initial efforts in the early 1990s by a group known as the Southwest Space Taskforce to lobby the state legislature to create the Office for Space Commercialization within the Economic Development Department. The Office had considerable success in attracting Lockheed Martin to bring their VentureStar program to the state and in winning the right to host annual X Prize Cup events. Cancellation of VentureStar, along with hosting three successful X Prize Cup events, led to refocusing efforts on entrepreneurial space projects. In the mid-2000s, during the administration of Governor Bill Richardson, a series of legislative efforts set in motion the investments needed to construct the Spaceport.

Among the first legislative actions was the authorization to issue $4 million in Severance Tax Bonds for the construction of roads, runways, and other infrastructure for a Southwest Regional Spaceport site.[18] Subsequent legislation ultimately established the Spaceport Authority to be administratively attached to the New Mexico Economic Development Department. This legislative act led to the formalized process of building Spaceport America.[19]

In 2006, the New Mexico Legislature approved the Regional Spaceport District Act.[20] This law enabled the development, creation, and promotion of a Southwest Regional Spaceport. It also enabled the election and imposition of the Municipal and County Regional Spaceport Gross Receipts Taxes (GRTs). These measures were instrumental in the development of Spaceport America.

In 2007, the New Mexico Legislature authorized up to $100 million in Severance Tax Bonds, with recognition that the construction of Spaceport America would not exceed $225 million.[21] The path to completion, however, was far from straightforward. A series of legislative proposals, county commission hearings, and public debate and votes dating back to the early 2000s provided the backdrop for the development of the Spaceport. A comprehensive set of the relevant New Mexico statutes is provided in Appendix B.

## 2.1.1 Discussion of New Mexico Legislative & Community Support from NMSA, Doña Ana and Sierra Counties, and More

The creation of Spaceport America can be traced back to the legislators who foresaw the scientific, economic, and educational benefits that the Spaceport would bring to New Mexico. The development of Spaceport America would not have been possible without the assiduous efforts by state legislators who set the public foundations for its development.

The creation of Spaceport America also required buy-in from the local community. In the spring of 2007, Doña Ana County voters approved a measure to impose an additional 0.25% GRT increment to fund the Spaceport. The tax was narrowly

18 HB 239, 2004 NM Legislature, authorizing the Economic Development Department to issue Severance Tax Bonds to design and construct roads, runways, and other infrastructure for a Southwest Regional Spaceport site.

19 Laws 2005, ch. 128, Spaceport Development Act, Sections 58-31-1 through 58-21-18 (NMSA 1978). The Spaceport Authority evolved and was merged with the Spaceport Commercialization Division within the New Mexico Economic Development Department. The Spaceport Commercialization Division was eliminated from the Economic Development Department, but its staff, functions, property, and contracts were transferred to the Spaceport Authority. These changes were codified into Section 9-15-4 NMSA 1978 at the end of the 2006 Regular Legislative Session.

20 Section 7-20E-25 (NMSA 1978).

21 Senate Bill 827, Section 68 passed by the New Mexico Legislature in 2007 authorized issuance of Severance Tax Bonds at such time as the Spaceport Authority certified its need for the proceeds of the bonds, anticipating such needs would extend over a multiyear period. Section 68.C. of the legislation provided that:
The proceeds from the sale of the bonds are appropriated to the Spaceport Authority to acquire land and to plan, design, construct, furnish, and equip the southwest regional spaceport in Sierra County and to acquire rights of way, plan, design, and construct drainage and paving improvements and transportation infrastructure improvements in Sierra County and Doña Ana County that are related to the spaceport.

approved with 50.8% in favor in Doña Ana County. However, Sierra County adopted the 0.25% GRT increment ordinance in 2008, which voters approved with a 65.7% favorable margin in April of that year. Dona Aña County's narrow approval rate suggests the support was not entirely resolved, and the GRT issue continues to be a topic for debate.

Legislative funding, combined with tax increment distributions and proceeds from GRT Revenue Bonds provided the financial means for the construction and completion of Spaceport America. As the Spaceport became operational, voices of inconformity arose, arguing that the Spaceport was not producing economic benefits. The opposition rose to the level of requesting records from the Spaceport to assess its economic impact on the region,[22] and to propose repealing the spaceport local option GRT.

The opposition to Spaceport America generally raises two concerns: one relating to continuing the local GRT increment, and the other relating to concerns the promised economic impact is illusory.

With respect to the local GRT increments, the commonly expressed concern is that residents were led to believe that the GRT increment would not be used to fund the operations, but would only be used for Spaceport construction bond retirement—an expressed concern that is not consistent with the statutory authority for the tax.[23] There have been years in which the GRT revenue increment has exceeded bond repayment obligations, and the surplus has been used to fund Spaceport operations.

These concerns have been expressed in both the affected counties and in the New Mexico Legislature, with various proposals offered to limit the use of these funds for operations or to repeal the tax increment completely. At the same time, there are those in the community and legislature that support the Spaceport and are in favor of increasing spaceport investments.

For example, New Space NM, a public-private partnership composed of key figures in the New Mexico aerospace community, released a report in February, 2019, highlighting the opportunities that the commercial space industry has to offer for New Mexico:

> *Over the past year, the New Space NM public-private partnership has worked with over 200 space industry stakeholders to study and educate leaders on the space industry market opportunity, highlight the many New Mexico space assets, and develop recommendations to grow, expand, and attract the New Mexico space industry.*[24]

Generally, supporters recognize that the impacts of Spaceport America are multidimensional, and include increased economic diversity and expansion of science, technology, engineering, and mathematics (STEM) educational activities in New Mexico via classroom outreach and the Spaceport America Cup (SA Cup).[25] Ties between the Spaceport and New Mexico State University (NMSU)

22 See, for example, Heath Haussamen, "After Spaceport Leases Released, NMPolitics.net Settles Lawsuit," NMPolitics, October 17, 2019, accessed November, 11, 2019, https://nmpolitics.net/index/2019/10/after-spaceport-leases-released-nmpolitics-net-settles-lawsuit/.

23 NMSA Section 7-20E-25 -- County regional spaceport gross receipts tax; authority to impose.

A. . . . the members of the governing body of a county that desires to become a member of a regional spaceport district pursuant to the Regional Spaceport District Act shall impose by ordinance an excise tax at a rate not to exceed one-half percent of the gross receipts of a person engaging in business in the district [and]

B. . . . shall dedicate a minimum of 75% of the proceeds of the revenue to the regional spaceport district *for the financing, planning, designing and engineering and construction of a spaceport or for projects or services of the [spaceport] district* . . . and may dedicate no more than 25% of the revenue for spaceport-related projects as approved by resolution of the governing body of the county. *[emphasis added]*

24 New Space NM, The Future in Space is in New Mexico, February 2019, accessed October 17, 2019, http://35.155.163.239/wp-content/uploads/2019/09/2019-New-Space-NM-Report-Final-Digital.pdf.

25 Teams from the University of New Mexico and New Mexico State University are among the approximately 150 teams that compete in the Spaceport America Cup; an unofficial New Mexico-only competition between just the Aggies and the Lobos also exists, which sparks communication between the students at each of these schools and highlights the presence of aerospace research in the state.

NEW MEXICO COUNTY SPACEPORT GROSS RECEIPTS TAX INCREMENT

The 0.25% GRT increment adopted by both Sierra and Doña Ana counties has raised more than $65 million to fund Spaceport America-related activities since enacted in 2007–2008. The funds have been used for a variety of purposes, including the repayment of bonds issued for the construction of the Spaceport America facilities and its operations.

In Sierra County, there have been nearly $170 million in construction activities related to the Spaceport, and in Doña Ana County both construction and operational activities have generated more than $23 million in taxable direct expenditures. These activities have generated Taxable Gross Receipts.

NMSA has provided for a part of capital expenditures through revenue bonds issued in 2009 and 2010, and the 0.25% GRT increment has been assessed over the subsequent time period. Current balances owed on the bonds that have been issued stand at $49.4 million, and these bonds will not be retired until 2029 under current repayment schedules.

Doña Ana County has had GRT spaceport increment distributions of $24 million, and Sierra County has been provided GRT distributions of $1.4 million during this time period. These GRT distributions have been augmented by the direct, indirect, and induced economic activities associated with the Spaceport. There's no precise way to quantify the GRT contributions associated with Spaceport America economic activities, but the substance of this report is helpful in understanding these fiscal impacts.

Importantly, the appropriate way to understand the relationship between the 0.25% tax increment and the economic and fiscal benefits is to recognize the time shifting of the benefits relative to the tax increment. That is, substantial GRT revenues are generated by the major capital investments and expanding operational activities during the period in which a two-decade long revenue stream is created for the repayment and retirement of the bond indebtedness.

were strengthened in 2019 with the opening of new offices at Arrowhead Center located on the university campus, and the signing of a Memorandum of Agreement to form a collaborative effort to advance student success in the STEM fields, along with research, economic development, and community outreach.[26]

In summary, further appropriations and capital outlay allocations advanced the construction of Spaceport America. Total depreciable assets are valued at $169,152,378 in FY2018. This includes the buildings, vehicles, and equipment at the Spaceport.[27] Additional support has come from state legislators and from Governor Michelle Lujan Grisham. This support includes the formation of the Space Valley Collaboratory, announced by Governor Lujan Grisham on January 8, 2020.[28] As Virgin Galactic continues its preparations to send tourists into space, New Mexico officials have appropriated funds to the New Mexico Tourism Department to host watch events around the state for the inaugural launch.[29]

26 "NMSU and Spaceport America to Announce STEM Partnership, Unveil Spaceport America's New Las Cruces Office," Spaceport America, press release, September 6, 2019, accessed October 30, 2019, https://www.spaceportamerica.com/nmsu-and-spaceport-america-to-announce-stem-partnership-unveil-spaceport-americas-new-las-cruces-office/.

27 NMSA 2018 Comprehensive Annual Financial Report (CAFR), Note 9.

28 An initiative collaboratively joining the space-related activities of Sandia National Laboratories, Los Alamos National Laboratory, Kirtland Air Force Base, White Sand Missile Range, New Mexico's academic community, and related state agencies.

29 Senate Bill 536, Section 13 passed by the 2019 Legislature appropriates $100,000 to the Tourism Department related to this Virgin Galactic inaugural flight.

FIGURE 2: Spaceport America Timeline

**2020** — Governor Lujan Grisham conducts Space Valley Summit and announces Space Collaboratory

**2019** — $12M General Fund appropriated for launch facilities; Virgin Galactic finishes interior 'Fit-Out' of 'Gateway to Space'; UP Aerospace successfully launches SL-14 rocket to 57 mile altitude with NASA payload

**2018** — Commercial Aerospace Protection Act enacted; completion of Southern Access Road

**2017** — Inaugural Spaceport America Cup competition held

**2016** — Government liquor control licenses issued to NMSA

**2013** — Appropriations continue to be authorized for projects such as a taxiway and internal roads; Spaceport liquor license approved

**2012** — First licensed launch from Spaceport America

**2011** — Virgin Galactic 'Gateway to Space' Dedication

**2010** — NMFA issued GRT Revenue Bonds on behalf of NMSA in the amount of $20.6 million; Dedication of Runway at Spaceport America

**2009** — NMFA issued GRT Revenue bonds on behalf of NMSA in the amount of $58 million; Spaceport construction breaks ground

**2008** — Sierra County voters approve GRT increase to help fund construction

**2007** — Legislature authorizes up to $225 million and approves up to $100 million Severance Tax Bond issuance to fund Spaceport construction; Dona Ana County voters approve GRT increase to help fund construction; Design plans for the Spaceport released

**2006** — Spaceport Development Fund created; temporary launch facility active; first vertical launch from Spaceport

**2005** — New Mexico Spaceport Authority created; $1M General Fund appropriated for developing the Southwest Regional Spaceport

**2004** — $4 million in Severance Tax Bonds authorized for infrastructure improvements for SW Regional Spaceport

**2003** — Use of Spaceport vehicles and fuel become exempt from GRT

**2001** — Changes to GRT and Compensating Tax allow deduction for "space operations operating and recovering space vehicles or payloads"

**1998** — Contingent appropriations made to Space Commercialization Division to develop a proposal for construction of a spaceport

**1997** — Space Commercialization Division developed

**1996** — Legislative proposals for spaceport construction first introduced - unsuccessful

**1994** — Office for Space Commercialization established by the New Mexico legislature

## 2.2 ATTRIBUTES & COMPETITIVE DEVELOPMENT POTENTIAL

Spaceport America is the world's first purpose-built commercial spaceport. Situated on 18,000 acres neighboring the US Army White Sands Missile Range (WSMR), the Spaceport has access to the rocket-friendly environment of 6,000 square miles of restricted airspace belonging to WSMR—an area larger than the state of Connecticut. Sparse population allows for launching and testing without putting any large population at risk.[30] The Spaceport offers a 12,000-foot runway, vertical launch complexes, and a favorable climate offering 340 days of sunshine and low humidity.

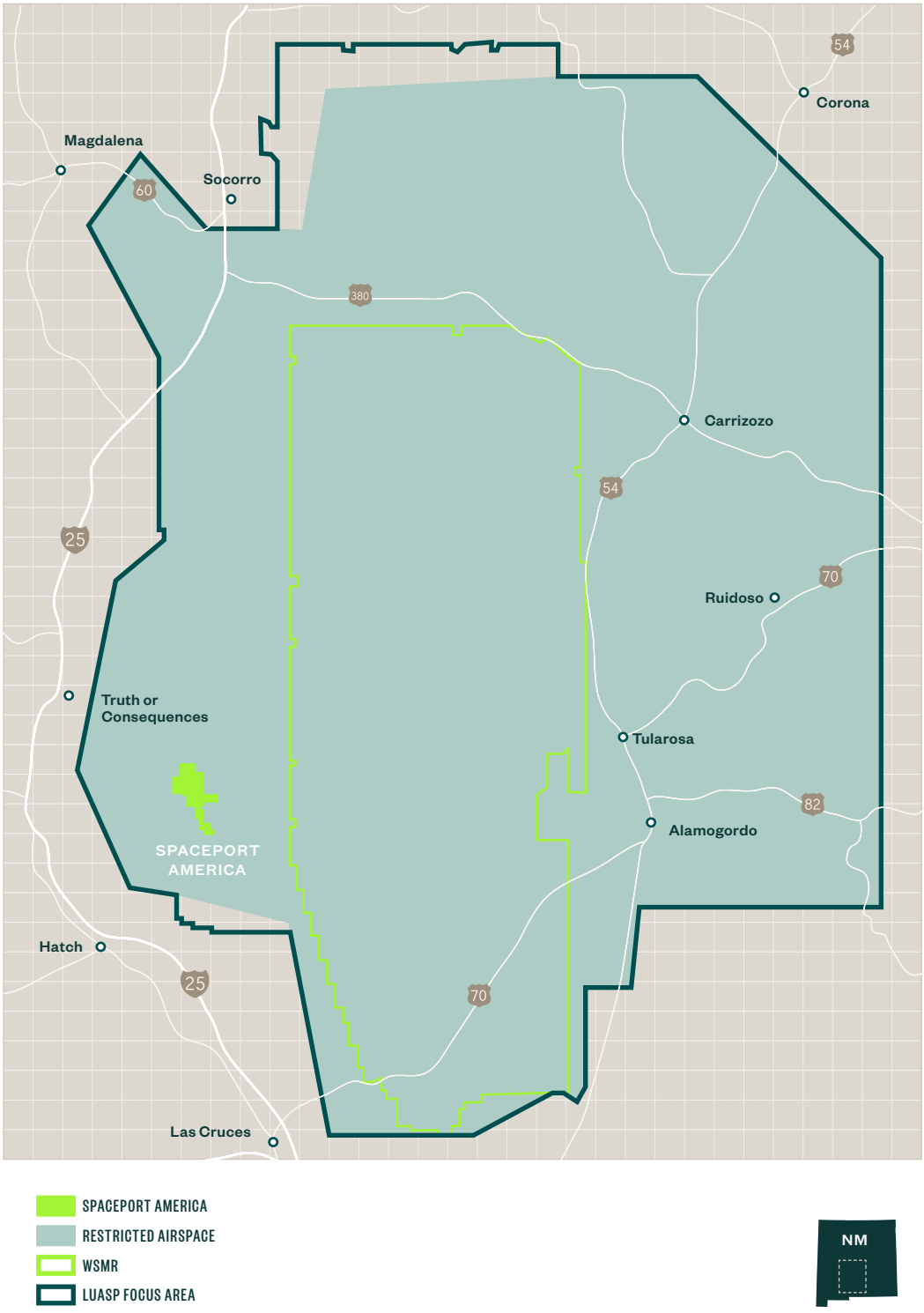
It is notable that Spaceport America is located on a site that is approximately 4,600 feet above sea level that, compared to coastal space launch facilities, essentially provides the significant advantage of a one-mile head start on reaching space, as well as thinner air and reduced drag. These advantages significantly reduce the energy requirements to achieve launch apogees and orbital goals.

Figure 3 depicts the single most distinguishing feature of Spaceport America—access to 6,000 square miles of restricted airspace. There are only two locations in the United States where the FAA does not control airspace operations: over the White House and Capitol complex in Washington, DC, and WSMR and Spaceport America. Spaceport America and WSMR have a Memorandum of Agreement allowing Spaceport America to have access to the restricted airspace controlled by WSMR. No private aircraft may utilize this airspace, and the diagram depicts how air traffic is routed around this restricted airspace.

30 For example, Spaceport America has standing agreements with the seven residents, ranchers, located within five-mile radius related to evacuation prior to launch activities.

**FIGURE 3:** Restricted Airspace Map

Spaceport America and White Sands Missile Range

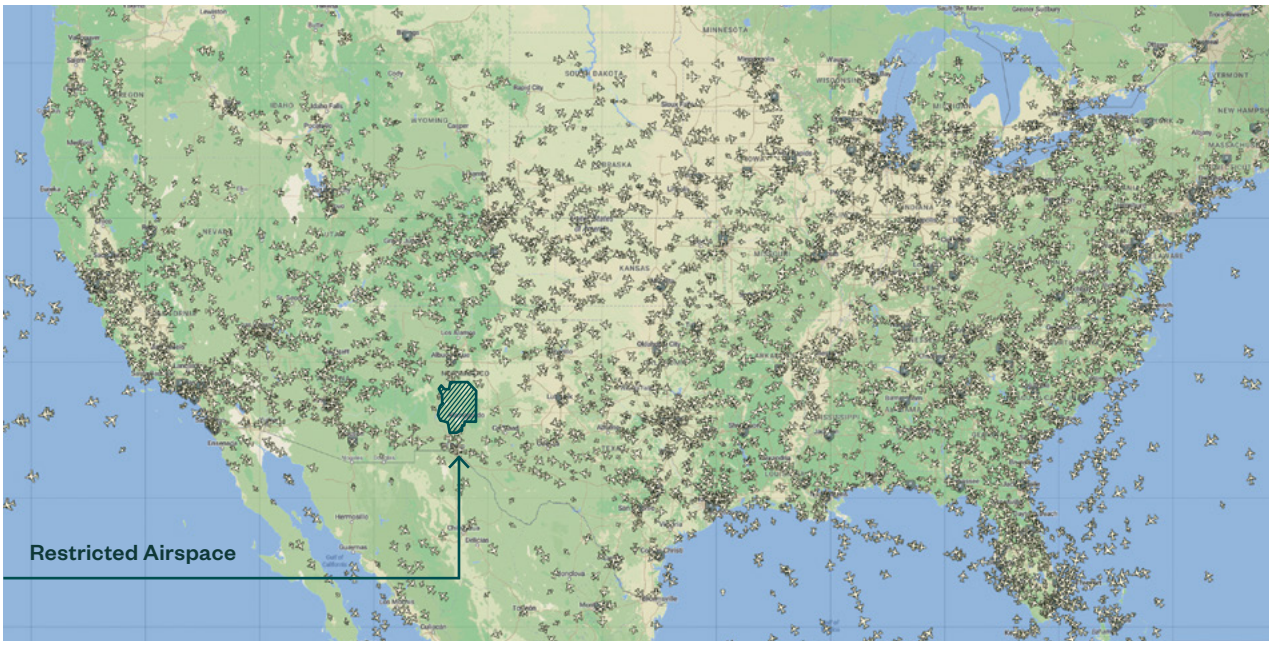


The restricted airspace surrounding Spaceport America is graphically depicted in Figure 4. The red lines in the diagram reflect actual aircraft flight paths and graphically illustrates the benefit of the restricted airspace—the only airspace conflicts would result from WSMR operations.

**FIGURE 4:** Air Traffic
Spaceport America and White Sands Missile Range

Commercial and private air traffic is able to utilize all other airspace controlled by the FAA in the United States. Figure 5 below graphically depicts common utilization of airspace throughout the United States, and virtually every other spaceport must coordinate spacecraft launches by having the FAA reroute air traffic to allow for safe launch windows. No other US spaceport launch site enjoys Spaceport America's restricted airspace advantage.

**FIGURE 5:** US Air Traffic[31]




The journey toward having a profitable business in an emerging industry is complex to say the least. Other spaceports across the nation face similar challenges as Spaceport America—meaning that they're not self-sustaining,

31 Image courtesy of AirNav Systems: www.radarbox24.com.

including competitors in Florida and Virginia.[32,33] Public funds—federal, state, or local—are used to fund operations and development at other spaceports. As recently as October 2019, it was announced that Space Florida would receive almost $90 million in federal funds to replace the Cape Canaveral Spaceport Indian River Bridge.[34] Operating revenues also rely on state appropriations. The Florida Department of Transportation (FDOT) has made significant investments in infrastructure and program funding. In FY2018, FDOT invested $34 million in the Florida Spaceport.[35]

Space Virginia funding resembles that of Florida in the sense that it also relied on public funding for operations. During FY2018, Space Virginia registered a net operating loss of almost $18 million. The operating revenue came in at $9.8 million while operating expenses amounted to $27.9 million. In terms of cash, the Virginia spaceport received state appropriations of $15.9 million from noncapital financing activities and $20 million in cash from capital financing activities.

The funding reported in Florida and Virginia serves simply to illustrate how the various spaceports across the United States to this day rely on public funds.

The competitive position of Spaceport America is strong, but the coastal launch sites currently dominate. These coastal sites are advantaged by orbital launch technologies, which at the present time allow orbital launches with booster rockets landing in ocean environments. Until reusable boosters are successfully developed, or launch-to-orbit technologies allow inland spaceports to provide FAA-approved orbital launch trajectories, inland spaceports are disadvantaged with respect to orbital launch capabilities.

However, both the need for rapid orbital launch capabilities, and economic cost considerations, are driving technology developments that should create opportunities for Spaceport America to engage in increasingly robust and competitive service offerings throughout the portfolio of Space 2.0 commerce.

32 Space Florida is an independent special district and political subdivision of the state that was created by the legislature in 2006, and has engaged in master planning for the modernization and growth of space infrastructure throughout five designated geographic districts. Since 1998, Space Florida and industry partners have enabled approximately $1 billion in non-federal public and private investment in Florida's spaceport infrastructure. All Florida Spaceport System partners receive annual funding to accomplish their individual missions. As an independent special district of the state of Florida, Space Florida has unique financing capabilities, and has been responsible for the funding and financing of $639 million space facilities investments to date. Space Florida, Florida Spaceport System Plan 2018, accessed November 16, 2019, https://www.spaceflorida.gov/wp-content/uploads/2018/12/FSSP18_FINAL__03-06-2018__Low-Res.pdf.

33 Created in 1995, the Virginia Commercial Space Flight Authority is a political subdivision of the Commonwealth of Virginia. Virginia Space owns and operates the Mid-Atlantic Regional Spaceport (MARS), the MARS Payload Processing Facility, and the MARS Unmanned Systems Test Range. Collocated on the NASA Wallops Flight Facility on the eastern shore of Virginia, the mission of Virginia Space and MARS is to provide low-cost, safe, reliable, schedule-friendly access to space and secure facilities for testing of unmanned vehicles for integration into the National Air Space. According to a report by the Performance Management Group (PMG) at VCU entitled, Competitive Analysis of Virginia's Space Industry, the Virginia space industry contributes $7.6 billion in annual direct economic output and directly supports 29,638 jobs. Virginia Space, History of MARS, accessed November 16, 2019, http://vaspace.org/index.php/about-virginia-space/history-of-mars.

34 "Space Florida Awarded $90M Infrastructure Grant from US Department of Transportation," Space Florida, October 17, 2019, accessed November 16, 2019, https://www.spaceflorida.gov/news/space-florida-awarded-90m-infrastructure-grant-from-u-s-department-of-transportation/.

35 "Gov. Scott's Fighting for Florida's Future Budget Invests More Than $10 Billion in Florida's Transportation and Infrastructure," Capital Soup, January 31, 2017, accessed November 16, 2019, https://capitalsoup.com/2017/01/31/gov-scotts-fighting-floridas-future-budget-invests-10-billion-floridas-transportation-infrastructure/.

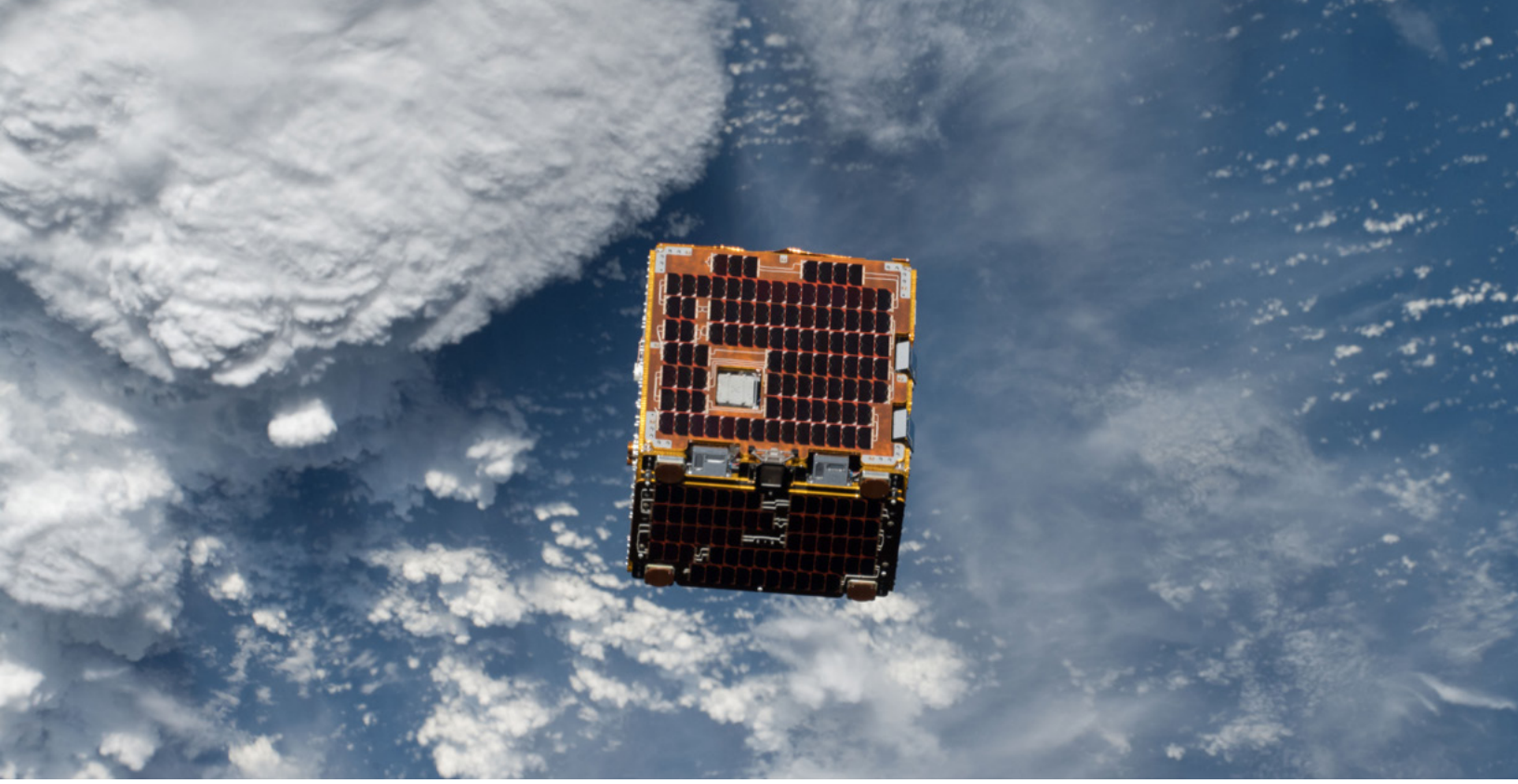


*Image credit: NASA*

# 2.3 CURRENT STATUS OF SPACEPORT AMERICA

## 2.3.1 Statement of Scope of Spaceport America Development & Breadth of Purpose Such as Launch, Non-Launch, and Educational Priorities

Spaceport America is committed to providing state-of-the-art facilities and services that further the commercialization of space exploration. Spaceport America offers infrastructure for both horizontal and vertical launches, and a host of various firms have taken advantage of Spaceport America launching facilities to conduct horizontal and vertical tests.

Educational outreach is a significant component of Spaceport America initiatives. Spaceport America hosts the annual SA Cup, and staff at the Spaceport conduct STEM outreach to middle school students. NMSA's Dr. Bill Gutman leads classroom visits to every sixth-grade classroom in Las Cruces, also showcasing the research and launch activities statewide. Dr. Gutman reaches approximately 1,200 sixth-grade students annually.

The purpose of Spaceport America extends beyond simply providing a facility for rocket launches. The spaceport is committed to playing an important role in the future of space exploration by inspiring and helping to prepare the next generation of space explorers.

## 2.3.2 Developments

Spaceport America seeks to improve its service delivery by enhancing and adding to its current capital infrastructure. The Spaceport has laid out a five-year plan to invest in capital projects that will enhance services to its customers. These investments are in equipment, facilities, and transportation. These upgrades would cost $10.5 million over four years.

Spaceport America is planning to construct several buildings for different purposes. IT, visitor access, welcome center, payload processing center, warehouse, and rocket motor test facilities have all been proposed. The construction of dedicated buildings for these operations would add up to $70 million over five years.

The third development component is related to transportation. Spaceport America is planning to invest in a Runway Taxiway, an investment that will cost a total of $20 million over two years.

In FY2019, the core network equipment overheated twice. This is due in part to the age of the equipment. Most of the IT equipment is more than nine years old and past its end-of-life. The location of the equipment is also of high importance. The current network distribution center is located in the Terminal Hangar Facility building. Importantly, cell phone service is limited to one carrier.

Identified infrastructure issues relate to upgrade of reliability of the electrical services provided by the incumbent utility—Sierra Electric Cooperative, Inc.—as there's a significant record of recent outages, which could impact critical operations at the spaceport.[36] Additionally, a short rail spur would significantly augment future heavy equipment and bulk commodities deliveries.

## 2.3.3 Operations

### 2.3.3.1 COMMERCIAL LAUNCHES

Spaceport America is host to a number of companies at the forefront of space exploration. The following list includes Spaceport America's current commercial clients:

| |
|---|
| **ABL Space Systems** |
| **Boeing** |
| **EXOS Aerospace Systems and Technologies** |
| **Pipeline 2 Space, Inc.** |
| **SpinLaunch, Inc.** |
| **UP Aerospace, Inc.** |
| **Virgin Galactic, Inc.** |

In FY2019, Spaceport America had 16 aerospace launches, 12 of which were vertical. These launches were conducted by several of its customers listed above.

36 Unclear at the time of this report's development is whether or not the issues relate to the reliability of the electric service supplied by the cooperative, or internal to Spaceport America's internal electrical distribution systems.

### 2.3.3.2 ANCHOR TENANT: VIRGIN GALACTIC

In 2019, Virgin Galactic relocated 140 staff members to its headquarters in Las Cruces, New Mexico, to support accelerating operations, and is actively trying to fill additional positions—over 200 total—to support its commercial launches. Several investments and contracts have been announced in late 2019,[37] and the firm revealed its commercial-specification spacesuit in mid-October 2019. The flight equipment is actively testing and progressing toward FAA flight certifications before their operational readiness objective date in 2020.

George Whitesides, CEO of Virgin Galactic, has touted the opportunities offered by Spaceport America. The company is shifting operations from Mojave to Spaceport America, with support staff moving to New Mexico. The spaceport facilities will allow Virgin Galactic to continue testing operations of its WhiteKnightTwo spacecraft, Spaceship Eve, and launch-related activities with intention of initiating commercial service beginning in mid-2020. As Sir Richard Branson stated,

> *New Mexico delivered on its promise to build a world-first and world-class spaceport. Today, I could not be more excited to announce, that in return, we're now ready to bring New Mexico a world-first, world-class spaceline.*[38]


*Image credit: Virgin Galactic*

### 2.3.3.3 OTHER CURRENT CUSTOMERS

**ABL Space Systems**

ABL Space Systems was founded by former SpaceX engineering leaders in 2017. Its mission is to develop low-cost launch vehicles for the small satellite industry. The company conducted a series of successful tests of its E2 bipropellant rocket engine at Spaceport America.[39] ABL is currently developing RS1, a space vehicle capable of delivering a 1,200-kilogram payload to orbit at the price of $12 million. It is planning a first launch of RS1 in 2020.[40]

**Boeing**

Boeing is the world's largest aerospace company and leading manufacturer of commercial jetliners, defense, space and security systems, and service provider of aftermarket support. Boeing also designs and builds advanced space and communications systems for military, commercial, and scientific uses. Its current operations involve research on commercial spacecraft, such as the CST-100 Starliner, which have the potential of opening up a market for space tourism and manufacturing, as well as supporting operations conducted on the ISS.[41]

**EXOS Aerospace Systems and Technologies**

EXOS Aerospace's mission is to provide "affordable, repeatable, and reliable" commercial spaceflight.[42] In 2012, The EXOS Aerospace team, working as Armadillo Aerospace, became the first FAA-licensed launch operator from Spaceport America with their STIG Family of vehicles. EXOS completed the Pathfinder Launch of the SARGE vehicle on August 25, 2018. This was the first step in testing the SARGE SRLV[43] that was flown and recovered for future use. As part of this launch, EXOS gained valuable flight data that allowed for the

37 "Virgin Galactic and Italian Air Force Announce World First Government Contract for Human Tended Research Flight," Virgin Galactic, October 1, 2019, accessed October 22, 2019, https://www.virgingalactic.com/articles/virgin-galactic-and-italian-air-force-announce-world-first-government-contract-for-human-tended-research-flight/.

38 "Virgin Galactic Moving Commercial Spaceflight Operations Base, 100 Employees to New Mexico's Spaceport America," Office of the Governor Michelle Lujan Grisham, May 10, 2019, accessed October 22, 2019, https://www.governor.state.nm.us/2019/05/10/virgin-galactic-moving-commercial-spaceflight-operations-base-100-employees-to-new-mexicos-spaceport-america/.

39 Annamarie Nyirady, "Lockheed Martin Invests in ABL Space Systems," Via Satellite, July 23, 2019, accessed October 22, 2019, https://www.satellitetoday.com/business/2019/07/23/lockheed-martin-invests-in-abl-space-systems/.

40 Id.

41 Boeing in Space, Boeing, accessed on October 22, 2019, https://www.boeing.com/space/.

42 Team, Exos Aerospace, accessed October 22, 2019, https://exosaero.com/team/.

43 Suborbital Autonomous Rocket with Guidance (SARGE) Suborbital Reusable Launch Vehicle (SRLV)

improvement of the SARGE vehicle design.[44] EXOS Aerospace has a five-year contract with Spaceport America.[45]

**Pipeline2Space, Inc.**

According to its website, "Pipeline2Space is using RAM-Accelerator technology to radically change the economics of space exploration. Pipeline2Space enables projectiles to deliver payloads to space."[46] Pipeline2Space has been operating at Spaceport America for three years.

**SpinLaunch, Inc.**

SpinLaunch is developing an innovative method for providing low-cost access to space for the rapidly growing small satellite industry by developing a terrestrial-based launch platform to place constellations of small satellites into low earth orbit (LEO). According to Bloomberg, "Rather than using propellants like kerosene and liquid oxygen to ignite a fire under a rocket, SpinLaunch plans to get a rocket spinning in a circle at up to 5,000 miles per hour and then let it go."[47]

Eliminating the need to lift a rocket from the ground and into orbit using fuel tremendously lowers the cost of delivering payloads into orbit. In 2018, the company received $40 million in a Series A financing round from Airbus Ventures, Google Ventures, and Kleiner Perkins.[48] SpinLaunch began construction on a new $7 million scale, proof-of-concept test facility at Spaceport America in May 2019.

**UP Aerospace Inc.**

UP Aerospace (UPA) is a space launch and flight test service provider that has developed low-cost and rapid suborbital payload access to space. It achieves this using its SpaceLoft launch vehicle, a low cost but highly reliable Reusable Launch Vehicle (RLV) system. UPA has launched 13 of these vehicles for a variety of customers. Most of the launches are currently conducted for the NASA Flight Opportunities Program. It is also developing a larger vehicle based on this technology that will increase payload capacity and increase microgravity time.[49] UP Aerospace has been launching rockets from Spaceport America since 2006.

44 Exos Aerospace, "Sarge Mission I Success: Exos Aerospace Systems & Technologies, Inc. Announces First SARGE Reuse Mission 1 Test Launch at Spaceport America," press release, March 6, 2019, accessed on October 22, 2019, https://exosaero.com/2019/03/06/sarge-mission-1-success/.

45 EXOS Aerospace has a ground lease with NMSA executed May 1, 2016, with a termination date of April 31, 2021. Michael Baylor, "Exos Aerospace's SARGE Rocket to Serve as Platform for a Reusable Small Satellite Launcher," NASASpaceFlight.com, October 13, 2018, accessed October 22, 2019, https://www.nasaspaceflight.com/2018/10/exos-aerospaces-sarge-platform-reusable-small-satellite-launcher/.

46 Welcome to Pipeline2Space, Pipeline2Space, accessed November 4, 2019, http://www.pipeline2space.com/#welcome

47 Polina Marinova, "This Futuristic Startup Raised $40 Million to Fling Heavy Objects Into Space," Fortune, June 15, 2018, accessed October 22, 2019, https://fortune.com/2018/06/15/spinlaunch-space-catapult/.

48 SpinLaunch Secures First Contract for Revolutionary New Space Launch Services, Business Wire, June 19, 2019, accessed October 22, 2019, https://www.businesswire.com/news/home/20190619005661/en/SpinLaunch-Secures-Contract-Revolutionary-New-Space-Launch. In January 2020, SpinLaunch announced an additional $35 million in investment capital for development of its kinetic launch system. Jeff Foust, "SpinLaunch Raises $35 million," SpaceNews, accessed January 17, 2020, https://spacenews.com/spinlaunch-raises-35-million/.

49 Up Aerospace Inc.: A Space Launch Services Company, Up Aerospace Inc., accessed November 4, 2019, http://upaerospace.us.com/.

*Image credit: Virgin Galactic*

### 2.3.3.4 NON-AEROSPACE ACTIVITIES

In addition to commercial launches, Spaceport America hosts the annual SA Cup. The SA Cup is organized by the Experimental Sounding Rocket Association (ESRA), a not-for-profit organization focused on promoting engineering and rocketry knowledge. ESRA partnered with Spaceport America in 2017, which is when their Intercollegiate Rocket Engineering Competition became a flagship activity of the then-new SA Cup.

In 2019, the SA Cup drew approximately 1,500 college students from 14 different countries. The SA Cup saw a total of 91 launches. It is worth highlighting that more than 98% of participants were undergraduate students.[50] This statistic is telling of the sort of opportunities that Spaceport America offers—students don't need to be enrolled in advanced programs to participate in advanced rocket launching competitions. The types of participants, combined with the volume of launches, reveal the footprint that Spaceport America has on education.

Commercial aerospace and SA Cup launches make up the bulk of the current operations at the Spaceport. There are however, additional activities taking place at the facility. Construction of an expanded fuel farm at the site is in progress.

The design, tank installation, acquisition of new fuel trucks, concrete work, and electronic pumping system have been completed. This first phase of the project cost $3.9 million. The fuel farm enables production and easy supply of various types of fuels used for rocket launches. According to Spaceport America staff, sales of fuel have exceeded initial expectations. It is presumed that location convenience has played in favor of the Spaceport.

Aviation gas, diesel, Jet A, and unleaded gasoline are some of the types of fuels offered at the Spaceport, with other fuels available as required by spaceport customers. The second phase of construction will make the fuel even more accessible to the customers, with a $1.1 million investment to construct a dedicated fuel road to the runway.

Other non-launch activities and business opportunities for the Spaceport include hosting special events. The unique architecture of the hangar provides a scenic backdrop for television commercials, photography sessions, corporate meetings,

50 Moreover, space technology firms, such a Virgin Galactic, have used the Spaceport America Cup as an opportunity to interview prospective employees.

and other special events. In particular, the 12,000-foot runway could be of benefit for the automotive industry in which to showcase their vehicles in action.

### 2.3.4 Defining Spaceport America's Opportunities

In the race for Space 2.0, companies like Virgin Galactic, Boeing, and ABL have utilized Spaceport America for testing and launching activities. These companies have taken advantage of the unique setting that the Spaceport offers. Companies have conducted testing of their technologies at the Spaceport, taking advantage of its ideal climate and most importantly, its restricted airspace.

Virgin Galactic moved its White Knight operations to Spaceport America in August 2019. Boeing has completed three successful launches of large balloons carrying a test version of their CST-100 space capsule designed to ferry crews to and from the ISS. These tests are needed to qualify the parachute recovery system. Release from the balloon and actual parachute testing takes place on WSMR, but winds are most favorable for launching the balloon from Spaceport America during most of the year.

Virgin Galactic, as well as other private firms, is developing and testing spacecraft for commercial services. Fundamentally, the tourism industry may be reshaped by adding spaceflight as a new travel destination. Virgin Galactic's transfer of its spacecraft to Spaceport America will bring the company closer to commercial service. Virgin Galactic's team has been working at Spaceport America getting it ready for commercial service. Ground infrastructure has been installed and ground tests have been conducted at Spaceport America to ensure that it is ready for commercial operations.

With Virgin Galactic as the anchor tenant, space tourism is the dominant public perception of Spaceport America today. Currently, this involves horizontal launches with a detachable spaceship that briefly takes astronauts and cargo into space. Virgin Galactic has also recently announced a contract with the Italian Air Force to fly a research payload mission from Spaceport America, with three Italian astronauts serving as payload specialists for the flight.[51] Virgin Galactic has moved its headquarters to Spaceport America and is currently conducting FAA flight certification testing.

Virgin Galactic is expecting to permanently hangar two WhiteKnightTwo aircraft and up to five SpaceShipTwo spacecraft at Spaceport America within the next several years. With the two launch-assist aircraft and multiple spacecraft on site, Virgin Galactic's goal is to be able to routinely conduct weekly flight operations with passengers, cargo, or a combination of the two.

Aside from its space tourism objectives, Spaceport America has been hosting small vertical suborbital launches carrying payloads. It currently hosts three providers of launch services under the NASA Flight Opportunities Program. This is potentially a fast-growing market in the space industry. In particular, there's a focus on small reusable launch vehicles (SRLVs). The FAA defines RLVs as "vehicles that access outer space, operate within the space environment, return safely to earth, and can be used again…"[52] About 20 RLVs have been successfully launched from Spaceport America.

As discussed above, the commercial space market is currently dominated by the deployment of small satellites. These allow researchers, companies, and governments relatively low-cost access to space. There is a significant history deploying small satellites as secondary payloads on larger rockets, but there

51 Virgin Galactic, "Virgin Galactic and Italian Air Force Announce Worlds First Government Contract for Human Tended Research Flight," press release, October 2, 2019, accessed October 3, 2019, https://www.virgingalactic.com/articles/virgin-galactic-and-italian-air-force-announce-world-first-government-contract-for-human-tended-research-flight/.

52 Federal Aviation Administration, US Department of Transportation, The US Commercial Suborbital Industry: A Space Renaissance in the Making, October, 2011.

has been recent development related to launching smaller rockets into LEO from surface and airborne platforms. For example, Virgin Orbit has recently successfully conducted drop tests of future rocket payloads from modified Boeing 747-400 aircraft, which could further reduce the cost of deploying small satellites into orbit.[53]

There is potential for Spaceport America to eventually launch to orbit, but this would first require the right technologies to be developed. The inland location currently poses challenges with respect to orbital launches; every FAA-licensed spaceport capable of orbital launching is located on the coast.

The current, proven technology for launching to orbit is via multistage boosters and requires jettisoning booster stages along the rocket's trajectory into orbit. For US and European launch systems, these expelled stages are designed to land in water, thus the need for a coastal spaceport location. The type of technological development required to make it possible for Spaceport America to launch-to-orbit includes single-stage-to-orbit technology and improved returnable boosters. Such launch capabilities are under development, but are not available to vertical launch programs at Spaceport America today.

Looking forward, there will be a transition to launch-on-demand services with rockets and spacecraft designed for standardized, rapid production, and deployment. The transition to these commercial services ensures launch vehicles are available on standby and are ready to be assigned a payload for launch on demand. These are programs under development worldwide, but several of Spaceport America's current customers are moving quickly toward this capability, including EXOS Aerospace and UP Aerospace.

Attracting business to Spaceport America is no easy task. While the industry looks for launch sites such as Spaceport America, the companies themselves are still developing spacecraft to launch. Market research by Northern Sky Research, a firm focused on the space industry, reveals that there is money to be made from hosting companies while they are in the research phase.[54] Space companies require launch sites to test their products, and sites such as Spaceport America provide facilities to conduct those tests. In this setup, the companies benefit from launch facilities, and spaceports benefit from rents.[55]

As the space industry continues to mature, New Mexico stands to reap benefits from early entry into the space industry.

53 Kristin Kloberdanz, "Success In The Skies: Virgin Orbit's Cosmic Girl Launches Test Rocket," GE, July 12, 2019, accessed October 5, 2019, https://www.ge.com/reports/success-in-the-skies-virgin-orbits-cosmic-girl-launches-test-rocket/.

54 Northern Sky Research, "Satellite Manufacturing & Launch Services Market to Generate $225 Billion in Next Decade," press release, July 16, 2019, accessed October 24, 2019, https://www.nsr.com/new-nsr-report-satellite-manufacturing-launch-services-market-to-generate-225-billion-in-next-decade/.

55 Sophie Quinton, "Commercial Space Industry Still Waiting for Liftoff," The Pew Charitable Trusts, June 28, 2018, accessed October 26, 2019, https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2018/06/28/commercial-spaceports-still-waiting-for-liftoff.

SECTION THREE

3

# Economic Foundations

*This section describes the geographic scope of the report, focusing on regional economies that are influenced by Spaceport America and the regional economies from which Spaceport America is likely to draw resources.*

For the purposes of this study, it is important to understand the study area as much more than simply a set of geographic boundaries, but as an ecosystem of interconnected entities that will all contribute to, and benefit from, Spaceport America's economic development. The entities include counties and municipalities, along with universities, military installations, national laboratories, state agencies, private businesses, and most importantly, people.

New Mexico and Spaceport America have a certain composition of these factors at the present, and the opportunity and capability to augment them going forward.

These factors define the space industrial base in New Mexico. The Industrial Base Capability (IBC) for commercial spaceport facilities is discussed in detail in Appendix C, but—stated simply—encompasses all of the goods and services that enable a sustainable space-based economy. Any locale with the political will and suitable location can decide to develop a spaceport. However, the chances of that spaceport becoming sustainable depends largely on its ecosystem supporting the space industry.

This includes elements that are already in place, as well as those that develop alongside a spaceport. The more robust the base, the greater the capability for realizing the goal of a self-sustaining spaceport.

New Mexico has a unique blend of existing space industrial base capabilities. Some of the factors relate to the physical environment surrounding Spaceport America, including the unparalleled access to special restricted airspace and reliable sunny weather. Spaceport America's proximity to WSMR also creates unique opportunities for partnerships, such as landing payloads launched at the Spaceport at WSMR. These physical characteristics are discussed in more detail in Section 2.1.2, but form the foundation upon which the rest of the ecosystem is built.

Other capabilities include the presence of Sandia National Laboratories (SNL) and Los Alamos National Laboratory (LANL), the Air Force Research Laboratory at Kirtland Air Force Base (KAFB), and the numerous private high-technology contractors located in New Mexico to support the national laboratories. The labs form a critical component of the existing space industrial base in New Mexico and present cutting-edge capabilities for partnerships and support of Spaceport America and its customers. Similarly, New Mexico's major research universities, especially NMSU, the New Mexico Institute of Mining and Technology, and the University of New Mexico, are a component of the existing industrial base capability. They each provide opportunities for partnerships with researchers, and help to develop the necessary workforce for a sustainable space industry.

NOTE TO READER

The data reported herein attempts to rely on the most current or relevant data available. The data comes from multiple sources, and inferences must occasionally be taken by cross-referencing data from disparate sources. A reader should undertake review of the information presented with the expectation that the narrative is assembled to relate a comprehensive perspective on the economic activities described, and understand that the specific data referenced may be the best available to support the economic analyses presented.

*Image credit: Virgin Galactic*

A study on the Washington state space economy prepared for the Puget Sound Regional Council repeatedly stresses the importance of having a sufficiently trained workforce available:

> *Maintaining and enhancing the quality and availability of local talent will be a major consideration in promoting space-related businesses into the future.*[56]

Washington state represents an area with a robust and mature aerospace industrial base, with major space and aerospace-related manufacturers like Boeing and Blue Origin based in the region. Numerous component manufacturers and suppliers, and others like SpaceX and Aerojet Rocketdyne, Inc. have spacecraft manufacturing facilities there.

New Mexico does not currently have the same existing mature base for the space industry, but is well equipped to begin building a strong foundation for its development.

Most importantly, New Mexico is already home to a technically-trained workforce. According to a 2016 report prepared by the New Mexico Legislative Finance Committee titled *Science, Technology, Engineering, and Math (STEM): Degree Production and Employment Outcomes*, New Mexico ranks first in high-tech resources, which includes PhDs and federal research dollars per capita. Roughly 2,600 students graduated with STEM degrees in 2016, and individuals in this field have the highest salaries behind the health industry.[57]

> *Incentivizing STEM education pays for itself, but the state is underproducing STEM degrees for an average high tech economy.*

People critical to the space IBC are not just those who will be directly employed in the space industry. Taxpayers and appointed and elected decision-makers are also key factors. Spaceport America exists as it does now through the vision and will of the people and decision-makers of New Mexico. Without their continued support, none of the other factors are relevant, and the Spaceport can not be successful. The story of the economic and fiscal impacts of Spaceport America is a story of how all of the interrelated parts participate in, and benefit from, its development.

56 BERK, 2018.

57 New Mexico Legislative Finance Committee, *Science,Technology, Engineering and Math (STEM): Degree Production and Employment Outcomes, Program Evaluation Unit*, Report #16-05, Santa Fe, NM, May 12, 2016. (LFC STEM Report, 2016).

# 3.1 GEOGRAPHICAL STUDY AREA

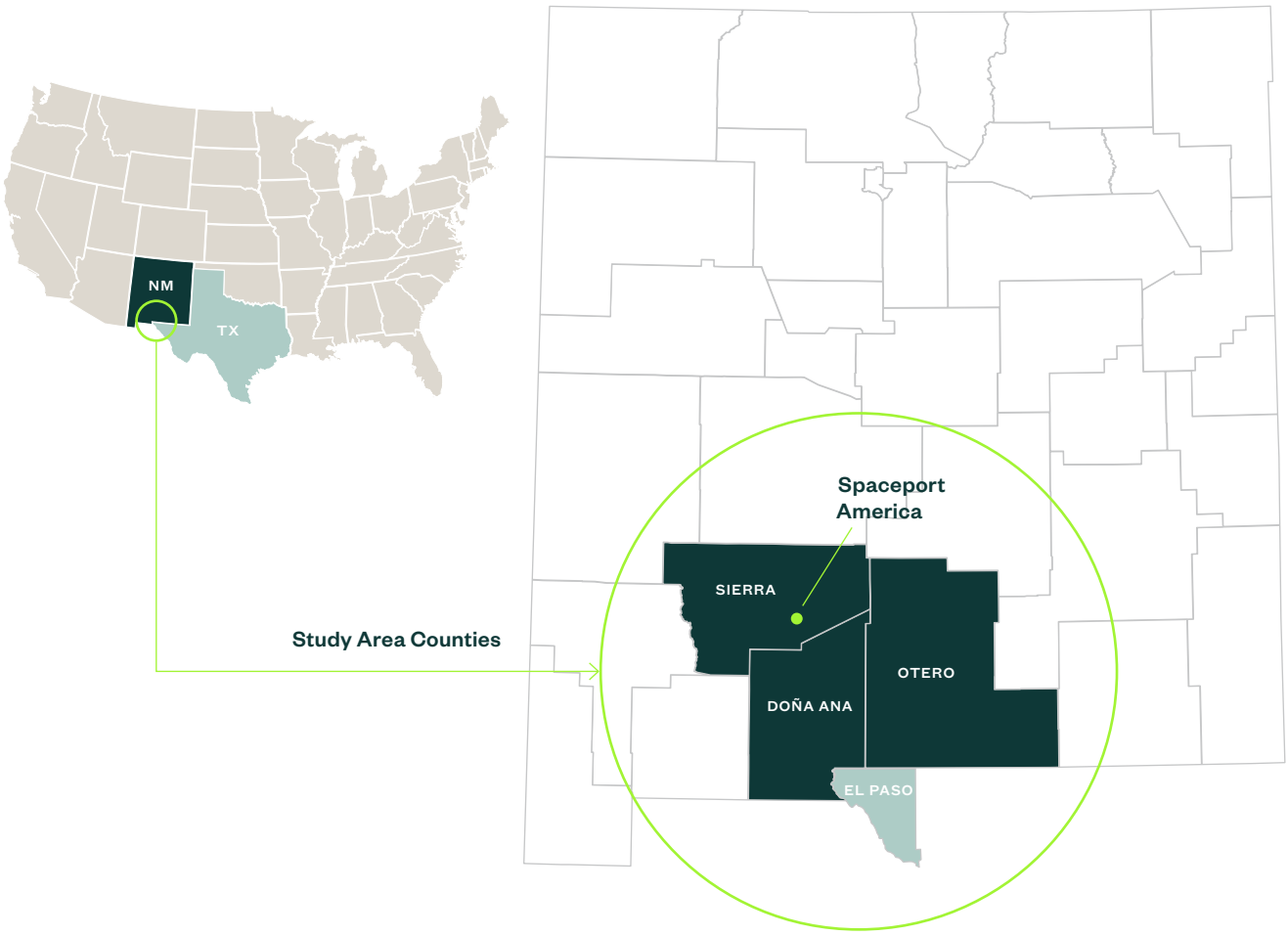
We have defined a geographical area that will likely see the primary economic and fiscal impacts of Spaceport America's development. The economic footprint of Spaceport America extends beyond Sierra County out to Doña Ana County, Otero County, and El Paso County, TX. These counties form the primary study area, as depicted in Figure 6.

*Note, detailed individual county profiles are provided in Appendix D.*

## 3.1.1 Expanded Study Area

While the primary direct, permanent employment related to the Spaceport will likely be located in the primary study area, it is expected that Bernalillo County will supply a portion of the construction labor and resources for developing projects related to Spaceport America's activities. The spaceport will also benefit from partnerships with Albuquerque and Los Alamos-based components of the space industrial base.

FIGURE 6: Study Area Map



## 3.1.2 Why El Paso County?

The isolated location of Spaceport America suggests that construction crews, equipment, and materials are sourced from locations outside Sierra County. Labor, heavy machinery, steel, and other construction materials were likely sourced from areas in the vicinity capable of providing those services. El Paso is located 99 miles south of Spaceport America, about an hour and a half drive away, making it a likely source of construction crews and material, with the other comparable source of primary construction services and materials likely provided from the Albuquerque area, 177 miles away.[58]

By example, data from the Bureau of Labor Statistics (BLS) indicates that there were 1,247 establishments in El Paso County engaged in Construction—North American Identity Classification System (NAICS) code 23—in the first quarter of 2019. Average employment was just under 16,000 in the construction sector in El Paso County. This can be compared to Doña Ana County, which is the nearest most populous county, and which reported 539 establishments with average employment of 3,700 during the same period. This context forms our assumption that economic impacts from the development and construction of Spaceport America extend to El Paso County, Texas.

DATA SOURCES

The economic data in this report relies primarily on data from the Bureau of Labor Statistics (BLS) in the US Department of Labor, although other sources are occasionally used and cited when necessary.

BLS is a national statistical data agency that is the primary source of economic information for the federal government. The BLS data found in this report is primarily from the Quarterly Census of Employment and Wages, which uses the North American Industry Classification System (NAICS). NAICS identifies and groups data by type of economic activity determined by the activity's process of production.

The NAICS is broken up further by level of detail, with the number of industry digits increasing with increasing level of detail. For example, the NAICS digits 336415 represent the NAICS industry Guided Missile and Space Vehicle Propulsion Unit, and Propulsion Unit falls under the more general NAICS industry code 3364—Aerospace Product and Parts Manufacturing—which falls into the even more general code 33-34—Manufacturing. The level of detail most appropriate for any analysis depends on a number of factors including relevance, relatability, and often most importantly, the availability of data at each detail level.

58 Although NMSA and its contractors generally apply a New Mexico preference in procurement activities, that does not ensure that New Mexico firms will be successful bidders in procurements.

## 3.1.3 Primary Study Area Economic & Demographic Profile

The primary study area is comprised of four counties: Doña Ana County, NM; Sierra County, NM; Otero County, NM; and El Paso County, TX.

The largest community in the study area is El Paso. Other significant communities within the study area include Las Cruces, Socorro, and Alamogordo. A current demographic profile is provided in Figure 7.

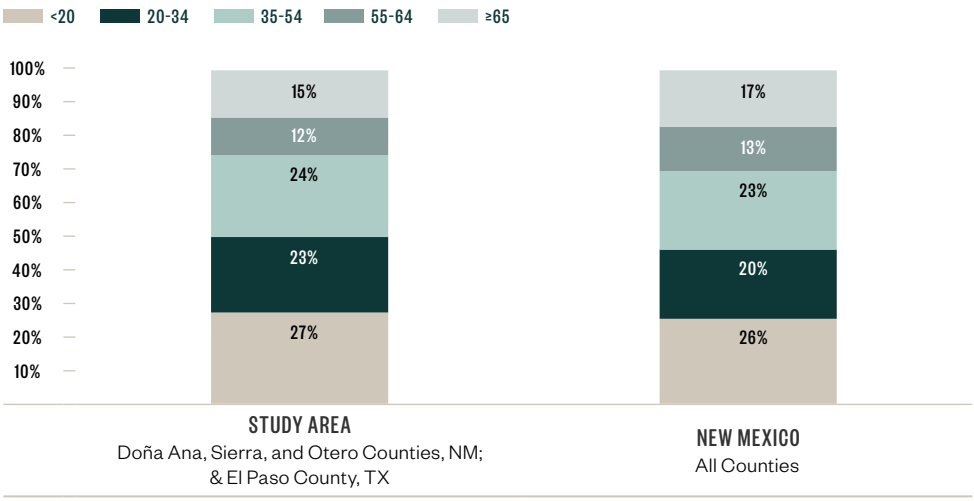
**FIGURE 7:** Population & Employment
Study Area with Selected Comparisons to New Mexico, 2013, 2017, 2018

| POPULATION | | | |
|---|---|---|---|
| **CITY AND VILLAGE** | | **2013** | **2017** |
| **El Paso** | *El Paso County, TX* | 660,795 | 678,266 |
| **Las Cruces** | *Doña Ana County, NM* | 99,186 | 101,014 |
| **Socorro** | *Socorro County, NM* | 32,227 | 33,587 |
| **Alamogordo** | *Otero County, NM* | 30,903 | 30,963 |
| **STUDY AREA** | | | |
| 2018 Estimate | | | 1,136,029 |
| 2010–2018 Growth Rate | | | 4.20% |

| EMPLOYMENT[59] | | | |
|---|---|---|---|
| **LABOR FORCE** | **EMPLOYMENT** | **UNEMPLOYMENT** | **NM UNEMPLOYMENT** |
| 484,603 | 462,420 | 4.6% | 4.6% |

Although reflecting a slightly younger composition, Figure 8 demonstrates that the population by age in the study area is roughly representative of New Mexico as a whole.

**FIGURE 8:** Percentage of Population by Age
Study Area and New Mexico Comparison, 2018 Estimate (years old)




59 Labor Force, Employment, and Unemployment in 2018, New Mexico Department of Workforce Solutions, accessed January 16, 2020, https://www.jobs.state.nm.us.

60 Local Area Unemployment Statistics 2018, Texas Workforce Commission, accessed January 16, 2020, https://texaslmi.com/LMIbyCategory/LAUS.

*Image credit: Virgin Galactic*

Agriculture is a significant economic sector in the study area, which is dominated by crop-related farming activities. An agricultural profile is provided in Figure 9.

**FIGURE 9:** Study Area Agricultural Profile
2017

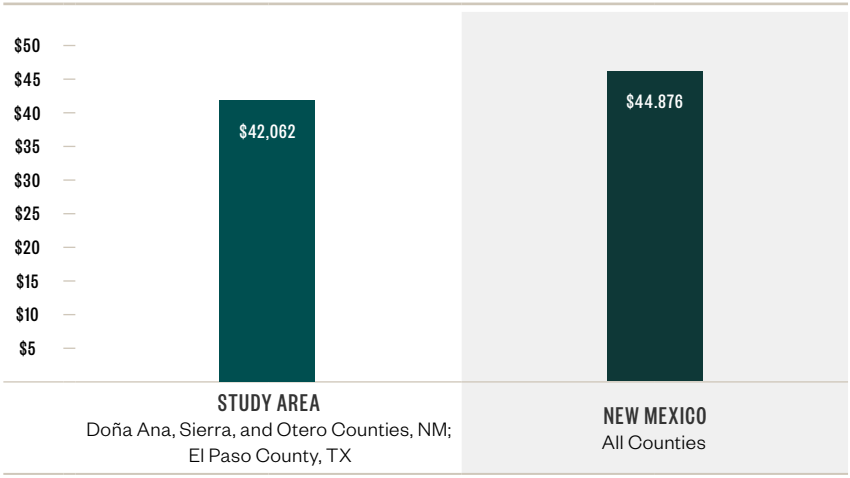
| FARM DEMOGRAPHICS | 2012 | 2017 |
|---|---|---|
| Number of Farms | 3,583 | 3,332 |
| Average Farm Size (acres) | 933 | 811 |

| PRODUCTS SOLD | | |
|---|---|---|
| **MARKET VALUE** | **%** | **$MILLION** |
| Crops | 61.77% | $288.50 |
| Livestock and Poultry | 38.23% | $178.50 |
| **Total** | **100%** | **$467.00** |

| SALES VALUE BY COMMODITY GROUP | % | $MILLION |
|---|---|---|
| Fruits, tree nuts, berries | | $176.76 |
| Milk from cows | | $130.73 |
| Vegetables, melons, potatoes, sweet potatoes | | $37.98 |
| Cotton and cottonseed | | $29.71 |
| Nursery, greenhouse, floriculture, sod | | $21.51 |

The BLS 2019 average wages and salaries for all industries in the study area provides an estimated average annual pay of $42,062 per employee. The New Mexico statewide average compensation is $44,876 per year, reflecting that reported wages and salaries in the study area are approximately 94% of the state average. See Figure 10.

FIGURE 10: Study Area Average Annual Compensation
Study Area and New Mexico Comparison, 2019 ($ thousands)




According to BLS annual data, there was an average of 44,084 establishments providing employment in the study area in 2019, with 42,588 (96.61%) of those private firms, 372 (0.84%) state government establishments, 468 (1.06%) federal government establishments, and 656 (1.49%) local government establishments. The largest sector by employment was Health Care and Social Assistance with a total employee count of 64,914 in 2019, followed by Retail Trade (48,961), Accommodation and Food Services (44,198), and Administrative and Support and Waste Management and Remediation Services (30,029). A summary of establishments, employment, and wages by industry is provided in Figure 11.

FIGURE 11: Average Employment & Wages by Major Industry
Study Area, 2019

| SECTOR | | ESTABLISHMENTS | | EMPLOYEES | | ANNUAL WAGES |
|---|---|---|---|---|---|---|
| NAICS | NAME | COUNT | % | COUNT | % | $ |
| 62 | **Health Care and Social Assistance** | 3,197 | 7% | 64,914 | 9% | $36,667 |
| 44-45 | **Retail Trade** | 2,778 | 6% | 48,961 | 7% | $38,246 |
| 72 | **Accommodation and Food Services** | 2,020 | 5% | 44,198 | 6% | $19,621 |
| 56 | **Administrative and Support and Waste Management and Remediation Services** | 1,078 | 2% | 30,029 | 4% | $21,411 |

The study area includes Texas, so tax data has to be split into New Mexico Counties for GRT and El Paso County, Texas for Sales Tax. The economic sector reporting the highest levels of GRT in the New Mexico counties in FY2019 was the Retail Trade sector, with GRT revenues from this sector making up 28% of the total GRT followed by Construction and Health Care and Social Assistance, 14% and 13% respectively. See Figure 12.

The New Mexico portion of the study area had a total of more than $400 million in GRT in FY2019. For El Paso County, the economic sector reporting the highest levels of sales tax in FY2019 was also the Retail Trade sector, representing 56%

of the total amount of sales subject to tax that year followed by Accommodation and Food Services with 19%. El Paso County had a total of more than $7.7 billion in sales subject to state tax. See Figure 13.

**FIGURE 12:** Gross Receipts Tax by Sector
New Mexico Study Area Counties, FY2019

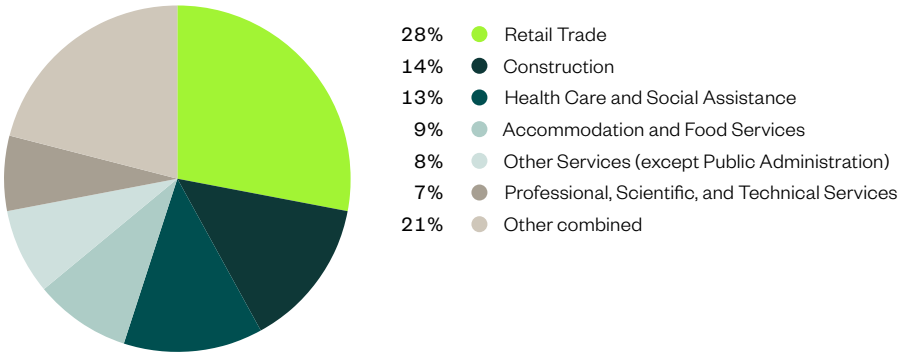
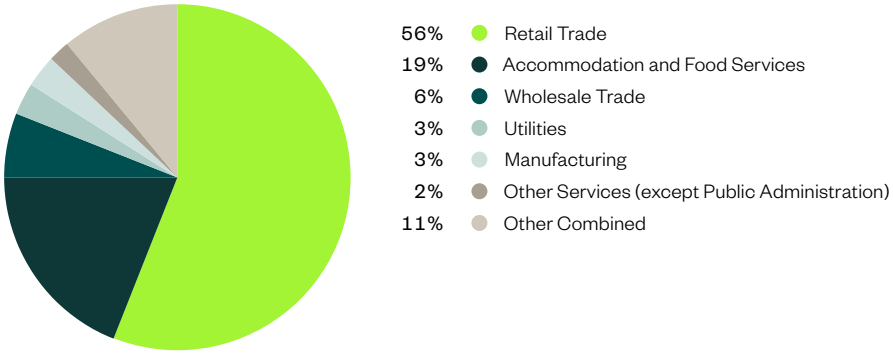



**FIGURE 13:** Sales Tax by Sector
El Paso County, TX, FY2019



# 3.2 INDUSTRIAL BASE CAPABILITY

Industrial Base Capability refers to the composite of industries in the local economy that specialize in goods and services for highly-technical and highly-specialized operations. The IBC may be defined as the public and private skills, knowledge, processes, facilities, material, and equipment needed to design, develop, manufacture, repair, and support space launch resources.[61]

For example, engineering services, laboratory testing, rocket launching, and scientific testing are some of the goods and services that may make up an IBC. In the context of space operations, other industries such as the NAICS defined industries Propulsion Units & Parts for Space Vehicles and Guided Missiles (NAICS 33641), Satellite Telecommunications (NAICS 517410), and Nonscheduled Chartered Freight Air Transportation (NAICS 481212), are highly relevant when analyzing the resources available in the local economy.

Distinguishing between *capability* and *capacity* is important. Industrial capability refers to *what* can be done, as opposed to capacity which refers to *how much* can be done.[62] Bernalillo and Los Alamos counties have experienced an IBC development to support various defense-related space programs such as satellites and weapons.

This complex of industries has matured over the years to provide for a space launch systems development environment. These industries provide the skilled personnel, information, and material essential for space-related operations.

INDUSTRIAL BASE CAPABILITY

IBC may be defined as the public and private skills, knowledge, processes, facilities, material, and equipment needed to design, develop, manufacture, repair, and support space launch resources.

## 3.2.1 New Mexico Aerospace Industry

The New Mexico Economic Development Department lists eight reasons why New Mexico is the ideal place for aerospace research and testing.[63] These include New Mexico's ideal flying weather, superior launch opportunity stemming from low air traffic and restricted airspace at WSMR, and significant tax incentives. Besides these larger environmental factors, the list includes research—identifying entities such as the US Air Force Research Laboratory and the state's three flight testing facilities—and people, meaning the specialized local workforce coming out of New Mexico's universities.

New Mexico is well-positioned for space focused development being home to two Department of Energy laboratories: SNL and LANL.

KAFB is located in Bernalillo County and operates three space initiatives: Space Rapid Capabilities Office (Space RCO), Air Force Research Laboratory (AFRL), and Space and Missiles Center (SMC). These facilities conduct highly-specialized research, testing, and development of advanced technologies. It can be presumed that these laboratories and KAFB look to local businesses for auxiliary products and services.

SNL, for example, injected $317.3 million into small businesses in New Mexico in 2018, according to their published 2018 Economic Impact report.[64] KAFB published local annual expenditures of $957.2 million, having spent more than $115 million in small business firms.[65]

61 Industrial Base Capability concepts are adapted from Colonel Tom D. Miller, *The Defense Sustainment Industrial Base–A Primer, 21st Century Defense Policy Paper*, Foreign Policy at Brookings, Brookings Institute, June 30, 2010, accessed September 21, 2019, https://www.brookings.edu/wp-content/uploads/2016/06/0630_defense_industrial_base_miller.pdf. (Miller, 2010).

62 Miller, 2010, p.23.

63 Why New Mexico, New Mexico Economic Development, accessed October 26, 2019, https://gonm.biz/why-new-mexico/key-industries/aerospace-defense/.

64 Economic Impact 2018, Sandia National Laboratories, accessed October 23, 2019, https://www.sandia.gov/working_with_sandia/economic_impact/.

65 Kirtland Air Force Base, 2018 Economic Impact Report, accessed October 23, 2019, https://www.kirtland.af.mil/Portals/52/Economic%20Impact%20Statement%2016OCT.pdf.

How does Spaceport America fit into this context? Spaceport America is part of an emerging industry that could benefit from services and products available in the Bernalillo and Los Alamos regions. The industrial base that has developed around the national laboratories and the Air Force Base provides services in engineering, scientific research, and computer technologies that can benefit the operations at Spaceport America. Additionally, the IBC provides the skilled personnel, information, and materials essential for highly-specialized operations.

*A detailed IBC profile is provided in Appendix C.*

ABBREVIATIONS

**SNL:** Sandia National Laboratories

**LANL:** Los Alamos National Laboratory

**NAICS:** North American Industry Classification System

**IBC:** Industrial Base Capability

**KAFB:** Kirtland Air Force Base

### 3.2.1.1 NEW MEXICO'S GOVERNMENT-RELATED AEROSPACE RESEARCH FACILITIES

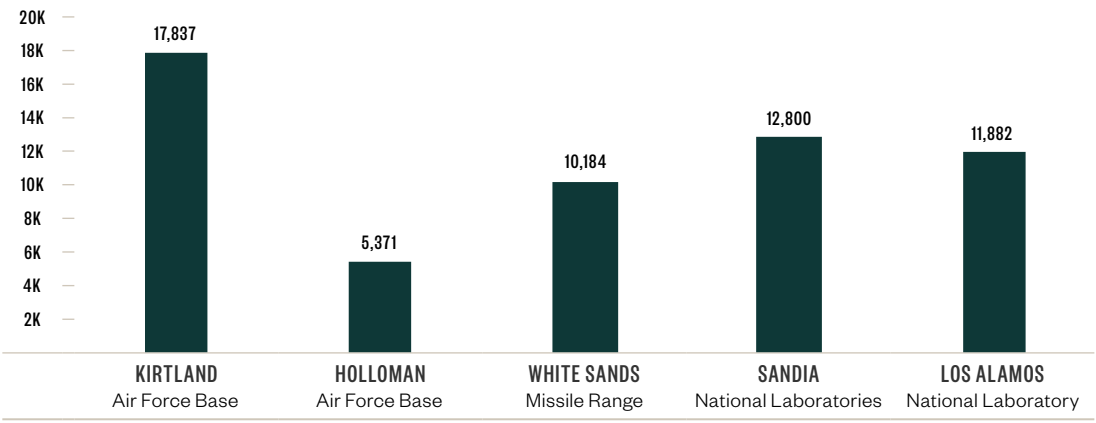
New Mexico has an extensive ecosystem of government-related facilities that play various roles anchoring aerospace and space launch technologies and development activities. The presence of these anchor government-related facilities through more than a half century have allowed the development of a variety of private government contractors, providing a foundation for the development of the IBC that is essential for robust development of private-public economic activities.

*Image credit: Virgin Galactic*

There are five primary government entities in New Mexico that are significantly involved in aerospace research and development: KAFB, Holloman Air Force Base, WSMR, SNL, and LANL. Detailed descriptions for each of these institutions, and particularly how they support the space industry in New Mexico and nationally, can be found in Appendix C.

Not only do these institutions fund and run aerospace-related projects, they also contribute to the state's space industrial base through their human capital needs. Figure 14 shows employment numbers for each of the five research institutions.[66]

FIGURE 14: Related Employment




66 2016 Economic Impact Statement, Kirtland Air Force Base, accessed on October 28, 2018, https://www.kirtland.af.mil/Portals/52/documents/KAFB-EIS-FY16.pdf.

Economic Impact, Holloman Air Force Base, accessed October 8, 2019, https://www.holloman.af.mil/Portals/101/Environmental%20documents/EIS%202016.pdf.

White Sands Missile Range (WSMR) Overview, White Sands Missile Range Presentation to Las Cruces County, 2014, accessed October 28, 2019, http://las-cruces.granicus.com/MetaViewer.php?view_id=2&clip_id=487&meta_id=47124.

Facts & Figures, Sandia National Laboratories, accessed October 28, 2019, https://www.sandia.gov/about/facts_figures/data.html.

Economic Impact on New Mexico, Los Alamos National Laboratory, accessed on October 28, 2019, https://lanl.gov/community/economic/index.php.

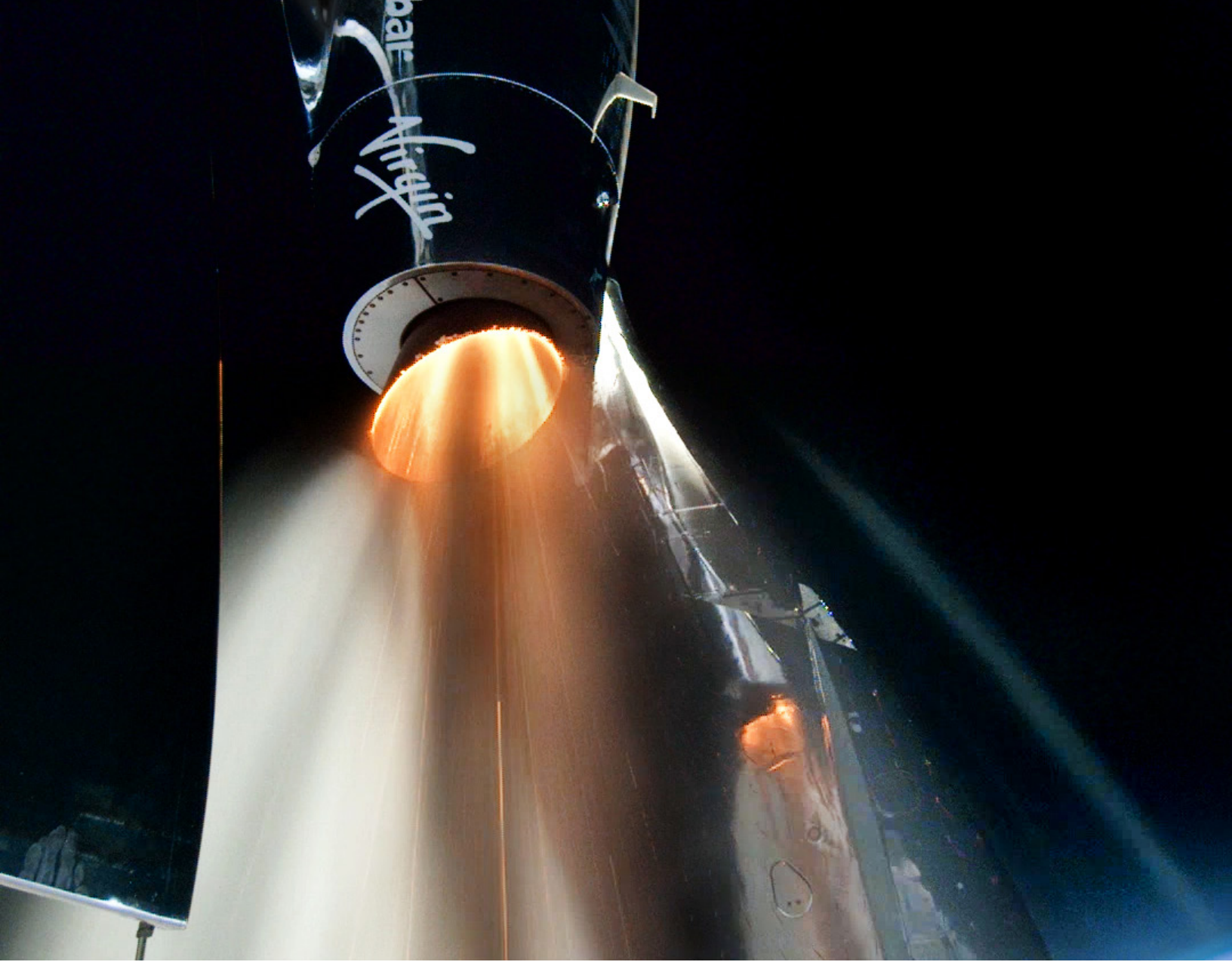


*Image credit: Virgin Galactic*

SECTION FOUR

# 4 Methodology

*This section provides an overview of the methodology that was used to estimate economic impacts and addresses the uncertainty involved in conducting an economic impact analysis in such an emerging and fast-changing industry.*

# 4.1 SPACEPORT ECONOMIC IMPACT MODEL METHODOLOGY & SPECIFICATION

The principal component of the analyses performed in this engagement is to define economic impacts of business activities related to Spaceport America for recent historic and a 10-year forecast period. Direct economic impacts are defined as expenditures, income, and fiscal revenues provided from the economic activities that are associated with the development and operation of the NMSA and the customers whose activities are associated with Spaceport America.

It is a relatively simple task to define expenditures producing economic impacts with respect to the activities of the NMSA. It is an entirely different matter to define the economic impacts associated with the customers whose activities are engaged with and facilitated by the NMSA.

It is important to define the term NMSA customer before further discussion of the economic impact methodology. A customer of NMSA is a party who directly engages to utilize the personnel and facilities that comprise the attributes and physical assets of NMSA. These attributes include NMSA offices and contracting authority, Spaceport America's physical assets and capabilities, and government authority and powers.

NMSA customers may be private business entities or government agencies, such as DOD, NASA, and WSMR, that enter into contracts to utilize the physical assets or personnel of NMSA to develop and operate its business activities. Customers may also be educational programs that directly engage with NMSA through agreements or memorandum which obligate NMSA to facilitate and support the sponsor of those programs, such as NMSU and public schools. Customers generally directly contribute fiscal revenues to NMSA.

Also important is a definition of clients that are related to NMSA or NMSA customers. Whereas a customer has a direct relationship to NMSA, via contract or agreement, clients are entities that engage NMSA customers for the performance of specific activities and to provide specific services which form the basis for the activities associated with the operations of either NMSA assets or personnel. NMSA may also have clients that engage NMSA to perform activities or services, contributing external revenues to NMSA to assist NMSA's customers. For example, NMSA may be engaged by sponsors of the SA Cup to provide financial support facilitating the activities of SA Cup participants.

4.2

# ECONOMIC IMPACT ANALYSES

Direct economic impacts are analyzed based on NMSA's business activities, as well as the business activities of NMSA's customers.

NMSA is a unique entity in our analyses. Although it is a government entity administratively attached to the New Mexico Economic Development Department, it has a number of quasi-private sector business activities. A portion of its funding is derived by direct appropriations from the New Mexico State Legislature and a dedicated increment of government tax receipts, but a significant additional component of its budget is provided by contractual fees.

The economic impact of NMSA is associated with its capital and operational expenditures, including its employees' income, all of which is produced by its business activities. The economic impact analyses include the treatment to be given to fees paid directly to NMSA by its customers—such as launch fees and facility rent—as fiscal impacts.

However, these fees paid to NMSA can not be counted both as direct expenditures providing economic impacts from a NMSA customer's business activities, and revenue contributions that provide economic impacts from NMSA's business activities. This would result in double counting of the direct economic impacts of these activities.

## SIERRA COUNTY CONSTRUCTION GROSS RECEIPTS TAX IMPACT ANALYSIS

The construction of Spaceport America had a measurable impact on the GRT collections of Sierra County. Tax distribution data shows significant increases during the construction period of the Spaceport. By analyzing the tax distributions before, during, and after the construction, we were able to segregate the impact of construction of the Spaceport.

Construction activities at Spaceport America commenced with a ceremony in late FY2009, with major construction activities beginning in FY2010 through FY2011. Construction activities are subject to GRT, which are reported to the locations in which they are performed. Thus, corresponding tax revenues collected from the construction activities at the spaceport site would be distributed to Sierra County.

Prior to the Spaceport's construction, the monthly GRT distributions in FY2008 and FY2009 averaged $89,370. Monthly average distributions increased to $128,710 in FY2010 through FY2011, during the construction of the Spaceport. Subsequently, the monthly distributions averaged $106,959 in FY2012 through FY2013, two years after completion of the major construction activities. GRT distributions decreased after the construction of the Spaceport, indicating that the increase in distributions to Sierra County was caused, at least in part, by the construction of Spaceport America.

Seldom does one find such an evident impact in the economy from a single event. The construction of Spaceport America was certainly an event with a significant impact in Sierra County. To verify further, we analyzed the taxes paid by the construction sector in Sierra County. The percentage of distributions from the construction sector, compared to total distributions for FY2008 and FY2009, averaged 32%.

Comparatively, the percentage of distributions from the construction sector averaged 51% in FY2010 and FY2011. In the period after construction, the average percentage from the construction sector averaged 34% in FY2012 and FY2013. This analysis further reveals the strong economic impact of the construction of the spaceport, and how it played an important role in increasing the revenues for Sierra County during that period.

As NMSA is a not-for-profit government agency, such revenue paid to NMSA by its customers will be analyzed as fiscal revenues supporting NMSA's expenditures, with direct economic impacts associated with those expenditures by NMSA.

The direct economic impacts of NMSA's customers are somewhat less complex, but have a significant additional element of uncertainty. Indeed, we have developed the assessment of future economic impacts on the basis of the best available information, including extensive interviews of existing NMSA customers.

These interviews sought to elicit information as to the expectations of the existing NMSA customers with respect to their Spaceport America programs, including historic and future expenditures and staffing. We have also sought to identify those factors that will modify the development expectations of the existing customers—seeking to identify both changes that would positively and negatively affect those expectations.

Based on interviews with existing customers and senior NMSA professionals as to their expectations of additional customer and client development activities—not associated with current customers—we have developed a Baseline Scenario, or most likely development scenario, that reflects the best available information as to how Spaceport America's operations will evolve through FY2029. Specific technology developments, private and government funding, and program successes and failures during the forecast period are all elements of uncertainty.

We document the bases for our scenario specifications, and have vetted the definition and specification of the stated scenarios. We acknowledge that no single scenario will accurately portray how Spaceport America operations will actually evolve and develop, but we present these scenarios based on the best available information and have attempted to employ rigorous, objective judgment in our definition of the potential future economic impacts of Spaceport America. We believe they represent a reasonable range of possible future development activities associated with Spaceport America.

4.3

# ECONOMIC IMPACT MODEL DESIGN

This engagement requires that we provide a quantitative assessment of the economic impacts that can be anticipated through FY2024, and what may be realized by FY2029. To accomplish this task, we have collected information regarding expenditures and employment, and developed scenario parameters that allow annual calculation of both NMSA and NMSA's customers' specific economic and fiscal impacts in the study area. We assessed these impacts on an annual basis and tabulated the nominal value of those direct economic and fiscal impacts.

**The economic impact model assesses potential development associated with four basic aspects of the Spaceport America programs:**

### DIRECT

Direct NMSA program impacts such as employment and expenditures

### HORIZONTAL LAUNCH

Impacts associated with horizontal launch activities such as Virgin Galactic missions

### VERTICAL LAUNCH

Impacts associated with vertical launch activities such as sounding rocket programs

### OTHER

Other NMSA and Spaceport activities such as hypersonic testing

It is important to note that we make no attempt to quantify the economic impact of the educational benefits that are part of NMSA and Spaceport America's missions, but have provided some additional assessment of the nonquantified benefits obtained from those important activities as well as the economic diversification associated with expansion of Spaceport America's economic activities.

Generally stated as a mathematical equation, the economic and fiscal impacts of NMSA and Spaceport America-related activities in any of the defined scenarios is given by the equation in Figure 15.

FIGURE 15: Economic & Fiscal Impacts Equation

$$\sum_{t=FY16}^{FY29} E\&F\ Impacts\ {}^{S}_{t} = \sum_{t=FY16}^{FY29} \left[ NMSA\ {}^{S}_{t} + H.Launch\ {}^{S}_{t} + V.Launch\ {}^{S}_{t} + Other\ {}^{S}_{t} \right]$$

where

$NMSA\ {}^{S}_{t}$ = Economic & Fiscal Impacts of NMSA in year t and under Scenario S

$H.\ Launch\ {}^{S}_{t}$ = Economic & Fiscal Impacts of Horizontal Launch Activities in year t and under Scenario S

$V.\ Launch\ {}^{S}_{t}$ = Economic & Fiscal Impacts of Vertical Launch Activities in year t and under Scenario S

$Other\ {}^{S}_{t}$ = Economic & Fiscal Impacts of Horizontal Launch Activities in year t and under Scenario S

# 4.4 REGIONAL IMPACT MODELLING ANALYSIS: GENERAL OVERVIEW

Economic and fiscal impact assessments are routinely provided to estimate how regional economies are benefited by new or expanded business activities.

**Economic impacts** generally include capital and operational expenditures, and analyses of wages and salary income from the creation of additional jobs.

**Fiscal impacts** are best understood as the expansion of government revenues in the form of taxes and other fees that are generated as a result of the new business activities in a regional economy.

Assessing and forecasting the direct benefits of specific business activities provides valuable economic information, and may be useful either in assessing alternative business decisions or addressing economic policy questions.

The NMSA physical assets have been developed over more than a decade. With respect to capital and operational expenditures, it should be noted that other costs have been incurred for the physical infrastructure, even if these are not categorized as depreciable assets in the annual financial statements.[67]

The total cost to build, access, and operate Spaceport America adds up to $221 million between FY2008–FY2018. Of that, $169 million was spent on capital assets: buildings, land improvements, vehicles, equipment, and furniture. Other costs include $18 million for contractual services, which include professional services related to the planning and design of the spaceport, environmental studies, and survey of the land. These expenditures are not included in the reported depreciable cost of capital assets, but have been essential for preparing the spaceport for operations.

Salaries and benefits paid from FY2008–FY2018 total just under $10 million, and while they make up a small part of the $221 million in total expenditures, these costs are essential for the operation of the Spaceport.

Lastly, construction of two access roads—the Northern and Southern Access Roads—cost $10 million and $14 million, respectively. These public roads are not owned by the NMSA, but are necessary to access the spaceport facilities, and are therefore included in this cost tabulation.

It is important to recognize that not all of these costs are capital expenditures, however, they are included because they are essential for the access and functional operations of Spaceport America. The construction of a spaceport in the middle of the desert with no existing access to infrastructure requires building roads and incurring other soft costs needed for the construction of the spaceport. It is also important to recognize the partnerships with Doña Ana and Sierra counties, as well as the New Mexico Department of Transportation, for their role in planning, design, and maintenance of the access roads to the spaceport.

Funding for the construction, access to, and operations of Spaceport America derive mainly from Severance Tax Bond proceeds, GRT Revenue Bond proceeds, and State General Fund appropriations. $106.5 million was received from Severance Tax Bond proceeds, GRT Revenue Bond proceeds totaled $78.6 million, and State General Fund appropriations totaled $8.7 million. In addition to the GRT Revenue Bond repayment proceeds, $1.3 million in GRT excess revenue was

67 A summary of the depreciable capital assets can be found in the NMSA 2018 Comprehensive Annual Financial Report (CAFR) in Note 9.

appropriated for operations. These are GRT revenues left over after meeting bond repayment obligations.

Lastly, appropriations were made to the New Mexico Department of Transportation that totaled $17.5 million for the construction of the Northern Access Road to the Spaceport, and for other roadways inside the spaceport. More recently, NMSA received $14 million from Severance Tax Bond proceeds for the construction of the Southern Access Road.

FIGURE 16: NMSA Revenues & Expenditures
FY2008–FY2018

| REVENUES | |
|---|---|
| Severance Tax Bond Proceeds | $106,439,848 |
| Gross Receipts Tax (GRT) Revenue Bond Proceeds | $78,564,732 |
| NM General Fund Appropriations | $8,659,300 |
| GRT Excess Revenue for Operations | $1,339,853 |
| Severance Tax Bonds Appropriation to DOT | $7,500,000 |
| NM General Fund Appropriation to DOT | $10,000,000 |
| Severance Tax Bond Appropriation: Southern Road | $14,000,000 |
| Customer Revenues | $13,041,731 |
| **Total Revenues** | **$239,545,464** |

| EXPENDITURES | |
|---|---|
| **HARD ASSET EXPENDITURES** | |
| Depreciable Assets (brick & mortar) | $169,152,378 |
| Public Roadways | $24,000,000 |
| **SOFT ASSET COSTS (ENGINEERING, LEGAL, ETC.)** | |
| Contractual Services | $17,976,160 |
| **OTHER EXPENDITURES** | |
| Operational Costs | $9,850,840 |
| Revenue Bond Repayments[68] | $49,365,250 |
| **Total Expenditures** | **$270,344,628** |

FIGURE 17: NMSA Depreciable Capital Assets
FY2018

| DEPRECIABLE ASSETS | |
|---|---|
| Buildings | $72,818,700 |
| Improvements Other Than Buildings | $84,722,762 |
| Vehicles | $1,812,920 |
| Equipment and Furniture | $9,797,996 |
| **Total** | **$169,152,378** |

68 Includes Revenue Bond interest payments, and payments are funded by Spaceport's 75% distribution of GRT Spaceport Tax Increment revenues. The balance of 75% distribution of the GRT Increment is reflected as GRT Excess Revenue for Operations.

# 4.5 ECONOMIC MULTIPLIER ANALYSIS

When economists discuss the benefits of the expansion of an economic activity, they also recognize that direct economic benefits create an indirect benefit associated with the additional economic activity from industries buying from other local business sectors. For example, the direct construction activities associated with the projects will result in additional lodging and hospitality revenues for the local businesses hosting the out-of-area workers and other indirect retail trade purchases as a result of increased disposable income in the economy.

These are referred to as indirect impacts, or Type I economic multipliers. A further extension of the economic multiplier analysis takes into account the increased economic activities on the social institutions—households, state and local government, federal government, and capital—that first obtain direct and indirect benefits, and then recognize that every dollar collected locally by that institution will be re-spent for that local institution's operations. Including the induced effects in the economic multiplier analysis provides a Type SAM (Social Account Matrix) multiplier.

## 4.5.1 Historic & Current Impact Analysis Methods

Regional economic impact analyses have for decades relied on input-output summaries of economic activities, with most of these modeling efforts providing adaptations of national business sector outputs and intersector transactions to characterize the interaction of participants in the economy. The national models are then regionalized based on a variety of analytical methods. Both the US Department of Commerce[69] and private firms provide information as to the economic multipliers for specific states or local regions.

For the purposes of this analysis, there's reliance on IMPLAN© Group model,[70] a commonly utilized model, and on economic multipliers from a 2017 version of this model for New Mexico. Specific multipliers used depend on the character of the activity being performed. Multipliers selected are not always obviously fitted to the activities being modeled. Multiplier selection is often a compromise, especially with regard to emerging industries and specific activities. Every effort was made to select the multiplier sectors that most closely fit the activities being measured. A detailed discussion of the reasoning behind the selection of specific multipliers is provided in Appendix E. Figure 18 lists the specific multipliers used in this study.

69 Regional Input-Output Modeling System (RIMS II), US Department of Commerce, Bureau of Economic Analysis, https://www.bea.gov/regional/rims/index.cfm.

70 IMPLAN© Group, LLC. IMPLAN Pro 2017, Huntersville, NC. IMPLAN.com. This is the most current version of the model available for this analysis.

FIGURE 18: Comparison of Available Economic Multipliers

| ACTIVITY | IMPLAN SECTOR | TYPE I | TYPE SAM |
|---|---|---|---|
| **Training Center Construction** | Construction of new educational and vocational structures | 1.300436347 | 1.539941491 |
| **All Other Construction** | Construction of new commercial structures, including farm structures | 1.211838731 | 1.533614827 |
| **Building Maintenance** | Maintenance and repair construction of nonresidential structures | 1.324368181 | 1.634182243 |
| **Rocket Engine Testing** | Guided missile and space vehicle manufacturing | 1.057166299 | 1.270877068 |
| **Local Hardware Purchases** | Retail - Building material and garden equipment and supplies stores | 1.323142586 | 1.64617503 |
| **Rocket Launch Operations** | Air transportation | 1.401266179 | 1.60132817 |
| **Ground Transportation** | Transit and ground passenger transportation | 1.309613318 | 1.656938904 |
| **Spaceport Operations** | Scenic and sightseeing transportation and support activities for transportation | 1.490774661 | 1.883544079 |
| **Leased Housing** | Real estate | 1.209706187 | 1.302035844 |
| **Equipment Leasing** | Commercial and industrial machinery and equipment rental and leasing | 1.162462774 | 1.378703608 |
| **Research and Development** | Scientific research and development services | 1.363036529 | 1.741428769 |
| **Headquarters Operations** | Management of companies and enterprises | 1.36058049 | 1.67867311 |
| **Training Center Operations** | Other educational services | 1.245127448 | 1.756239525 |
| **Short-Term Lodging** | Hotels and motels, including casino hotels | 1.307478951 | 1.578469652 |
| **Food Expenditures** | Full service restaurants | 1.268874159 | 1.665820766 |
| **Wages and Salaries** | Private households | 1.0 | 1.72729276 |

# 4.6 DEVELOPMENT FORECASTING

## 4.6.1 General Considerations

We have been engaged to forecast economic activities that have a uniquely high level of uncertainty. Our survey of the development opportunities for Space 2.0 have focused on the breadth and depth of the demand for space launch capabilities, and the increasing cadence of economic development activities supporting the deployment of commercial and military launch capacity.

It is hard to deny the likelihood of these expanding economic opportunities, but how those specific activities will impact Spaceport America is more difficult to predict. We rely on extensive research and interaction with NMSA professionals, interviews with NMSA customers, and historic observations of the development of economic activities that have occurred in conjunction with Spaceport America's activities over the last decade.

However, at the end of the day, we must acknowledge that our forecasts and analyses can only rely on the best available information. We have documented our sources and provide as much detail as possible. It must be noted that much of the information shared with us—particularly by NMSA's customers—is understandably proprietary and subject to confidentiality restrictions.[71]

## 4.6.2 Scenario Analysis

Consonant with the immediately preceding comments, our primary analyses have focused on establishing a Baseline Scenario that reflects consensus assessment of the most likely development path for Spaceport America's activities. Our Baseline Scenario has been vetted through discussions with NMSA personnel, NMSA customers, and a group of senior Moss Adams personnel with decades of experience in various financial and advisory roles for aerospace clients. Collectively, the scenarios adopted for these analyses reflect extensive and diverse experience in assessing aerospace technologies.

It is also important that we reflect in a quantitative assessment how sensitive the Baseline Scenario is to the parameters and assumptions that define Spaceport America's development path. To do so, we also define two alternative scenarios—an Optimistic Scenario and a Pessimistic Scenario—that are based on specific variations of the parameters and assumptions that form the analyses for the Baseline Scenario. We define these alternative scenarios in the following discussions.

71 Formal nondisclosure agreements were executed with many of the firms.

# 4.7 SCENARIO DEFINITION PROCESS & VETTING

## 4.7.1 Baseline Scenario

In analyzing scenarios, it is important to first define the baseline. The Baseline Scenario reflects the best available information and does not include potential significant positive or negative shocks to the system. This is not to say that the Baseline Scenario is expected to be accurate—especially in an emerging high-risk, high-reward field like commercial spaceflight, we expect the unexpected.

The Baseline Scenario merely creates a conservative, consensus[72] starting point wherein current and near-term high-probability development occurs without any tectonic shifts that would radically impact outcomes. We do know, however, that spaceflight has the potential for significant positive and negative outcomes, and these will not be captured in the Baseline Scenario.

The Baseline Scenario includes the core set of activities that have developed at the spaceport to this point, along with modest organic growth based on information we have gathered from Spaceport America customers and personnel. At the heart of these activities is the historic activity of the Spaceport itself, and in particular, the budget appropriated and capital expenditures authorized by the New Mexico Legislature.

This budget appropriation and capital expense authorization is the only component of Spaceport America-related activities that is under direct government control. The budget is set annually by legislation, and while state budgets are subject to a level of uncertainty, the current state budget situation is not showing significant signs of weakness. Our Baseline Scenario assumes that the pending Spaceport Authority budget request is granted in full.

The Baseline Scenario will also include current Spaceport America customers and anticipated launch activities. Current customers are performing horizontal and vertical launch activities at an increasing frequency. Virgin Galactic is completing training and testing, with expected commercial launches to space beginning in 2020. Other horizontal launch customers are purchasing fuel from spaceport facilities, and paying launch or use fees.

UP Aerospace is manufacturing rocket motors at the spaceport in addition to its launch activities. SpinLaunch is currently constructing a launching system to prove its concept of kinetic energy-based launching, and its activities are also supported by a DOD Responsive Launch Prototype contract.

Where we have information that current customers are firmly committed to expanding operations, those expanded activities are included as well. For example, anchor customer, Virgin Galactic, is in the process of relocating its headquarters and related personnel to New Mexico, specifically in support of its operations at the Spaceport. While that will represent a significant increase in Virgin Galactic's New Mexico employment and operations, that move is well underway, and is considered a part of the Baseline Scenario. Virgin Galactic's activities in the Baseline Scenario are principally defined by the forecast of launch activities defined in its 2019 Securities and Exchange Commission (SEC) filing related to its public offering.

Similarly, EXOS Aerospace is currently increasing its launch frequency. It is committed to a continuing expansion of New Mexico operations to include a training facility in conjunction with its spaceport activities in Las Cruces. In the

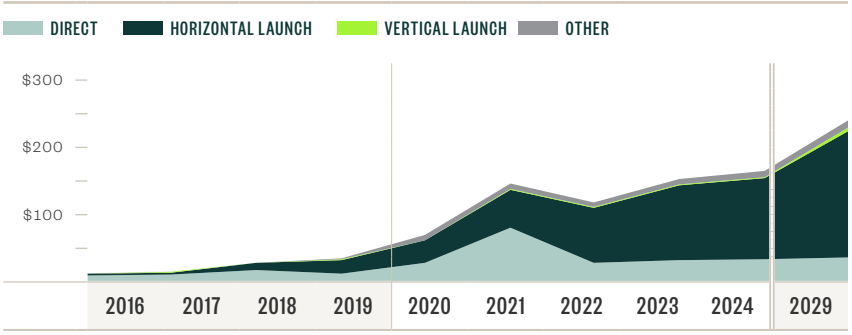
72 The Baseline Scenario definition excludes any game-changing technology developments, and was vetted by both senior team members from Moss Adams, each of whom have extensive professional practice clients in the aerospace industry, and by NMSA leadership.

Baseline Scenario, the facility will be built and the base number of jobs will be added, based on information provided by EXOS.

Another important component economic impact is the SA Cup. The SA Cup represents a quantifiable measure of STEM academic outreach that is in other ways not directly measurable, though surely it has a real impact in encouraging future space-related professionals. Spaceport personnel have also provided information about aggressive efforts to increase the size of the SA Cup. The Baseline Scenario will include growth in the SA Cup based on prior years' growth.

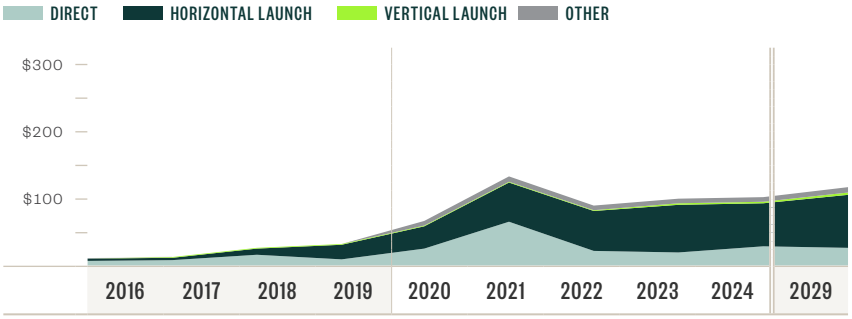
FIGURE 19: Scenario Comparison, Direct Economic Impacts
FY2016–FY2029

**Optimistic**



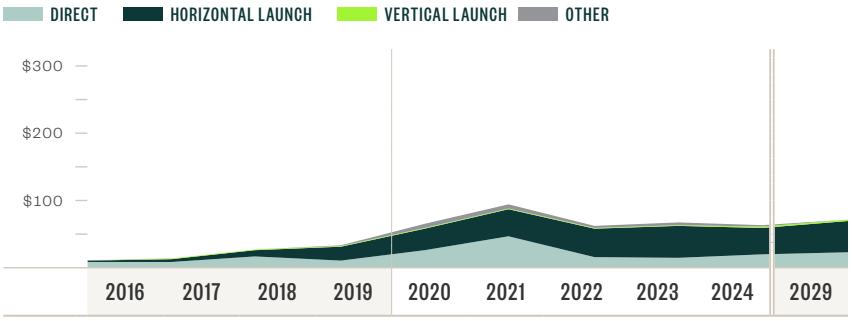

Optimistic Scenario assumes strong growth in all categories.

**Baseline**




Baseline Scenario assumes moderate growth in all four categories, with the strongest growth in Horizontal Activities.

**Pessimistic**




Pessimistic Scenario assumes a slower growth rate in all categories and a reduction in Other Activities, with modest growth in Horizontal Activities.

## 4.7.2 Alternative Scenarios

The alternative scenarios are derived from the Baseline Scenario, and build on the assumptions and parameters that define the baseline. In some elements defining the alternatives, there is simply an acceleration or deceleration of the

activities related to a particular customer. For example, Virgin Galactic activities in the Baseline Scenario are principally defined by the forecast of launch activities identified in its 2019 SEC filing related to its public offering—the Optimistic and Pessimistic Scenarios simply adjust the pace of Virgin Galactic's launch activities, and reflect changes in its staffing and launch-related expenditures related to the changes in the number of launches in the annual periods forecasted.

The reasons for such changes don't need to be defined, as such flight schedule modifications could arise from multiple sources. Some technological problem could constrain the operations—a Pessimistic Scenario assumption; or some substantial positive response to successful launch activities to accelerate the demand for suborbital tourism flights—an Optimistic Scenario assumption.

Figure 19 illustrates the differences between the Baseline Scenario and alternative scenarios in terms of direct economic impacts by category. The impacts from FY2016–FY2019 are actual impacts, with the five-year forecast period from FY2020–FY2024, and the potential outlook for FY2029 included as well.

Either way, the alternative scenarios reflect the economic and fiscal impact results obtained from the modeling, and serve to demonstrate the sensitivity of the model to specific assumptions.

More generally, the horizontal launch activities will be driven by both market demand and changes in deployment of technologies. The emergence of new NMSA customers relying on funding for development of space launch-related technologies, such as hypersonic testing and development,[73] or technologies that allow for horizontal launch-to-orbit capabilities—such as Virgin Orbit[74]—could dramatically change both horizontal flight operations and capital expenditures for Spaceport America. As mentioned, the horizontal launch activities in the Baseline Scenario may also be subject to a number of unexpected constraints that are expressed in the Pessimistic Scenario assumptions.

The profile of vertical launch activities may also be driven by both market forces and technology developments. As previously mentioned, current technologies, and FAA permitting, prohibit orbital launches from Spaceport America. If there are no technology developments that allow inland spaceport launch of rockets with vertical flight profiles, development and testing of rockets launched from Spaceport America will be limited to vertical launch technologies with apogees and flight profiles that allow safe operations within the 6,000 square miles of restricted airspace. A game-changing technology that allows vertical launch-to-orbit from Spaceport America would open a market opportunity that will likely require substantial additional capital investment and the opportunity to serve a much greater market opportunity than is defined in the Baseline Scenario.

Other uses of the Spaceport's facilities, including as a venue for rocket competitions and as a venue for commercial film activities, also share upside and downside potential when contrasted with the Baseline Scenario assumptions. For example, is there a limit to the number of teams that can participate in a student rocket competition, or is the growth in aerospace science such that the next decade will see an explosion of interest in the educational and training benefits obtained by students' participation in such rocket launch competitions? These characteristics are addressed in the operational profiles that are defined as the Optimistic and Pessimistic Scenarios.

Of course, there are almost infinite variations of these scenario assumptions. We have not tried to create an analysis that captures all possibilities, but instead, seek to define alternative scenarios that offer an opportunity to understand the scope and magnitude of changes in economic and fiscal impacts that may be

73 Hypersonic flight operations are generally defined as exceeding Mach 5 flight speeds—approximately 3,840 miles per hour.

74 Currently in development, with a Boeing 747 aircraft intended to carry a rocket to altitude, which would then be released to be flown into orbit.

associated with the specific assumptions and parameter that define the modelled scenarios.

### 4.7.3 Note on Uncertainty

Uncertainty is a defining feature of forecasting.[75] Forecasting the economic impacts from the activities on the cutting edge of commercial space flight is especially fraught with uncertainty. This is not to say that there is no value to undertaking such an exercise, but it is important to explicitly acknowledge that we can not overstate the lack of precision of the results, or understate the uncertainty involved.

The two sources of uncertainty that we will explicitly address here are really rooted in the same issue: commercial space flight is essentially in its infancy. First, traditional forecasting methodologies rely on data, preferably lots of it. This study is forecasting activities that have either very few or no previous occurrences. Second, the uncertainty involved with something as inherently risky as commercial space flight. Space flight has traditionally only been accomplished by national governments for a reason.

To address the first issue, traditional formal forecasting methods are not applicable with data containing such a small number of observations. Some minimum number can be established for a particular model, but in reality, this only works for a textbook example with almost no randomness. In truth, many more observations than the minimum are usually necessary.[76] Dealing with at most three or four observations, formal forecasting methods can not be applied in this situation.

The second issue is tied to the business uncertainty. We have tried throughout this analysis to build a Baseline Scenario from the best available information for NMSA and its customers. All of the entities involved have provided information related to what they are doing and planning on doing in the short term, to the best of their knowledge. As commercial enterprises, the future of these entities depends on success of these plans, but success is not guaranteed.

These plans have layers of contingencies built in. As an example, Virgin Galactic, the highest-profile customer of Spaceport America, has plans to provide suborbital space flight to paying customers starting in 2020. They stopped taking reservations for the $250,000 tickets with 600 people signed up, and have received hundreds of additional inquiries. To get from zero commercial passenger space flights in 2019 to over 1,500 passengers a year in 2023, a lot has to go right. On the other hand, Virgin Galactic is in a much better position to judge this uncertainty, and we defer to its short-term forecasting. We will estimate based on Virgin Galactic's forecast the economic and fiscal impacts in New Mexico.

75 Spyros Makridakis, Robin M. Hogarth, and Anil Gaba, "Forecasting and Uncertainty in the Economic and Business World," International Journal of Forecasting 25.4 (2009): 794-812.

76 Rob J. Hyndman and Andrey V. Kostenko, "Minimum Sample Size Requirements for Seasonal Forecasting Models," Foresight 6. Spring (2007): 12-15.

SECTION FOUR

5

# Economic & Fiscal Impact Analyses

*This section is composed of five primary subsections and describes the analytical details of both the historic and projected impact analyses of Spaceport America. This analysis considers current and historic impacts separate from projected impacts, but provides a summary of total impacts at the end of the section.*

# 5.1 FORECASTING & SCENARIO DEVELOPMENT

## 5.1.1 Analytical Details

### 5.1.1.1 SCENARIO DEVELOPMENT

In developing the scenarios analyzed in this report, it is necessary to define the set of parameters that would differ between the scenarios to create the changes in the modelled impacts over time. Individual parameters function as the quantifiable building blocks of the impact model. They are the discreet activities that will be added up into a total impact. The parameters also function as the levers that we adjust to simulate a potential change in the model of Spaceport America's impacts. Selection of appropriate parameters is key to the success of this analysis, because they'll provide the input that produce changes in impacts.

### 5.1.1.2 SCENARIO PARAMETERS

Parameters are organized into four broad categories: Spaceport America Direct Impacts, Horizontal Launch Activities, Vertical Launch Activities, and Other Activities. They are separated to create logical groupings for thinking about a lot of individual parameters, and also for the purposes of properly categorizing the impacts for the analysis of return on investment. This will be discussed in detail, but in brief, legislatively appropriated amounts are separated out to form part of the investment component while the multiplier effects of this spending is appropriately included as part of the return.

Direct Spaceport America Impact parameters are intended to capture the direct activities that the Spaceport undertakes that cause economic and fiscal impacts. This includes operational and capital expenditures. The largest impacts in this category to date have been construction related to capital expenditures. There are four parameters in this category: Spaceport Operational Expenditures, Spaceport Payroll, Spaceport Contract Employment, and Facility Enhancement, which are briefly described in Figure 20.

FIGURE 20: Spaceport Direct Impact Parameters

| | |
|---|---|
| **Spaceport Operational Expenditures** | Direct impacts of Spaceport America operational expenditures. Revenues for these expenditures are provided both by New Mexico State Government, through general fund appropriations, GRT increment, and Severance Tax Bond appropriation, and from customer fees and rents. |
| **Spaceport Payroll** | Impacts of direct NMSA employment. |
| **Spaceport Contract Employment** | Contract employment, like Fiore Industries, providing protective services. The number of employees and average wage can be adjusted to differentiate between scenarios. |
| **Facility Enhancements** Payload Processing, Capital Projects, and Others | Impacts of the construction of additional facilities at the spaceport outside of basic operations. Includes a planned payload processing facility developed by NMSA. |

These parameters have to be considered carefully because the source of the spending that created the impacts is partly taxpayer dollars in the form of Revenue and Severance Tax Bonds, appropriations from the state General Fund and revenues obtained contractually from NMSA customers.

*Image credit: Virgin Galactic*

The spaceport collects revenues from its customers. In fact, NMSA's FY2019 derives 83% of total spaceport operational revenues from rentals, fees, and other customer revenues. These revenues to the spaceport from customers constitute a fiscal impact, as they're contributions to government.

The second broad category of parameters relates to Horizontal Launch Activities. In the current operations of Spaceport America, Virgin Galactic dominates the landscape in the horizontal launch area. Developments in technology and the market for horizontally launched spaceflight may result in additional horizontal launch customers for Spaceport America in the future.

Here, once again, we distinguish between revenues and expenditures. Virgin Galactic may receive $250,000 for a ticket on SpaceShipTwo, but this does not constitute a $250,000 per passenger economic impact in New Mexico. Impacts reflect direct expenditures in New Mexico.

The economic and fiscal impact of a Virgin Galactic passenger flight includes a variety of expenditures. The ticketed astronauts will come to New Mexico and spend at least several days at Spaceport America training for space flight. Many of them will also bring family and friends to witness the experience. Anecdotally, some astronauts are planning to bring more than 100 additional people with them. Astronauts and their guests will require food and lodging during their stay. They come from all over the world, so their trip will not likely be limited to just the minimum number of days required for training and spaceflight; there will be additional tourism-related impacts.

On top of the expenditures of the astronauts and their guests, Virgin Galactic will also incur expenses in New Mexico for each launch. For example, the WhiteKnightTwo carrier aircraft will use thousands of pounds of jet fuel purchased directly from the spaceport's fuel farm. Other direct variable costs of launching are expended in New Mexico and included in the per passenger impacts.

Permanent employment impacts related to horizontal launch activities currently involve Virgin Galactic relocating its headquarters to Las Cruces to be near

Spaceport America. This involves more than 140 employees currently, and in the near-term 200 permanent, full time, high-paying jobs that were either relocated to the region or hired locally. These jobs bring wages that are significantly higher than the regional or state averages.

Another category includes the impact of several drone research programs. Presently, there are three specific programs that may be located at the spaceport as early as FY2021.

This category also includes the potential for orbital spaceflight, which would represent a significant opportunity for the spaceport to participate in a large and growing market for placing small satellites into LEO. Orbital flights originating at the spaceport are possible with the addition of a customer such as Virgin Orbit, which could use the existing launch system from the spaceport to put things into orbit while dropping rocket segments into the ocean, and circumventing the problems of dropping rockets over land. However, Spaceport America does not currently have a customer capable of horizontally launched orbital flight from the spaceport.

Finally, this category includes a parameter that allows for the acquisition of any of a number of government programs, whether they be DOD, DARPA, or other agency, that would immediately increase the impacts of horizontal launch activities through expanding the frequency or scope of the activities that take place at Spaceport America. Figure 21 lists the parameters included in the Horizontal Launch category.

FIGURE 21: Horizontal Launch Impact Parameters

| | |
|---|---|
| **Passenger Launch Impact** | Suborbital passenger flight activities. Impacts don't reflect the ticketed passenger revenue. Estimated impact that includes hotel nights, and estimates of attending family and friends encompassing the duration of the training. |
| **Virgin Galactic Headquarters Impacts & Other Permanent Employment** | The impacts of Virgin Galactic's headquarters relocation to include permanent full-time employment and capital expenditures among other impacts. |
| **Drone Programs** | The impacts of any of a number of drone research programs for which Spaceport America is competitive in the site selection process. |
| **Research & Payload Launch Impact** | Horizontal flight activities of a test or research nature that are not primarily manned passenger flights. |
| **Orbital Horizontal Launch** | Impacts of potential orbital vertical launch activities at Spaceport America. This would represent a major development and could lead to drastically higher impacts. |
| **Project Development & Expenditures** | Impacts of capital project development or potential government contracts won either by Spaceport America directly, or by customers. Examples include DARPA's Rapid Agile Launch Initiative, air-launched Hypersonic Air-Breathing Weapon Concept, or activities related to the Virgin Orbit program. |

The third category of parameters involves vertical launch activities. The key parameter in this category is the actual frequency of launches, which is combined with an estimated average per launch local expenditure to estimate the direct impact of vertical launches. As it currently stands, Spaceport America has several vertical launch customers that operate in a somewhat similar fashion to each other, though the scope and costs structure varies depending on the customer.

These customers are not permanently based at Spaceport America. They manufacture their rockets elsewhere, transport them to the Spaceport for launch, and then return to their base locations. A number of the existing customers use the rocket launch activities as a demonstration of its technologies for investors, many times bringing dozens of additional visitors for rocket launches. The impacts from these activities, currently, are largely in the food, accommodation, and equipment rental sectors.

Another parameter here is the impacts of the SA Cup, an intercollegiate rocket launch competition hosted by Spaceport America. This parameter has impacts related to food and accommodation sectors, like other vertical launch activities, but it has a significantly different per participant impact, as it can be expected that college students will have a different spending profile from organized commercial activities. This area also has unquantifiable educational impacts that will be discussed in a further section of the report.

Testing activities are another vertical launch-related parameter that form an important part of Spaceport America's economic impacts. Current testing activities largely fall into the category of research and development testing, which means that a customer comes out and tests an engine design and then takes the test result back to evaluate the design. Changes are made and the engine might be tested again.

This is contrasted with production testing, which would require permanent facilities and a much higher frequency of testing. Indeed, one current customer does multi-month campaigns, bringing employees to Spaceport America for extended production testing cycles. Production testing is not currently taking place at Spaceport America, though at least one customer is getting close to that stage.

With current technologies and rules, vertical launches from an inland spaceport in the United States are limited to suborbital flight. However, orbital flight from Spaceport America isn't technically impossible. An orbital vertical launch parameter is included to allow for the possibility that it becomes feasible in the future. The Baseline Scenario does not include orbital vertical launches in the short term. A parameter for major government programs is also included here, with implications that were described in the horizontal launch section. Figure 22 lists these parameters.

FIGURE 22: Vertical Launch Impact Parameters

| | |
|---|---|
| **Suborbital Launch Impact** | Impacts of suborbital vertical launch activities. |
| **SA Cup Impact** | Impacts arising from the SA Cup, an intercollegiate rocket launch competition hosted at Spaceport America. |
| **Project Development & Capital Expenditures** | Impacts of potential government contracts won either by Spaceport America directly, or by NMSA customers. An example is something like DARPA's Rapid Agile Launch Initiative or NASA Sounding Rocket Programs. |
| **Testing Activities** | Impacts of testing activities in support of vertical launches. |
| **Orbital Launch Impact** | Impacts of potential orbital vertical launch activities at Spaceport America. Orbital launch capability would represent a significant technological and economic breakthrough, and isn't currently occurring. |

The final broad category of impact parameters involves Other Activities. The diversity of these activities are sometimes generally characterized as Advanced

Technology or Hypersonic Activities, but this category also includes all other activities that don't fit neatly into one of the other categories. The largest current economic impacts arise from the Project Development Parameter. One customer, SpinLaunch, is currently constructing a $7 million project that will test their method of launching to space using the kinetic energy generated in what is essentially a mass accelerator. This method, if successful, represents significant addition.

FIGURE 23: Other Activity Impact Parameters

| | |
|---|---|
| **Project Development** | Impacts from developing projects outside of vertical and horizontal launch activities. For example, SpinLaunch is currently developing the facilities for kinetic launch activities. |
| **Other Support Activities** | Impacts of activities that don't fit into other more defined categories. Relates to science and technology enterprises which locate in the study region with direct connection to Spaceport America customers' business activities. |
| **Training Center Impact (EXOS)** | Impacts of training facilities developed at or in conjunction with Spaceport America-related activities specifically for spaceport purposes. |
| **Major Government Programs** | Impacts of potential government contracts won either by Spaceport America directly, or by customers. An example is something like DARPA's Rapid Agile Launch Initiative or Sounding Rocket Program. In response to the Governor's Space Valley Collaboratory, a summit will be held, gathering state agencies, research universities, federal research labs, and other stakeholders in the space industry. |

## 5.2 BASELINE SCENARIO & ALTERNATIVE SCENARIOS

The baseline estimates of the economic and fiscal impacts of Spaceport America constitute the heart of this study. Economic impacts encompass the effects on the regional economy resulting from the Spaceport and its activities, and include jobs created and money expended in the region. Fiscal impacts include revenues to governments like taxes and fees. In many cases, economic impacts also create fiscal impacts, as expenditures are often taxable.

A simple example of how economic and fiscal impacts interact can be illustrated around the SA Cup. The direct economic impacts are largely related to food and lodging of the participants. Participants spend money in the region to rent hotel rooms and purchase food. Tax revenues are generated by the hotel stays and food purchased in restaurants, which constitutes fiscal impacts. The teams also pay entrance fees to the Spaceport, which is another source of fiscal impacts.

We organized these estimates into three types: employment impacts, direct economic impacts, and fiscal impacts. Employment impacts are measured in terms of permanent full-time equivalent positions created, while the wages and salaries from those jobs are counted as direct economic impacts, along with all other expenditures made into the regional economy as a result of Spaceport America. Fiscal impacts are also measured in terms of dollars, but consist of taxes and fees paid to government agencies. Some of the fees are paid directly to Spaceport America for the use of facilities, while a small amount of fees is paid by the Spaceport to the State Land Office for the lease of the land that Spaceport America occupies. Taxes are generally paid to the New Mexico Taxation and Revenue Department for distribution to state and local funds.

## 5.2.1 Employment Impacts

The activities of Spaceport America have created employment impacts in various ways. Permanent employment at the spaceport and in the surrounding communities is the most obvious of these impacts. NMSA directly employed 22 full-time, permanent staff in FY2019. This is less than half of the total current requirement of 58 personnel. The Spaceport has identified 18 of those remaining positions as critical and has plans for their hiring in the short-term future.

The spaceport has also created permanent employment through contracted services for security and fire, and other operational jobs. This employment is a mixture of full- and part-time employees that amounted to about 28 full-time equivalents (FTE) in FY2019, who are employees of Fiore Industries.[77]

Virgin Galactic has also brought permanent, full-time jobs to New Mexico as it relocates its headquarters to Las Cruces to support its Spaceport America operations. These jobs are highly-paid professional positions that pay significantly above the regional average salary. Virgin Galactic currently has more than 140 full-time permanent employees in New Mexico with near-term plans for substantial expansion as the headquarters relocation is completed.

Another set of employment impacts is related to Spaceport America's customers' spaceflight operations. Most of these customers are not based in New Mexico, but come to the spaceport for a set amount of time to conduct launch operations, in addition to testing, and even manufacturing of rocket motors in some cases. These impacts are not permanent New Mexico jobs, but do contribute to the New Mexico economy during their stay at the spaceport.

Finally, Spaceport America has, directly or through its customers, created numerous temporary construction jobs. Spaceport construction projects have included everything from roads and utilities to the main hangar and terminal building and runway in the horizontal launch area. The local labor requirements are significant. As shown elsewhere, the study area construction sector has a total employment of 20,949 people by the 1,960 firms operating in 2019.

Similarly, the study area's 1,189 firms operating in the transportation sector employed 17,327 individuals in 2019. These are two primary sectors that have been directly impacted by the Spaceport's construction activities, and significant portions of the local labor requirements have been sourced from the locally available labor force. Specialized trade skills such as specifically trained welders may not be available in the study area per se, but the proximity to Albuquerque and the associated bulk of the state's construction contracting firms increase the likelihood that the required skilled labor requirements may be met by in state resources.

**FIGURE 24:** Employment Impacts
FY2016–FY2029 (Jobs)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|
| NMSA Direct Employees | 18 | 18 | 18 | 22 | 32 | 40 | 66 | 76 | 81 | 133 |
| Contract Employees | 21 | 21 | 27 | 28 | 32 | 45 | 66 | 76 | 81 | 100 |
| Virgin Galactic Employees | 15 | 25 | 43 | 80 | 150 | 170 | 200 | 200 | 200 | 200 |
| Other NMSA Customer Employees | 0 | 0 | 0 | 20 | 36 | 47 | 47 | 67 | 67 | 83 |
| **Total FTE Employment** | **54** | **64** | **88** | **150** | **250** | **302** | **379** | **419** | **429** | **516** |

77 An Albuquerque, New Mexico-based contractor.

## 5.2.2 Direct Economic & Fiscal Impacts

Spaceport America encompasses an array of activities. It is not a single project to be completed and then operated essentially unchanged for a set lifespan. It is an evolving ecosystem, made up of government and private members that are constantly changing and developing. It is expected that the Spaceport of 10 years from now will likely look nothing like the Spaceport of today. To attempt to forecast future impacts, the foundation of historical impacts must be laid to present the current platform on which the future spaceport will be built.

As we have organized this analysis, direct economic and fiscal impacts arise in four separate broad categories, which have been described previously. It is important to note again that the Spaceport America Direct Impacts include a portion of taxpayer-funded activities. The impacts are presented separately here so that they can be distinguished from other impacts. We have also broken out the proportion of spaceport expenditures funded by customer rents and fees.

### 5.2.2.1 DIRECT IMPACTS

The first category is the Direct Impacts of the New Mexico Spaceport Authority. From FY2016 through FY2019, Spaceport America directly spent a total of $42.93 million. Of that, $6.49 million was in operational expenditures, excluding payroll.

FY2019 operational expenditures include payroll, and contractual services were $6.22 million. About 83.1% of the operational expenditures in FY2019 ($6.22 million) came from rents and fees paid by customers ($5.17 million), while the remaining 16.9% ($1.05 million) was sourced from state General Fund appropriations and excess Spaceport GRT Increment revenues.

While Spaceport payroll and contract payroll are also part of operations spending, the impacts of these two parameters are stated separately, reflecting the importance of job creation, and to allow the parameters to grow at separate rates in the forecast periods. In FY2019, Spaceport direct payroll totaled $1.89 million, while contract payroll amounted to $2.89 million.

We have also presented capital expenditures separately. Capital projects, which we are classifying as Facilities Enhancements, have the potential for additional impacts in the future—either they will become direct revenue generators themselves, or they are necessary developments to attract further customer business. Two examples of major projects that fit into this category are the proposed payload processing facility and the paving of the road to the launch areas. The former has the potential to directly generate revenues, and the latter will greatly improve the accessibility of the launch areas of Spaceport America. Other capital improvements are included in the Facility Enhancement parameter. Figure 25 lists the Spaceport America Direct Impacts that have been calculated for the Baseline Scenario consistent with the prior discussion.

FIGURE 25: Spaceport America Direct Impacts
FY2016–FY2029 ($million)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|
| Operational Expenditures | $1.42 | $2.29 | $1.33 | $1.44 | $1.86 | $2.81 | $3.09 | $3.40 | $3.73 | $6.01 |
| Payroll | $1.49 | $1.47 | $1.47 | $1.89 | $2.33 | $2.92 | $3.95 | $4.53 | $4.73 | $7.28 |
| Contract Employment | $1.50 | $2.30 | $2.30 | $2.89 | $3.20 | $4.00 | $4.50 | $5.18 | $5.52 | $6.82 |
| Facility Enhancements | $3.47 | $2.56 | $11.24 | $3.86 | $19.00 | $57.00 | $11.50 | $6.50 | $15.00 | $7.50 |
| **Direct Economic Impacts** | **$7.89** | **$8.63** | **$16.33** | **$10.08** | **$26.38** | **$66.73** | **$23.04** | **$19.61** | **$28.99** | **$27.61** |
| Direct & Indirect | $10.06 | $11.43 | $20.49 | $13.02 | $32.89 | $82.14 | $29.20 | $25.19 | $36.71 | $35.50 |
| Direct, Indirect & Induced | $13.41 | $15.13 | $26.59 | $17.34 | $42.68 | $105.28 | $38.75 | $33.95 | $48.62 | $48.25 |
| **Gross Receipts Taxes Generated** | $0.29 | $0.22 | $0.94 | $0.32 | $1.60 | $3.15 | $0.97 | $0.55 | $1.26 | $0.63 |

### 5.2.2.2 HORIZONTAL LAUNCH ACTIVITY IMPACTS

The second broad category of impacts arise from activities related to horizontal space launches. The passenger launch parameter captures the impacts of the highest profile of current Spaceport America customers, Virgin Galactic. To this point, Virgin Galactic hasn't provided manned commercial spaceflight to paying customers. They've been performing some test flights of the WhiteKnightTwo carrier aircraft from Spaceport America, which has some impacts due to fuel purchased from the Spaceport, and other per flight costs, but the major impacts from this parameter are in the future. Virgin Galactic plans to begin commercial flights sometime in 2020. The research and payload horizontal flight parameter is also expected to begin showing impacts in the near future.

Where Virgin Galactic has already had a significant impact related to the relocation of its headquarters to Las Cruces, and in the capital investment made both in the headquarters building and the Gateway to Space—Virgin Galactic's combination hangar and terminal from which it will undertake its launch activities. To date, Virgin Galactic has invested more than $11 million in capital improvement projects in New Mexico because of Spaceport America.

Virgin Galactic also now employs more than 140 residents of New Mexico, and continues to add to that, with an emphasis on hiring from the local workforce. The projected total is expected to reach 200 permanent full-time personnel by the end of FY2022. This amounts to $21.6 million in wages and salaries, at an average of $108,000 annually, well above the regional average annual wage of $42,000. The indirect and induced impacts of this high-paying employment will be seen in all facets of the regional economy, from housing markets to retail sales.

Orbital launch from a horizontal takeoff would represent a massive shift in the share of the commercial space launch market available to Spaceport America. Currently, the technology is being developed whereby this would be possible, with companies such as Virgin Orbit, but this activity is not currently taking place at the spaceport and is excluded from the Baseline Scenario. The parameter is included to capture such activities in the alternate Optimistic Scenario.

The final parameter in this category includes capital improvements to the spaceport horizontal launch facilities made by customers, as well as the potential impact of large government program participation, such as the Rapid Agile Launch program, whereby additional capital expenditures would be made possible without state government financing. Figure 26 lists direct impacts in the Horizontal Launch category.

FIGURE 26: Horizontal Launch Activity Impacts
FY2016–FY2029 ($million)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|
| Passenger Launch Impact | - | - | - | - | $1.32 | $12.92 | $19.30 | $31.30 | $32.77 | $46.00 |
| Virgin Galactic HQ & OPS | $2.27 | $3.78 | $10.01 | $21.11 | $31.48 | $34.51 | $39.04 | $39.04 | $30.24 | $30.24 |
| Drone Program | - | - | - | - | - | $10.31 | $0.31 | $2.00 | $2.00 | $2.00 |
| Research & Payload Launch | $0.40 | $0.01 | $0.01 | - | $0.10 | $0.10 | $0.15 | $0.15 | $0.15 | $0.26 |
| Horizontal Orbital Program | - | - | - | - | - | - | - | - | - | - |
| Project Dev. & Capital Exp. | - | - | - | - | - | - | - | - | - | - |
| **Direct Economic Impacts** | **$2.67** | **$3.79** | **$10.02** | **$21.11** | **$32.90** | **$57.84** | **$58.81** | **$72.50** | **$65.17** | **$78.50** |
| Direct & Indirect | $3.02 | $4.18 | $11.84 | $25.28 | $38.50 | $70.20 | $70.48 | $87.71 | $77.95 | $95.12 |
| Direct, Indirect & Induced | $4.54 | $6.49 | $16.90 | $35.46 | $55.49 | $94.90 | $97.42 | $119.31 | $107.25 | $128.30 |
| **Gross Receipts Taxes Generated** | $0.12 | $0.12 | $0.60 | $1.38 | $1.86 | $4.14 | $4.08 | $5.40 | $4.59 | $6.03 |

### 5.2.2.3 VERTICAL LAUNCH ACTIVITY IMPACTS

The third category is Vertical Launch Activities. The first parameter reflects the impacts directly related to suborbital vertical launch activities. The Spaceport has multiple current, active customers launching into suborbital space. These customers represent a range of technologies, from unguided spin-stabilized solid fuel rockets, to guided liquid fueled rockets testing reusable booster systems. Since FY2016, Spaceport America has hosted 41 commercial vertical launches, with 16 of them in FY2019.

The typical current vertical launch customer builds its rocket off-site, transports it to the spaceport, erects and launches the rocket, and then returns to its home base out of state to evaluate the results. The result of this is that the majority of the impact is seen in food and lodging sectors, and does not result in full-time employment in New Mexico, or extensive capital investment in facilities; although there has been some significant capital spending related to vertical launch activities, employees are not typically permanently based in New Mexico.

In FY2019, the vertical launch activities produced $349,900 in economic impacts, at an average per launch impact of approximately $21,900. The impacts of individual launches vary greatly, with the most significant having an impact of approximately $35,000 per launch. Launch activities have been occurring at an increasing frequency, up 433% in FY2019 over FY2016.

Testing activities is another parameter that has had a significant impact, and has the potential to grow. An example of this kind of activity is the static testing of rocket motors on test stands. One current customer conducts research and development testing in six-month cycles. During that time, the customer is spending about $60,000 per month in the regional economy, for a six-month cycle total of about a $360,000 impact. This includes equipment leased from local vendors, leases paid to the Spaceport, ground transportation, leased housing, meals and entertainment, and other supplies purchased from local sources.

In the future, once a design is certified and production begins, this customer anticipates a strong possibility that it would move permanent production testing to the spaceport. This would entail capital expenditures on facilities, permanent New Mexico employees, and constant operational expenditures of about $60,000 monthly.

Another vertical launch-related impact comes from the SA Cup. These are collegiate teams, so the commercial impact of this competition is less than some of the other parameters. However, there is a significant unquantifiable impact of creating interest and involvement for space-related careers in undergraduates that can not be ignored and is discussed with other STEM-related impacts in another section. The direct quantifiable impacts of the SA Cup are categorized in two ways: entry fees paid to the Spaceport and in the food and lodging expenses incurred by the participants.

In FY2019, there were over 1,500 participants, comprised of 150 teams from all over the world. Those participants needed to be fed and housed over the course of the competition, as well as additional days as tourists in some cases. These impacts amounted to $150,000 in fees—accounted for as revenues to NMSA—and an estimated $750,000 in the hospitality sectors. This is an estimated average impact.

As with the Horizontal Launch category, the orbital launch and major government program participation parameters are included for use in alternative scenarios in the future. Launching of small satellites into LEO represents an enormous potential market. If technology and regulations allow for orbital launch from Spaceport America in the future, it has the potential to be a game-changer in terms of commercial activity.

**FIGURE 27:** Vertical Launch Impacts
FY2016–FY2029 ($million)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|
| Suborbital Launch | $0.06 | $0.11 | $0.12 | $0.35 | $0.16 | $0.18 | $0.27 | $0.33 | $0.37 | $0.89 |
| SA Cup | - | $0.56 | $0.72 | $0.75 | $0.83 | $0.90 | $0.98 | $1.05 | $1.13 | $1.50 |
| Testing Activities | - | $0.01 | $0.05 | $0.19 | $0.09 | - | $0.27 | $0.27 | $0.27 | $1.44 |
| Orbital Launch | - | - | - | - | - | - | - | - | - | - |
| Project Dev. & Capital Exp. | - | - | - | - | - | - | - | - | - | - |
| **Direct Economic Impacts** | **$0.06** | **$0.67** | **$0.89** | **$1.29** | **$1.07** | **$1.08** | **$1.51** | **$1.65** | **$1.77** | **$3.83** |
| Direct & Indirect | $0.08 | $0.88 | $1.15 | $1.67 | $1.40 | $1.42 | $1.96 | $2.14 | $2.30 | $4.61 |
| Direct, Indirect & Induced | $0.10 | $1.06 | $1.39 | $2.02 | $1.68 | $1.71 | $2.37 | $2.58 | $2.77 | $5.94 |
| **Gross Receipts Taxes Generated** | $0.01 | $0.06 | $0.07 | $0.11 | $0.09 | $0.09 | $0.13 | $0.14 | $0.15 | $0.32 |

### 5.2.2.4 OTHER & HYPERSONIC ACTIVITY IMPACTS

The final category of economic and fiscal impacts is associated with a variety of non-aerospace, training, and project development activities. Of those activities, the development of the $7 million SpinLaunch facility dominates this category, with the kick-off of that project in FY2019 having a nearly $600,000 economic contribution between capital expenditures, wages and salary, housing of personnel, and fees paid to NMSA—the latter fees captured as revenues to NMSA. In FY2019, an additional economic contribution was provided by commercial use of the Spaceport America facilities for various events and video production, providing a direct economic impact of nearly $90,000 and an additional $176,000 in fees paid to NMSA—again, NMSA fees are included as revenues to NMSA.

FIGURE 28: Other & Hypersonic Activities Impacts
FY2016–FY2029 ($million)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|
| Project Dev. & Operations | - | - | - | $0.59 | $5.85 | $6.51 | $5.16 | $5.15 | $5.13 | $5.87 |
| Tracking Center (EXOS) | - | - | - | - | $1.37 | $1.43 | $1.56 | $1.81 | $2.17 | $2.59 |
| Other Non-aerospace Activities | - | $0.01 | $0.02 | $0.09 | $0.10 | $0.11 | $0.13 | $0.14 | $0.15 | $0.25 |
| Major Government Programs | - | - | - | - | - | - | - | - | - | - |
| **Direct Economic Impacts** | **-** | **$0.01** | **$0.02** | **$0.68** | **$7.32** | **$8.06** | **$6.85** | **$7.09** | **$7.46** | **$8.70** |
| Direct & Indirect | - | $0.01 | $0.02 | $0.77 | $8.48 | $9.16 | $7.62 | $7.93 | $8.39 | $9.76 |
| Direct, Indirect & Induced | - | $0.01 | $0.02 | $1.10 | $11.75 | $13.16 | $11.40 | $11.83 | $12.48 | $14.63 |
| **Gross Receipts Taxes Generated** | - | - | - | $0.06 | $0.68 | $0.73 | $0.60 | $0.63 | $0.67 | $0.78 |

## 5.2.3 Summary of Economic Impacts Estimated in Baseline Scenario

Figure 29 provides a summary of the estimated economic and fiscal impacts of Spaceport America under the Baseline Scenario, as previously described. Note, that these are annual estimates of these impacts, and they represent all of the direct expenditures in the regional economy. It is also important to understand that these annual impacts may be summed over the time period presented—that is, for the historic period for which we are relying on actual data, FY2016 through FY2019, the total direct economic impact of Spaceport America is approximately $84.13 million.

As can be seen in the annual estimates for the forecasted period of FY2020 through FY2024, the increased economic activities anticipated in the Baseline Scenario—including the planned capital expenditures—accelerate the annual economic impacts dramatically.

Indeed, the Baseline Scenario forecast anticipates that nearly $500 million in direct economic impacts may be associated with the continuing development and operation of Spaceport America.

Finally, note that the Baseline Scenario also anticipates that by FY2029, the total annual direct economic impact will have increased to $118.64 million, which would reflect an average annual growth rate of approximately 2.79% during that five-year period.

FIGURE 29: Annual Economic Impacts-Baseline Scenario
FY2016–FY2029 ($million)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|
| NMSA | $7.89 | $8.63 | $16.33 | $10.08 | $26.38 | $66.73 | $23.04 | $19.61 | $28.99 | $27.61 |
| Horizontal Launch Activities | $2.67 | $3.79 | $10.02 | $21.11 | $32.90 | $57.84 | $58.81 | $72.50 | $65.17 | $78.50 |
| Vertical Launch Activities | $0.06 | $0.67 | $0.89 | $1.29 | $1.07 | $1.08 | $1.51 | $1.65 | $1.77 | $3.83 |
| Other Activities | - | $0.01 | $0.02 | $0.68 | $7.32 | $8.06 | $6.85 | $7.09 | $7.46 | $8.70 |
| **Direct Economic Impacts** | **$10.62** | **$13.10** | **$27.25** | **$33.16** | **$67.68** | **$133.71** | **$90.20** | **$100.84** | **$103.38** | **$118.64** |
| Direct and Indirect | $13.16 | $16.49 | $33.50 | $40.74 | $81.27 | $162.93 | $109.27 | $122.97 | $125.34 | $144.99 |
| Direct, Indirect, and Induced | $18.04 | $22.69 | $44.91 | $55.92 | $111.61 | $215.05 | $149.95 | $167.68 | $171.13 | $197.12 |
| **Gross Receipts Taxes Generated** | $0.41 | $0.40 | $1.62 | $1.88 | $4.22 | $8.11 | $5.77 | $6.71 | $6.67 | $7.77 |

## 5.2.4 Indirect & Induced Impacts: Economic Multipliers

We have discussed the nature of economic flows in a regional economy, describing how a dollar of direct expenditure provides a cycle of additional economic activities as income and expenditures create additional income and expenditures through indirect and induced behavior of economic agents. Economic multipliers are commonly incorporated in economic impact analyses.

In the case of the aerospace industry, and specific economic activities associated with Spaceport America, we have identified published economic multipliers to apply to the specific activities engaged by NMSA and its customers. See Appendix E for details.

Figure 29 reports the calculated direct, indirect, and induced economic impacts of the forecasted Baseline Scenario economic activities. Note, the indirect multipliers applied to the various direct impacts result in about a 22.5% estimated increase in economic activities—these are additional economic impacts related to the expenditures of the suppliers of goods and services to NMSA and its customers. For example, the purchase of a new truck results in income to the dealership and its employees, who in turn spend that additional income on other goods and services in the economy.

Based on the direct impacts of Spaceport America, the direct and indirect economic impacts of the forecasted Baseline Scenario for FY2016 through FY2024 is estimated to be $705.7 million.

The induced economic impacts capture the much broader impacts in the economy from direct economic activities, and add an average 44.2% increase in regional economic activities. Building on the prior example, not only does the dealership and its employees utilize the additional income, but also those additional economic activities create additional economic activities in the form of need for police, librarians, sanitation workers, and other service providers to support the expansion in the economy.[78]

Based on the direct impacts of Spaceport America, the direct, indirect, and induced economic impacts of the forecasted Baseline Scenario for FY2016 through FY2024 is estimated to be $956 million.

These economic multiplier impacts are both well understood and commonly utilized in economic impact analyses. In our analyses, we have attempted to be as

78 IMPLAN© refers to these induced economic impacts as Social Accounting Matrix (SAM) multiplier impacts.

precise as possible in selecting the multipliers utilized to reflect the impacts of the specific economic sectors where the activities occur.

## 5.2.5 Summary of Fiscal Impacts

Fiscal impacts include all of the revenues accrued by government agencies as a result of the spaceport. Some of these are directly measurable, while others are estimated based on local tax rates and estimated expenditures. Fiscal impacts of Spaceport America include three separate categories: tax revenues generated by activities taking place at Spaceport America, fees and lease payments made to the Spaceport by customers, and the revenue generated by the local GRT increments dedicated to spaceport purposes in Doña Ana and Sierra counties. Each of these types of impact is distinct and requires different treatment. Figure 30 summarizes the fiscal impacts of Spaceport America over the study period.

FIGURE 30: Summary of Fiscal Impacts-Baseline Scenario
FY2016–FY2029 ($million)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|
| Fees and Leases | $2.31 | $2.16 | $3.29 | $5.21 | $5.72 | $6.29 | $6.92 | $7.61 | $8.36 | $13.45 |
| Spaceport Local GRT Increment | $8.53 | $9.02 | $9.40 | $9.50 | $9.66 | $9.81 | $9.96 | $10.11 | $10.27 | $11.02 |
| GRT Generated on Spaceport Activities | $0.41 | $0.40 | $1.62 | $1.88 | $4.22 | $8.11 | $5.77 | $6.71 | $6.67 | $7.77 |
| **Total Fiscal Impacts** | **$11.25** | **$11.58** | **$14.31** | **$16.58** | **$19.61** | **$24.21** | **$22.65** | **$24.43** | **$25.29** | **$32.23** |

The most straightforward of these fiscal impacts is the tax revenue generated by activities of, and related to, the Spaceport. These are ordinary fiscal impacts commonly seen in any economic and fiscal impact study. While much of the activity of Spaceport America itself is excluded from GRT due to deductions and exemptions passed by the legislature, a large portion of the direct impacts of the spaceport have come in the form of construction spending, which is specifically excluded from the deductions.

Spaceport customers also generate GRT revenue through their activities such as food and lodging expenditures. In FY2019, we estimate that about $1.9 million in GRT revenue was generated by spaceport and customer activities. Planned and ongoing customer construction and operational activity result in an immediate increase to $4.2 million in FY2020. As taxable customer activity increases in the forecast, our Baseline Scenario estimates that GRT generated will grow to about $6.7 million in FY2024 and $7.8 million by FY2029. The GRT revenue impacts generated are listed in tabular form alongside the economic impacts.

Another type of fiscal impact measured here consists of leases and fees paid to the Spaceport by customers, as well as the lease payments made by the Spaceport to the State Land Office; although at $35,000 per year, these are much smaller than the customer payments. In FY2019, the Spaceport received about $2 million in fees from tours and launch fees, and $3.2 million in customer leases. In the Baseline Scenario projection, these are forecast to increase to $3.2 million in tours and launch fees, and $5.1 million in lease payments. Figure 31 lists fiscal impacts related to fees and leases.

**FIGURE 31:** Fees & Lease Revenues
FY2016–FY2029 ($million)

| | 2012-15 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tours and Launch Fees | $2.76 | $1.19 | $0.97 | $0.91 | $2.00 | $2.20 | $2.42 | $2.66 | $2.93 | $3.22 | $5.19 |
| Customer Lease Payments | $2.93 | $1.08 | $1.16 | $2.35 | $3.17 | $3.49 | $3.84 | $4.22 | $4.64 | $5.11 | $8.22 |
| Lease Payments to SLO | $0.14 | $0.04 | $0.04 | $0.04 | $0.04 | $0.04 | $0.04 | $0.04 | $0.04 | $0.04 | $0.04 |
| **Total Fees and Rentals** | **$5.82** | **$2.31** | **$2.16** | **$3.29** | **$5.21** | **$5.72** | **$6.29** | **$6.92** | **$7.61** | **$8.36** | **$13.45** |

The regional spaceport GRT increments enacted by Doña Ana and Sierra counties represent another kind of fiscal impact. These increments raise GRT revenue not just on activities taking place at the Spaceport, but also county-wide. The revenue-generating activities are not necessarily related to the Spaceport—although GRT-generating activities at the Spaceport will also be subject to the 0.25% increment—but the revenue would not be generated if not for the Spaceport. There's no sunset clause on the spaceport tax.

Statute governs the use of the revenues thus generated. The Regional Spaceport District Act states:

> *At least 75% of the municipal regional spaceport gross receipts tax or county regional spaceport gross receipts tax revenues received by each governmental unit must be used by the district for the financing, planning, designing, engineering, and construction of a regional spaceport. No more than 25% of the municipal regional spaceport gross receipts tax or county regional spaceport gross receipts tax revenues may be used by the governmental unit enacting the tax for spaceport-related projects as approved by resolution of the governmental unit.*[79]

Spaceport America has used the portion of funds received by the district for debt service on bonds issued in the construction of the Spaceport, as well as for operational expenditures. To the extent that the tax increment revenues have been used to repay bonds, this represents a shifting of the burden of repayment of the bonds to the taxpayers in the locations most likely to receive direct economic benefits from the spaceport. In FY2019, Sierra County generated $413,000 and Doña Ana County generated $9 million in revenue from this tax increment.

The amount of revenue retained by the county in practice has been precisely 25% in every year except FY2009, based on published RP-500 Reports available from the New Mexico Taxation and Revenue Department. The distributions generated in Doña Ana County are larger due to greater amounts of taxable gross receipts in the county because the increment enacted in each county is the same quarter of a percent. Figure 32 lists the revenues accrued due to the Spaceport Regional GRT increments.

79 Regional Spaceport District Act, NM Stat Section 5-16-1 (2018).

FIGURE 32: Spaceport Regional Gross Receipts Tax
Doña Ana and Sierra Counties, FY2012–FY2029 ($million)

| | 2012-15 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DOÑA ANA COUNTY** | | | | | | | | | | | |
| Retained by County | $15.39 | $2.02 | $2.14 | $2.25 | $2.27 | $2.29 | $2.32 | $2.36 | $2.39 | $2.43 | $2.46 |
| Transferred to Spaceport District | $35.12 | $6.05 | $6.41 | $6.75 | $6.80 | $6.86 | $6.97 | $7.07 | $7.18 | $7.29 | $7.39 |
| **Total Revenue Distributed** | **$50.51** | **$8.07** | **$8.55** | **$9.01** | **$9.07** | **$9.14** | **$9.29** | **$9.43** | **$9.57** | **$9.72** | **$9.86** |
| | 2012-15 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2029 |
| **SIERRA COUNTY** | | | | | | | | | | | |
| Retained by County | $0.92 | $0.12 | $0.12 | $0.10 | $0.11 | $0.13 | $0.13 | $0.13 | $0.14 | $0.14 | $0.14 |
| Transferred to Spaceport District | $2.17 | $0.35 | $0.35 | $0.30 | $0.32 | $0.39 | $0.39 | $0.40 | $0.41 | $0.41 | $0.42 |
| **Total Revenue Distributed** | **$3.09** | **$0.46** | **$0.47** | **$0.40** | **$0.43** | **$0.52** | **$0.53** | **$0.53** | **$0.54** | **$0.55** | **$0.56** |

## 5.2.6 Summary of Alternative Scenarios' Economic & Fiscal Impacts

As previously noted, the alternative scenarios are derived from the Baseline Scenario. The alternative scenarios build on the assumptions and parameters defined by the Baseline Scenario. In some parameters, there's simply an acceleration or deceleration of the activities related to a particular customer. For example, the number of vertical launches can be scaled up or down, or requested capital investments can be appropriated sooner or later, increased or decreased.

In other parameters, new activities are introduced—or Baseline Scenario activities eliminated—in the alternative scenarios. These are game-changers, and their occurrence causes a fundamental shift in the estimated economic impacts. A prime example would be achieving orbital flight from the spaceport, whether from a vertical launch or horizontally. This capability would open the door for Spaceport America to capture a portion of the market for placing small satellites into LEO, which is a market that is large and expected to grow at a very rapid rate.

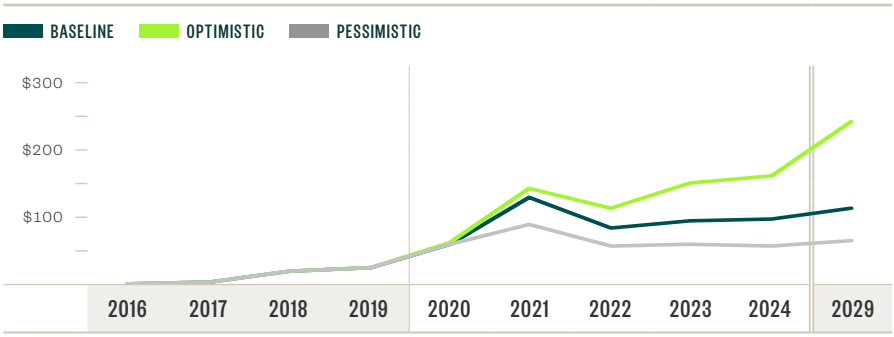
In summary, the modeled alternative scenarios produced direct economic impacts as in comparison to the Baseline Scenario as shown in Figure 33.

FIGURE 33: Summary Comparison of Direct Impacts in Alternative Scenarios
FY2016–FY2029 ($million)

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Baseline** | $10.62 | $13.10 | $27.25 | $33.16 | $67.68 | $133.42 | $90.20 | $100.84 | $103.38 | $118.64 |
| **Optimistic** | $10.62 | $13.10 | $27.25 | $33.16 | $68.70 | $146.90 | $118.31 | $153.04 | $165.19 | $241.84 |
| **Pessimistic** | $10.62 | $13.10 | $27.25 | $33.16 | $65.65 | $95.26 | $62.93 | $67.39 | $63.67 | $72.17 |

As with the Baseline Scenario, the alternative scenarios are developed around each of the four primary activities: NMSA's operations of Spaceport America, horizontal launch activities, vertical launch activities, and other Spaceport America activities. The deviations from the Baseline Scenario economic impacts are more easily considered in Figure 34.

FIGURE 34: Alternative Scenario Comparison: Total Direct Economic Impacts
FY2016–FY2029 ($million)

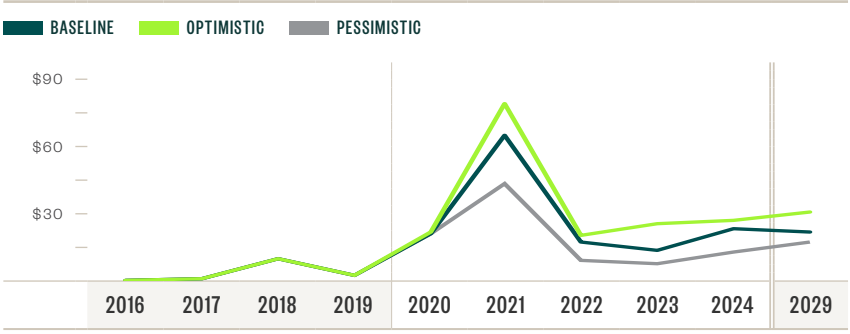



In defining NMSA's operations of Spaceport America's for the alternative scenarios, the timing and amounts of capital project expenditures provides the biggest component of the variation. We also assumed that there would be differences in the staffing levels, both direct and contracted, and that the positions would be filled at different times.

For the Pessimistic Scenario, we assumed that capital projects would be funded more slowly, and at a reduced rate: a total of about $81.25 million in capital expenditures over the time period covered. With slower facilities growth and the associated activities, we also reduced the peak employment level in FY2029 to 80 direct agency employees, which is still a significant increase from the current NMSA employment, but significantly fewer than specified in the Baseline Scenario. Similarly, fewer contract operations employees are necessary in the Pessimistic Scenario, peaking at 100 in FY2029.

Conversely, in the Optimistic Scenario, project schedules are accelerated, and budgets for some projects are increased, reflecting the increased needs for facilities enhancement as business in other areas increases faster than in the Baseline Scenario. For the Optimistic Scenario, we have estimated a total of about $140 million in capital expenditures. Likewise, direct employment peaks at 145, and contract employment at 110 in FY2029. Figure 35 illustrates the direct impacts of NMSA's Spaceport America operations in the three scenarios.

FIGURE 35: NMSA's Spaceport Operations Alternative Economic Impacts
FY2016–FY2029 ($million)




Horizontal launch activities offer some significant, realistic upside potential for economic impacts for Spaceport America, and a more muted potential downside risk.

The highest profile horizontal launch customer, Virgin Galactic, has demonstrated a strong commitment to Spaceport America by relocating its headquarters to Las Cruces. Our Pessimistic Scenario forecast assumes that, while Virgin Galactic will be successful in pioneering the market for commercial space tourism, it will

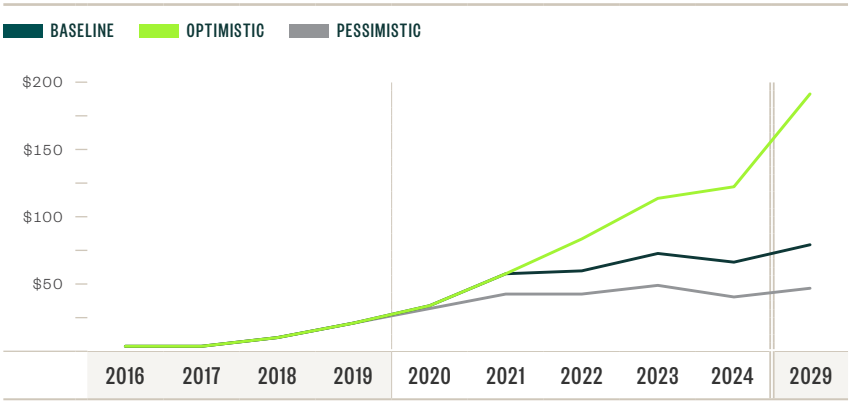
not achieve its flight schedule as quickly as planned—the Pessimistic Scenario forecasts half of the number of passenger horizontal flights in a given year, reducing the peak FY2029 impact of this parameter to $23 million in FY2029, from a total of about 1,150 passengers.

Subsequently, Virgin Galactic's headquarters employment is assumed to develop more slowly and peak at 150 employees. The Pessimistic Scenario also assumes that the drone testing programs currently being explored do not materialize.

In the Optimistic Scenario, successful orbital flights from horizontal launches drive significant additional economic impacts. This assumes that a new customer with existing technology, such as Virgin Orbit, can be licensed to operate out of the Spaceport. As significant operations would be relocated to Spaceport America and the study region, we assumed that this development would create 100 additional full-time permanent positions in New Mexico during the forecast period, and a total direct economic impact of over $100 million in FY2029.

This Optimistic Scenario also reflects increasing the scope of the proposed drone activities to reflect three customers, with a total of 60 full-time employees, capital expenditures totaling $30 million to develop hangars and facilities, and operational expenditures increasing to about $1.5 million in FY2029. The Optimistic Scenario also assumes additional capital expenditures by customers of a total of $5 million, as required by increased operational requirements. Figure 36 presents a comparison of horizontal launch activity impacts across the scenarios.

FIGURE 36: Horizontal Launch Activity Impacts
FY2016–FY2029 ($million)



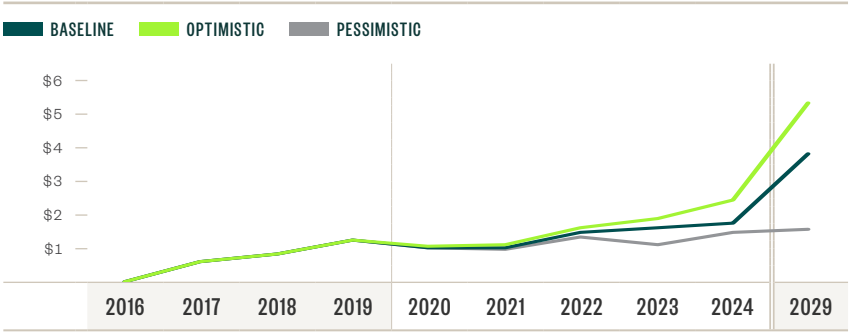

Vertical launch activities have limited downside in our three scenarios. This is due to the fact that Spaceport America is uniquely situated to provide suborbital vertical launch opportunities as is. Very little, if any, additional investment would be required for Spaceport America to retain and continue to attract the type of activities currently taking place. In the emerging market of commercial spaceflight, particular customers may come and go, but the testing and suborbital launch capabilities of the spaceport have little chance of going unused at something approximating the current level.

For the Pessimistic Scenario, we have reduced the growth rate of vertical launch activities, and lowered the peak number of launches to 26 in FY2029, for biweekly launches, as opposed to weekly in the baseline. We have also assumed a slower overall growth of the SA Cup, of 5% annually, to a total of 2,325 participants in FY2029. The biggest reduction in growth comes in the testing parameter. In this scenario, we assume that current customer ABL continues with its six-month testing cycles, but at half the rate of the baseline, and by FY2029 has not progressed to permanent production testing of rocket motors and has no permanent employment at the Spaceport.

One of the growth opportunities we have modelled in vertical launch activities comes in the form of an acceleration of current testing activities. In the Optimistic Scenario, vertical launch frequency increases at a greater rate, and reaches a level of 65 launches in FY2029. The SA Cup also grows at a faster rate and reaches a total of 3,375 participants by FY2029. This scenario also assumes that ABL will continue its once a year testing cycle, until 2024 when it will have two test cycles.

The Optimistic Scenario also includes $12 million in total capital expenditures by Spaceport America customers to keep up with increased operational needs. Orbital flight from a vertical launch is a possibility from Spaceport America that we have also included in the Optimistic Scenario. In the case of vertical launch to orbit, we have modeled a different scenario from horizontal orbital launch. Our Optimistic Scenario envisions a case in which a launch customer is found that is able, through some combination of updated technology and policy, to launch to orbit from an inland location and choses to do so from the Spaceport. The launch operation we have modeled here represents a one-off six-month launch operation in FY2029 that does not involve permanent personnel and facilities development. The impact, nonetheless would be significant—approximately $1 million for the six-month launch cycle. Figure 37 compares the three scenarios for vertical launch activities.

FIGURE 37: Vertical Launch Activity Impacts
FY2016–FY2029 ($million)




The category of Other and Hypersonic Activities offers potentially the greatest uncertainty of the four major areas of spaceport operations. Spaceport customers in this category are doing everything from television commercial shoots to cutting edge hypersonic project development. The biggest driver of economic impacts is in the development of hypersonic technologies.

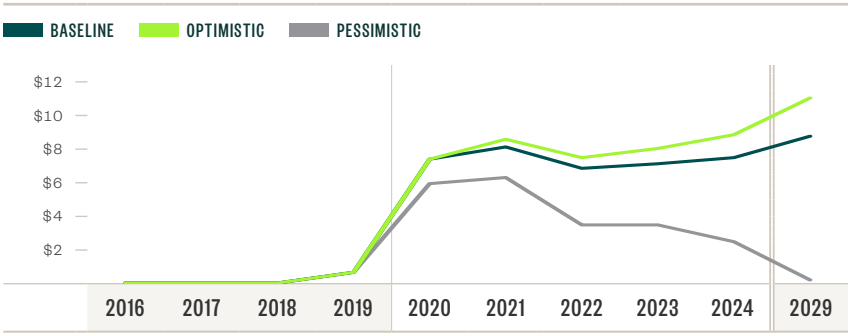
As previously discussed, one customer, SpinLaunch, is currently developing a second-stage proof-of-technology project. The kinetic energy launch, an electric mass accelerator, must yet be proven. However, if the scale testing is successful, follow on developments are anticipated to allow small satellites to launch into LEO, with only the use of a small rocket to circularize the orbit. If successful, this technology will allow for rapid, cheap launches to orbit. This category also provides impacts from a deployment of a training center planned by EXOS Aerospace, as well as a continuation of other uses such as a location for commercial and video shoots.

In the Optimistic Scenario, SpinLaunch's project development continues at the same pace as in the Baseline Scenario, but the training center for EXOS Aerospace reaches its full potential as EXOS' testing and vertical launch activities have accelerated in pace, requiring more instructors and full-time employees to train launch crews. This leads to peak employment of 40 full-time positions, and total direct annual impacts of about $4.8 million by FY2029. Filming activities continue with 10% annual growth.

In the Pessimistic Scenario, we have assumed that the SpinLaunch project does not achieve its goals, and employment and other impacts taper off over time rather than increasing. In this scenario, employment peaks in FY2020 and FY2021 at 30, which is the current level, decreasing to 20 by FY2024 and zero by FY2029. Economic impacts also peak at about $9.8 million in FY2021, then decreasing to zero by FY2029. In this scenario, we also assume that the planned training center is never realized. Other activities, like film shoots, continue on a similar pace to current.

The three scenarios for Other and Hypersonic activities are compared in Figure 38.

**FIGURE 38:** Other & Hypersonic Activity Impacts
FY2016–FY2029 ($million)



# 5.3 TAXPAYER RETURN ON INVESTMENT

One of the key components of this study is an analysis of the return on the investment (ROI) of New Mexico taxpayers in the development of Spaceport America. This investment has come in many forms, both as funds directly provided—General Fund appropriations, capital outlay funds, bonds issued, and GRT spaceport tax increment dedication.[80] Taxpayers and decision-makers have a strong interest in knowing the extent to which these investments have paid off.

Whenever taxpayer funds are directed towards economic development, it is desired that there will be a return on that investment that will be captured by the taxpayers.[81] The use of taxpayer money thus comes with a responsibility for proper use of these funds, and warrants an investigation of these impacts. This is largely a matter of accountability to the community that is not just supporting Spaceport America, but that made its existence in New Mexico possible.

A decision taken by the government to use taxpayer resource imposes what public welfare economics characterize as opportunity costs—that is, those resources could be used for other purposes, but for the deliberate allocation of those resources to the specific public purpose defined by the government's decision.

As described below, evaluating investment returns from government programs must address many attributes of a program. Indeed, as part of this analysis, we also engaged several of the senior economists in New Mexico state government. The discussions with economists from the Economic Development Department, Taxation and Revenue Department, and Legislative Finance Committee staff were robust, and are reflected in the scope of the analyses described below.

Quantifiable impacts are the foundation for a ROI analysis. It should, however, also be noted that educational impacts—for example, the engineering students attending the SA Cup each year, and the educational outreach of NMSA staff—are also a part of taxpayers' ROI through STEM education opportunities provided by Spaceport America activities. We can only acknowledge these additional sources of ROI.

## 5.3.1 Return on Investment Analysis

### 5.3.1.1 RETURN ON INVESTED CAPITAL

Ordinarily, return on invested capital (ROIC) is calculated with a standard formula:

$$ROIC = \frac{Net\ Operating\ Profit\ After\ Taxes}{Invested\ Capital}$$

In this case, we can identify the denominator easily enough. The investment in Spaceport America is public information. We know the magnitude, timing, and financing of the investments made. However, as a government agency, Spaceport America is not strictly profit-seeking, and the return—that is, net operating profit

80 Additionally, tax expenditures related to various credits, deductions, and exemptions from GRT associated with spaceport-related activities have a fiscal cost to the state and counties by reducing the GRT liability. It is not possible to quantify these additional fiscal impacts directly related to Spaceport America activities for this analysis.

81 That is, the question is if there is economic value added by investments in a program, process, or initiative. Economic development investments by government provide such programs.
P.P. Phillips and J.J. Phillips. ROI Basics, ROI Institute, ATD Press, Alexandria, VA, 2019, p.1.

is not a defined concept for this calculation in the case of NMSA. Government activities are not often evaluated in this way.[82]

An important first step in the evaluation of the ROI is to define the numerator of the equation. What will replace net profits in this case when profits are not a primary economic objective? There are many factors to take into account.[83] There is the obvious category of fiscal impacts—government revenues. It could be argued that the return on tax dollars spent should be measured in taxes generated from the expenditure—that is, fiscal impact. This approach underrepresents the true return, as it captures only one small component of the total economic impact of public expenditures.[84]

Another factor is the regional economic activity that is enabled by the capital investment. Spaceport America has created a nexus in New Mexico for space-based economic activity. This has the effect of attracting business activities that would not otherwise exist in New Mexico. These businesses create jobs and expenditures in the New Mexican economy that benefit all New Mexico taxpayers, and especially those in the surrounding study area.[85]

We assert that an appropriate substitute for net profits in this case would encompass both fiscal and economic impacts. These impacts have been presented in a previous section of the report and discussed there at length. These estimates represent—relying on the best available information—the public benefit generated by Spaceport America.

The amount of capital investment has only been generally discussed in detail thus far in this report. We believe it is appropriate to consider all capital investment since FY2008 in the denominator of the Return on Invested Capital (ROIC).

Spaceport America has received legislative funding from various sources facilitating the construction and operations of the facility. Through FY2019, the New Mexico State Legislature authorized nearly $114.3 million in Capital Outlay through Severance Tax Bonds. GRT Revenue Bonds were also issued in 2009 and 2010, providing $78.6 million for capital investments. Additionally, the legislature has also made appropriations from the General Fund for operational expenses at the Spaceport.

82 Return on investment in the public sector incorporates steps from long-standing concepts of cost-benefit analyses applied to public sector activities. Although ROI analysis is derived from accounting and finance concepts, as applied to public sector evaluations, it is grounded in welfare economics and public finance. The conceptual difference is that the benefit-cost analysis evaluates program benefits to the program costs—benefit-cost ratio—whereas the public ROI calculation evaluates net program benefits to invested capital.
Jack J. Phillips, PhD, "ROI in the Public Sector: Myths and Realities," ROI Institute, Inc., Public Personnel Management, June 22, 2004. (Phillips, 2004).

83 An important attribute of any methodology is the ability to replicate the results obtained. That is, it must follow principles of the scientific method. In the analyses presented here, we have demonstrated the bases for the calculation of economic and fiscal benefits, and rely on financial accounting records as the basis for stating invested capital.

84 Government expenditures to enhance private economic development activities presume the public benefits extend beyond simply fiscal revenues—creation of private sector jobs, income, and capital investment, as well as the additional revenues to government in the form of taxes and fees. This discussion is formalized in the economic literature related to public finance and public welfare economics.

See Kenneth J. Arrow and Mordecai Kurz, *Public Investment, the Rate of Return, and Optimal Fiscal Policy*, Resources for the Future, John Hopkins Press, New York/London, 2011.

85 If benefits of public investment are to be broadly evaluated, they must reflect a balance of both quantitative and qualitative data. That is,

The ROI represents a balanced profile of six types of data:

1. Reaction, satisfaction, and planned action
2. Learning
3. Application and implementation
4. Business impact
5. Return on investment
6. Intangible benefits—those benefits we choose not to convert to monetary value

Program must intend to do something with it—reaction. They must understand the function of the program and how to accomplish its purpose—learning. The program must do something—application and implementation. A positive outcome with regard to efficient and effective use of resources should occur—business impact. Positive outcomes or program benefits may be converted to monetary value and compared to the fully loaded cost of the program—ROI. Intangible benefits must be evaluated and are often the more important benefits of the program. "ROI is often misinterpreted when the complete story of program success is not reported." (Phillips, 2004).

These three sources of funding can be viewed as the New Mexico government's investment in Spaceport America. Expenditures of these funds produce economic and fiscal impacts in the economy. These impacts are direct, indirect, and induced. As demonstrated herein, direct impacts can be measured from the expenditures, and can include activities that create tax revenues for government coffers. There are additional indirect impacts and induced impacts that generally characterize the activities in the economy which create demand for other services.

The analysis of ROIC evaluates the economic and fiscal impacts, General Fund appropriations, and capital investment in the form of Severance Tax Bonds and GRT Revenue Bonds. The multiple analyses presented below serve to illustrate the relationship between the capital investments and the economic and fiscal benefits from the funding of those investments.

The first formulation of the ROIC analysis looks at only the economic and fiscal benefits and the capital assets. The capital assets have been funded by the Severance Tax Bond and GRT Revenue Bond proceeds. These two types of bond financing have been used for the primary construction of the terminal, runway, and other infrastructure at Spaceport America. The first formulation of the ROIC should be understood as a gross ROIC, and can be stated as:

$$ROIC_1 = \frac{Economic\ \&\ Fiscal\ Benefits}{Total\ Capital\ Assets}$$

The second form of ROIC evaluated subtracts the General Fund budget appropriations for operations from the economic and fiscal benefits. Whereas the gross ROIC takes the annual General Fund appropriations as simply a sunk cost, the second formulation calculates a net ROIC by subtracting the General Fund operating funding of NMSA provided by the New Mexico Legislature.

Spaceport America is a government agency, as such, it may not be appropriate to consider General Fund appropriations as part of the economic benefits obtained. General Fund appropriations for government agencies serve the purpose of funding the daily operations of government functions, and facilitate obtaining the economic and fiscal benefits.

$$ROIC_2 = \frac{Economic\ \&\ Fiscal\ Benefits - General\ Fund\ Appropriations}{Total\ Capital\ Assets}$$

The third formulation eliminates the GRT Bond proceeds from the capital assets—reducing total capital assets by $78.6 million—which is replaced by the actual stream of annual GRT Revenue Bond repayments. The reason for this type of analysis is recognition that the funding mechanism, Revenue Bonds, does not displace other capital funding opportunities,[86] but are proceeds from a special purpose bond that is being repaid on an annual basis by dedicated revenues collected from the GRT increment passed by Sierra and Doña Ana counties.

The GRT Bond repayments represent the cash equity investment in Spaceport America—the equity held in the assets built and acquired using GRT Revenue Bond proceeds. These assets were constructed with money borrowed via issuance of bonds. These bonds are being repaid with GRT revenues pledged for

86 That is, drawing on public welfare economics concepts, there is no opportunity cost to this bonding mechanism in that other public projects that could be financed by the bond issuance are not foregone or impacted. Instead, the citizens of Sierra and Doña Ana counties made a deliberate decision to invest in the capital project through imposing on themselves the additional GRT increment, allowing issuance of the GRT Revenue Bonds for Spaceport construction.

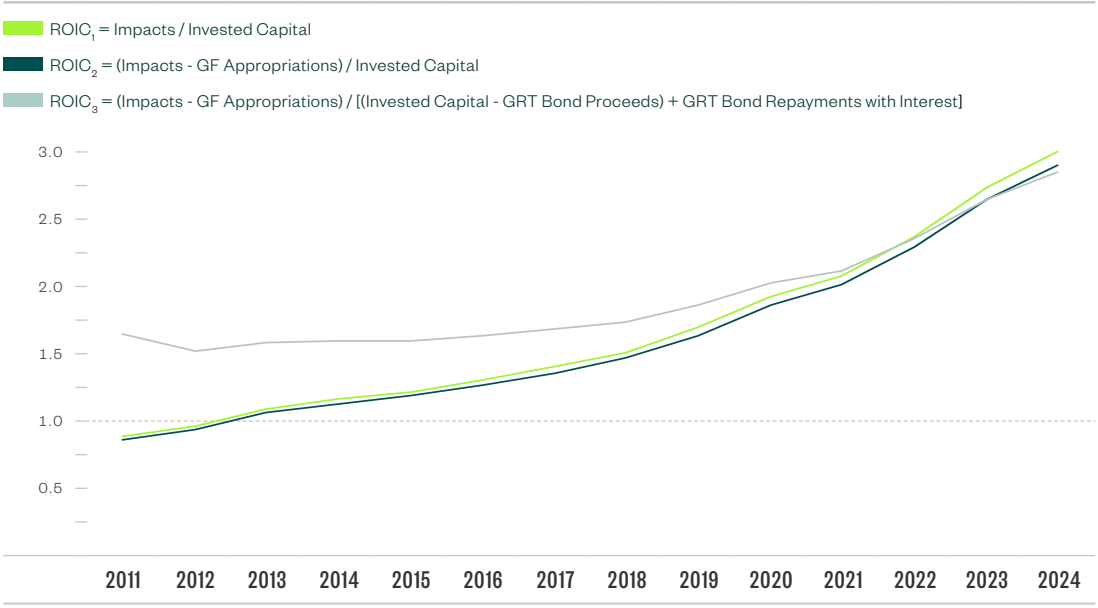
the repayment of the debt. As the payment of the debt obligations increase, so does the spaceport's equity of the assets.[87]

$$ROIC_3 = \frac{Net\ Operating\ Profit\ After\ Taxes}{(Total\ Capital\ Assets - GRT\ Bond\ Proceeds) + GRT\ Bond\ Repayments}$$

The three ROIC calculations produce different times when Spaceport America surpassed a ROIC ratio of one. A ROI ratio of one represents the break-even point and signals a period in which the economic impacts of Spaceport America are equal to the investment. A positive return is achieved in periods when the ROIC exceeds a ratio of one.

The ROIC analysis is a rolling sum of economic and fiscal impacts, appropriations, and capital investments. The reason for this is that particularly for capital investments, the value of the assets grow as capital is received by Spaceport America. As such, economic and fiscal impacts, and appropriations, are summed up year over year. The following charts illustrate the evolution of the ROIC over time with a forecast into future returns.

FIGURE 39: Alternative Return on Invested Capital Including GRT Revenue Bond Repayments
FY2016–FY2029




The figures presented above illustrates the ROIC measured three different ways. The first formula only analyzes the relationship between the economic and fiscal impacts and the capital assets. This approach reveals a ROIC ratio of 1.08 in FY2013. This year became the first in which the benefits equaled the capital investments from the two types of bond proceeds. In the years after FY2013, the ROIC ratio exceeded one consistently into the forecast period.

The second formula subtracts the General Fund appropriations from the economic and fiscal impacts and divides by the total capital assets appropriations, which are made up of Severance Tax Bond proceeds and GRT Revenue Bond proceeds. The results indicate that, based on this measure, Spaceport America surpassed the ROIC ratio of one in FY2013. Using this approach, Spaceport

87 This transaction is analogous to a home mortgage, in some senses. That is, Spaceport America (NMSA) essentially borrowed $78.6 million, and is repaying that principle and interest obligation by taxing current transactions that are subject to a GRT obligation in in the two counties. The issue then arises whether to treat the capital investment as the total bond proceeds received ($78.6 million), or if the investment is actually the actual payments that have been made on the GRT Revenue Bond obligations. Returning to the home mortgage analogy, the equity which you have in a home is primarily the repayment of the financed obligation.

America surpassed the break-even point in FY2013. This means that was the year when economic and fiscal impacts equaled the amount of capital investment.

The third ROIC calculation is the most unique and aims at capturing returns based on equity held in capital assets. This means that this approach subtracts the amount of GRT Revenue Bond proceeds from the capital assets total amount, but adds the bond repayment amounts. Spaceport America borrowed money for the construction of the facilities and has been making repayments since FY2010.

These repayments are the equity that Spaceport America has been building, creating a time shift in their full ownership of the capital assets. Moreover, this calculation shows that a ROIC ratio of one was exceeded in FY2009, much earlier than in the other calculations. This is because there are economic and fiscal impacts in the numerator that derive from capital investments that didn't come from government appropriations or revenues.

Spaceport America used funds from revenue bonds, essentially getting a loan, and turned those funds into economic and fiscal impacts with the construction of the spaceport. The revenue bond proceeds were received in FY2010 and FY2011 totaling $78.56 million. Through FY2019, Spaceport America has paid $55.01 in principal, interest, and issuance costs of the bonds.

#### 5.3.1.2 RETURN ON REGIONAL GROSS RECEIPT TAXES: DEDICATIONS

The return on regional GRT dedications has to be considered differently. By statute, counties that joined a Regional Spaceport District were eligible to implement an increment of county option GRT of no more than 0.50% of taxable gross receipts before the end of calendar year 2008.[88] As previously noted, two counties implemented such an increment at 0.25%. The language of the statute requires that at least 75% of all such revenue collected be dedicated to the financing, planning, designing, engineering, and construction of a spaceport or for projects or services under the Spaceport District Act. The remaining amounts are for spaceport-related projects as approved by resolution of the governing body of the county, and have been dedicated to STEM education programs in those counties' schools.

The use of the majority of the funding in the repayment of bonds creates a situation in which the actual burden, or investment, of the bonds falls entirely on the communities that have enacted the tax increment, unlike the burden of General Fund appropriations which falls on all of the taxpayers of New Mexico. Importantly, as the Spaceport and its related activities increase, to the extent that they're subject to GRT in Sierra and Doña Ana counties, that has the effect of increasing the amount of tax revenue raised under this increment, and increasing the potential rate of repayment of the bonds.

As mentioned, ROIC isn't a straight-forward analysis when it involves various forms of government funding. Severance Tax Bonds are issued on the basis of a pledge of future Severance Tax Revenues to repay principle and interest on the issued bonds. However, but for the pledge of those revenues to Severance Tax Bond repayment, those Severance Tax revenues would be used for some other authorized government purpose. The proceeds from a Severance Tax Bond issue are transferred to, in this case, NMSA, with no further obligation to repay.

In contrast, GRT Bonds represent an obligation to repay the principle and interest directly from GRT collections. In the case of Spaceport America GRT Revenue Bonds, the repayment is from the 0.25% GRT Spaceport Increment which was passed by Sierra and Doña Ana counties. This transaction is analogous to a home mortgage in some sense. That is, Spaceport America NMSA essentially borrowed $78.6 million, and is repaying that principle and interest obligation by taxing current transactions that are subject to a GRT obligation in the two counties.

88 Section 7-20E-25 (NMSA 1978).

## 5.3.2 Educational Returns

This STEM investment manifests in two separate ways. The county regional spaceport GRT adds 0.25% to the county GRT levied in Doña Ana and Sierra counties. Up to 25% of this revenue is dedicated to STEM education. In FY2019, this represented about a $2.4 million investment in STEM education in Doña Ana County and Sierra County schools.

In addition to that direct investment, Spaceport Director of Aerospace Operations Dr. Bill Gutman, PhD, visits classrooms and engages students directly in small groups with hands-on demonstrations. In the 2018–2019 school year, Spaceport America reached more than 1,200 sixth-grade students through classroom visits and other statewide field trips. Currently, the Spaceport is expanding these outreach efforts and taking the show on the road. Dr. Gutman has extended his school visits outside Doña Ana County including Albuquerque, Las Vegas, Española, and Socorro.

Investments in STEM education, through direct funding and outreach, may not produce easily measurable economic and fiscal impacts, but outreach has been shown to increase the chance of students choosing to enter into STEM careers.[89] STEM outreach and funding programs can create the early interest in students to pursue space-related jobs, and increase the potential future measurable impacts of Spaceport America.

## 5.3.3 Economic Diversification Returns

Economic diversification offers several opportunities for the study area. More diverse economies are more resilient in the event of economic shocks and better equipped to capitalize on new opportunities. Demands for specialized labor will be more easily met with greater diversity, and innovation is more likely with greater diversity of highly specialized experiences.

Southern New Mexico is benefiting from the industrial diversity through enhanced resilience and increased labor demand generated by the need for support of more highly specialized workers. See Section 6.3. The diversification of the local economy also relieves economic pressures on the education and workforce training facilities by increasing the depth and breadth of demands on the local labor markets.

89 Joseph A. Kitchen, Gerhard Sonnert, and Philip M. Sadler, "The Impact of College and University-Run High School Summer Programs on Students' End of High School STEM Career Aspirations," *Science Education*, 102(5), January 11, 2018, p. 529-547.

5.4

# SUMMARY OF ECONOMIC AND FISCAL IMPACTS, FORECASTING & CONCLUSION

Spaceport America is demonstrated to be a significant contributor to the New Mexico economy and has the potential to greatly expand its role in the near future. Many unique characteristics of the facilities—and the vigorous collaboration of government entities and private stakeholders—offer an opportunity for New Mexico to participate in the emerging commercial markets for space-related economic activities.

Importantly, this participation is more than just the physical assets of Spaceport America. The opportunity is to realize the development and expansion of the IBCs to support the services, technologies, and human resources that combine to form an ecosystem for robust development of New Mexico's role in the Space 2.0 economy. Such opportunity redounds to all New Mexicans, including not just direct economic performance, but also in an ability to provide significant educational and economic diversification benefits.

The analyses have focused on compiling data and information as to Spaceport America's economic performance since FY2016, and to identify the best available information upon which to prepare a 10-year forecast of the opportunities provided by the emerging commercial space launch economy. The recognition that "space is hard" tempers our analyses and opinions throughout the report, but we also recognize the opportunities to be substantial and the Spaceport America has many attributes which are attractive to commercial customers and government agencies in this market.

SECTION SIX

6

# Technical Appendices

*This section provides detailed technical support information for the report.*

# APPENDIX A

# 6.1 IDENTIFICATION OF GOVERNMENT SPACE-RELATED PROGRAMS

Numerous space-related government-funded initiatives currently provide significant opportunities for the development of Spaceport America, and New Mexico Spaceport Authority (NMSA) customer and client activities related to the Spaceport. In this appendix, we provide descriptions of those programs, as well as a discussion of a number of the government programs being pursued by the national laboratories and military bases in New Mexico.

The list provided is not comprehensive or exhaustive, but provides an indication of the level of government-sponsored investments being made in space launch initiatives.

## 6.1.1 Space-Related Government Initiatives

### 6.1.1.1 RAPID AGILE LAUNCH INITIATIVE

The Rapid Agile Launch Initiative (RALI) is a result of the Department of Defense's (DOD) Air Force Space Command Space and Missile Systems Center partnership with the Defense Innovation Unit. The program's goal is to support military weapons systems development by researching innovative ways of launching quickly and efficiently.[1] The purpose of RALI is to "competitively and rapidly award DOD launch service agreements with nontraditional, venture-class companies."[2]

In New Mexico, the DOD Space Test Program small launch division located at Kirtland Air Force Base (KAFB) has developed a growing demand for launching smaller experimental spacecraft.[3] In 2017, the program awarded Rocket Lab the STP-27RD mission, which launched from New Zealand in March 2019, carrying a satellite to orbit for the US Defense Advanced Research Projects Agency (DARPA).[4] The DOD Space Test Program uses funds from RALI. SpinLaunch is a current NMSA customer and participates in the RALI[5] program development with its innovative—and potentially—disruptive technology.[6]

### 6.1.1.2 EXPERIMENTAL SPACEPLANE PROGRAM

There's a growing need to develop a method of launching satellites into low earth orbit (LEO) on short-notice and at a lower cost, and the United States is currently critically dependent on commercial satellites for numerous commercial and military applications. With presently available technologies, it can take months or even years of preparation to launch a single satellite into orbit. DARPA's Experimental Spaceplane program's mission is to develop a new class of hypersonic aircraft that would allow for the deployment of satellites in a matter of days.

The design is a reusable, unmanned vehicle that takes off vertically and flies to hypersonic speeds. When the vehicle reaches a certain suborbital altitude, the booster releases an expendable upper stage that can deploy a satellite into orbit. The reusable first stage can then return to earth by landing horizontally and could, hypothetically, be ready for another launch within hours. If successful, this would allow for short-term flights at low cost, possibly as little as $5 million per flight.[7]

### 6.1.1.3 LAUNCH CHALLENGE PROGRAM

The DARPA Launch Challenge Program aims to encourage the development of timely launch capabilities in support of the growing small-launch provider's industry. Current launch systems are large, complex, and expensive with a focus on lowering risk rather than increasing timeliness or decreasing

1 The Kirtland Air Force Base (KAFB) small launch division is part of the Launch Enterprise Systems Directorate at the Air Force Space and Missile Systems Center. KAFB is participating in DOD's Rapid Agile Launch Initiative (RALI), and the RALI budget has grown to $25 million in FY2019.

Sandra Ewin, "Air Force Touts Deal with Rocket Lab as a New Way of Buying Affordable Rides to Space," SpaceNews, April 3, 2019, accessed October, 5, 2019, https://spacenews.com/air-force-touts-deal-with-rocket-lab-as-a-new-way-of-buying-affordable-rides-to-space/. (Erwin, 2019).

2 Erwin, 2019.

3 Id. See also Air Force Experimental Launch and Test Division (LEX), based at KAFB.

Experimental Launch & Test Division/Rocket System Launch Program, Los Angeles Air Force Base, accessed October 5, 2019, https://www.losangeles.af.mil/About-Us/Fact-Sheets/Article/1217574/experimental-launch-test-divisionrocket-system-launch-program/.

4 Mike Wall, "Rocket Lab Launches Experimental Satellite for DARPA," Space.com, March 28, 2019, accessed October 5, 2019, https://www.space.com/rocket-lab-launch-experimental-satellite-darpa.html.

5 Virgin Orbit, a spinoff of Virgin Galactic, has developed a satellite launch vehicle called LauncherOne that will be deployed from a Boeing 747 aircraft. The company is preparing to fly a small test satellite for the DOD in 2019. Sandra Erwin, "Air Force Wants to Become a Bigger Player in the Small Launch Industry," SpaceNews, February 6, 2019, accessed October 6, 2019, https://spacenews.com/air-force-wants-to-become-a-bigger-player-in-the-small-launch-industry/.

Jeff Foust, "Virgin Orbit Moves Closer to First Launch," SpaceNews, September 24, 2019, accessed October 5, 2019, https://spacenews.com/virgin-orbit-moves-closer-to-first-launch/.

6 Sandra Erwin, "SpinLaunch Joins Cadre of Small Launch Companies DOD Wants to Try Out," SpaceNews, June 20, 2019, accessed October 6, 2019, https://spacenews.com/spinlaunch-joins-cadre-of-small-launch-companies-dod-wants-to-try-out/.

7 Phase 2 of the Experimental Spaceplane program includes design, construction, and testing of the technology demonstration vehicle through 2019. It calls for initially firing the vehicle's engine on the ground 10 times in 10 days to demonstrate propulsion readiness for flight tests. Phase 3 objectives include 12 to 15 flight tests, currently scheduled for 2020. After multiple shakedown flights to reduce risk, the technology demonstration vehicle would aim to fly 10 times over 10 consecutive days, at first without payloads and at speeds as fast as Mach 5. Subsequent flights are planned to fly as fast as Mach 10 and deliver a demonstration payload between 900 pounds and 3,000 pounds into LEO. Scott Wierzbanowski, Experimental Spaceplane, Defense Advanced Research Projects Agency, accessed October 6, 2019, https://www.darpa.mil/program/experimental-space-plane.

cost. The challenge consists of two launch competitions to LEO within days of each other at to-be-announced locations. Three teams—Vector, Stealth Team, and Virgin Orbit—originally qualified for the challenge by successfully completing all prerequisites, including receiving a Federal Aviation Administration (FAA) launch license. These teams were awarded a $400,000 cash prize and the opportunity to proceed to Launch 1.

Currently, only Stealth Team remains—both Virgin Orbit and Vector dropped out of the competition—and the team will attempt to rapidly launch a payload into orbit in early 2020 for a chance to win $10 million. They will receive only a few days' notice. They will have to successfully complete Launch 1 in order to proceed to Launch 2.[8]

#### 6.1.1.4 HYPERSONIC WEAPONS PROGRAMS

According to the Congressional Research Service's September 2019 report, the Pentagon requested $2.6 billion in fiscal year (FY) 2020 for hypersonic-related research, including $156.4 million for hypersonic defense programs.

There are two types of hypersonic weapons concepts: tactical boost glide and hypersonic air-breathing weapons (HAWC). With the tactical boost glide concept, a rocket accelerates a payload to high speeds at which point the payload separates from the rocket and glides, unpowered, to its destination. This technology has potential to be applied for defense purposes, allowing for long-range missions with short response time.

Raytheon Company and DARPA completed a successful baseline design review for this system in July 2019, and earlier in 2019, DARPA awarded Raytheon a $63 million contract to further develop the design.[9]

Unlike the boost glide concept, the HAWC maintains powered flight from launch to impact. As of June 2019, Raytheon was planning the first flight of its scramjet-powered, air-launched HAWC prototype in the near future. DARPA awarded the company a $174.7 million contract to develop their technology under the joint DARPA & US Air Force Research Laboratory (AFRL) HAWC program. Lockheed Martin, which recently revealed a somewhat varied design of the air-launched HAWC, was awarded a similar $171.2 million contract.[10]

## 6.1.2 Space-Related Programs in New Mexico's Government Operated Facilities

GOVERNMENT AEROSPACE-RELATED RESEARCH FACILITIES

#### 6.1.2.1 KIRTLAND AIR FORCE BASE

KAFB is located in North Central New Mexico and occupies the majority of Southeast Albuquerque. As of 2015, the 377th Air Base Wing is the host organization for KAFB, which employed 1,200 active duty military members, 591 federal civilians, and 720 contractors assigned to the various agencies within the base. At that time, total employment for KAFB was reported to be 20,000 active duty members, civilians, and National Guard and US Army Reserve personnel. KAFB reported an annual local economic impact to Albuquerque of more than $7.6 billion in 2015, which included an annual payroll of $2.1 billion and a local impact of $3.8 billion.[11]

Some of the relevant space-related programs are described below.

**KAFB Experimental Launch & Test Division (LEX) Activities**

LEX, based at KAFB in New Mexico, is a unit of the Launch Enterprise Systems Directorate—based at Los Angeles Air Force Base (AFB) in El Segundo, California—whose mission is to provide launch services for the nation when and where they're needed. Per the Los Angeles AFB website, "LEX integrates, tests, and launches experimental technologies, prototype space vehicles, and operational systems requiring small launch."[12]

LEX manages the Rocket System Launch Program (RSLP), which allows small spacecraft to reach various orbits using retired Minuteman and Peacekeeper rocket motors. It is focused on cost-effective space launch, target launch, and studies based on customer funding. In general, government customers' space launch requirements can be met by RSLP within 18-24 months of the contract's initiation. RSLP provides space and target flight test mission program management, mission assurance, integration of launch and space vehicles, and day-of-launch operations. The program also maintains the Orbital-Suborbital Program (OSP) and the Small Rocket Program (SRP).[13]

**KAFB Space Vehicles Directorate Activities**

Headquartered at KAFB, the Air Force Research Laboratory's Space Vehicles Directorate provides space-based capabilities by developing and transitioning space technologies. This includes areas such as space-based intelligence, space communications, position navigation and timing, and defensive space control. It aims to leverage commercial, civil, and government resources in this effort.[14]

The Space Vehicles Directorate is organized into six divisions: Battlespace Environment, Experiments and Evaluation,

8 DARPA Launch Challenge, Defense Advanced Research Projects Agency, accessed October 6, 2019, https://www.darpa.mil/launchchallenge.
9 Congressional Research Service, *Hypersonic Weapons: Backgrounds and Issues for Congress*, Updated September 17, 2019, accessed October 6, 2019, https://fas.org/sgp/crs/weapons/R45811.pdf.
10 Robin Hughes, "Raytheon Prepares for First Flight of HAWC Prototype Demonstrator," Jane's, June 21, 2019, accessed October 6, 2019, https://www.janes.com/article/89437/raytheon-prepares-for-first-flight-of-hawc-prototype-demonstrator.
11 Kirtland Air Force Base and the 377th Air Base Wing, Kirtland Air Force Base, accessed October 8, 2019, https://www.kirtland.af.mil/Units/377th-Air-Base-Wing/.
12 Experimental Launch & Test Division/Rocket System Launch Program, Los Angeles Air Force Base, accessed October 8, 2019, https://www.losangeles.af.mil/About-Us/Fact-Sheets/Article/1217574/experimental-launch-test-divisionrocket-system-launch-program/.
13 On August 7, 2019, the Air Force Space and Missile Systems Center announced a $3.4 million contract award from the RSLP to Vector Launch to deliver experimental satellites to LEO. The mission will be launched from NASA's Wallops Flight Facility in Virginia.
14 AFRL Space Vehicles Directorate, Kirtland Air Force Base, accessed October 8, 2019, https://www.kirtland.af.mil/Units/AFRL-Space-Vehicles-Directorate/.

Spacecraft Technology, Integration and Operations, Corporate Information, and Contracting. In 2018, the Space Vehicles Directorate completed the design, build, test, and launch of the EAGLE and Mycroft spacecraft missions, which were launched from Cape Canaveral, Florida, in April 2018. This was done to demonstrate an innovative approach for getting satellites into orbit at a lower cost, and with improved space situational awareness for space vehicles.

#### 6.1.2.2 HOLLOMAN AIR FORCE BASE

Holloman Air Force Base (HAFB) is located in Otero County six miles west of Alamogordo, New Mexico. The 49th Wing— the host wing—at HAFB provides combat-ready airmen and trains F-16 Fighting Falcon pilots and MQ-9 Reaper pilots and sensor operators. HAFB hosts some of the nation's most advanced fighter aircraft. Most recently, this included two squadrons of F-22 Raptors, which maintain both fighter and strategic bombing capabilities. HAFB also houses the world's longest and fastest test track.

HAFB personnel also assisted White Sands Missile Range (WSMR) personnel in supporting the White Sands Space Harbor as an alternate runway for National Aeronautics and Space Administration (NASA) space shuttle missions. In 1982, the space shuttle Columbia landed at WSMR, and 1,400 HAFB personnel supported that landing.

In 2018, HAFB reported a total of 10,197 personnel, including 3,720 US Air Force active duty members and 1,651 civilians. The remaining 4,826 were other Air Force dependents. HAFB reported a total economic impact of more than $411 million, which included more than $23 million in payroll, more than $121 million in contract expenditures, and more than $77 million in value of jobs created.[15]

#### 6.1.2.3 WHITE SANDS MISSILE RANGE

WSMR "provides Army, Navy, Air Force, DOD, and other customers with high quality services for experimentation, test, research, assessment, development, and training in support of the Nation at war."[16] It is managed by the US Army for military testing, research, and support activities. It is the DOD's largest, fully-instrumented, open-air range.

WSMR has supported testing and evaluation efforts for Apollo, Skylab, Delta Clipper, Boeing X-40, Space Shuttle, and Orion Crew Exploration Vehicle (CEV) projects. WSMR controls all the airspace within the range and is located in close proximity to NASA White Sands Test Facility and Spaceport America. Its services and facilities include rocket launch services, rocket motor testing, launch and recovery, flight termination testing, propulsion systems, spin test facility, solar furnace facility, radiation and electromagnetic environmental effects test facilities, thrust stands, and a vacuum chamber.

WSMR has also developed several launch facilities in New Mexico, Utah, and Idaho for long-range testing. This involves missiles being fired from one of these alternative locations and directed to land at WSMR. As of 2015, it shares its range and facilities with the following tenant organizations: US Naval Air Warfare Center Weapons Division, the Deputy for the US Air Force; the Army's Battlefield Environment Directorate and Survivability and Lethality Analysis Directorate; NASA; the Army's Training and Doctrine Command's Analysis Center; and the Center for Counter Measures—reporting to the DOD.[17]

WSMR is currently involved in testing related to the US-European Orion spacecraft, which is being developed for missions to the moon and potentially to Mars. Boeing's CST-100 Starliner, a commercial space capsule, is also undergoing testing at WSMR, and recently completed its testing of parachute systems for ground landing. The CST-100 Starliner is being designed in collaboration with NASA's Commercial Crew Program and will be used for missions to the International Space Station.[18]

#### 6.1.2.4 SANDIA NATIONAL LABORATORIES

Sandia National Laboratories (SNL) is a multidisciplinary national laboratory and federally-funded research and development center. It develops advanced technologies to solve complex national security issues. There are four main programs within SNL: Nuclear Weapons, National Security, Energy, and Global Security.

Aerospace research at SNL supports atmospheric and space flight vehicles from subsonic to hypersonic. SNL's facilities include a high-altitude chamber, a trisonic wind tunnel, and a hypersonic wind tunnel. SNL operates the Kauai Test Facility (KTF), a rocket launch range in Hawaii that has supported a variety of rocket launch operations and more than 400 missions.

In FY2018[19], SNL employed 12,800 full-time employees (FTE). It had an operating budget of more than $3.5 billion, a capital equipment budget of more than $59 million, and a construction budget of more than $53 million. Its total Department of Energy (DOE) funding for FY2018 was $2.4 billion, with 89% of that funding coming from the National Nuclear Security Administration (NNSA).

Its strategic partnership projects included work with the DOD ($954.1 million), Department of Homeland Security ($53 million), other federal agencies ($130.6 million), nonfederal entities ($21 million), cooperative research and development agreements (CRADAs) and licenses and royalties ($12.9 million), and inter-entity work ($35.1 million). Total SNL revenue in FY2018 was $3.6 billion.[20]

#### 6.1.2.5 LOS ALAMOS NATIONAL LABORATORY

Los Alamos National Laboratory (LANL) is a multidisciplinary national laboratory and federally-funded research institution. Its mission is to develop and apply science and technology

15 Border Research, *Impact of Fort Bliss, Holloman AFB, and White Sands Missile Range on Jobs, Income, and Industry Output*, January 30, 2015, accessed October 8, 2019, https://home.army.mil/bliss/application/files/1015/4162/5071/SNMEP_JLUS_Economic_Impact_Study.pdf. (Impact of Fort Bliss, HAFB & WSMR, 2015).

16 Economic Impact, Holloman Air Force Base, accessed October 8, 2019, https://www.holloman.af.mil/Portals/101/Environmental%20documents/EIS%202016.pdf.

17 Impact of Fort Bliss, HAFB & WSMR, 2015.

18 Algernon D'Ammassa, "How White Sands Missile Range Helped Get Us to the Moon, and May Help Us Return," Las Cruces Sun News, July 20, 2019, accessed October 8 2019, https://www.lcsun-news.com/story/news/local/2019/07/20/new-mexico-white-sands-missile-range-moon-landing-apollo-11-nasa/1743842001/.

19 SNL fiscal year is October 1–September 30.

20 Facts & Figures, Sandia National Laboratories, accessed October 8, 2019, https://www.sandia.gov/about/facts_figures/data.html.

to ensure the safety, security, and reliability of the US nuclear deterrent; reduce global threats; and solve other emerging national security and energy challenges. With more than 12,750 employees, its budget exceeds $2.55 billion; it has a significant emphasis on weapons programs.[21] LANL is located in Los Alamos County, 35 miles northwest of Santa Fe, New Mexico, on about 34.7 square miles of DOE-owned property.

LANL has designed, built, and analyzed data from instrumentation for space missions, both near and far, for more than 50 years. Among its recent contributions to space science, LANL has:

- Provided extreme engineering relating to electrical, mechanical, computer, software, and system engineering for the development and deployment of sensors configured within tightly constrained mass, power, and volume resources. These sensors operate autonomously in a harsh radiation environment, must survive launch and landing, and must operate through known and unknown hazards.
- Supported development of data systems in space, providing onboard high-performance computing and reconfigurable computing in deployed space information systems.
- Engaged in detecting and forecasting of space weather and environments through technology and science applications.

The Intelligence and Space Research (ISR) Division continues the laboratory's legacy of helping ensure our nation's security, discovering the processes that govern the space environments, studying the composition of planetary bodies, and capturing the most distant, most powerful cosmic explosions.

Since the launch of the first Vela satellites in 1963, LANL has designed, built, and operated instruments to monitor international compliance with the Limited Test Ban Treaty. LANL has flown about 400 instruments comprising more than 1,400 sensors on more than 200 total launches.

The Space Science and Applications Group (ISR-1) leads a variety of civilian and defense-related programs sponsored by the DOE, the DOD, NASA, and other US government agencies.

Recently LANL scientists have adapted its long history of developing propellants as part of the nuclear weapons program to develop a unique segregated fuel oxidizer rocket fuel system. With specific application to CubeSats—small satellites typically unable to have a rocket motor onboard for payload safety reasons—the new propellant will allow in-orbit modification of flight paths, allowing extension of missions for these small satellite payloads.[22]

21 Facts, Figures, Los Alamos National Laboratory, accessed October 13, 2019, https://www.lanl.gov/about/facts-figures/index.php

22 Bryce Tappan, "Innovative Rocket Science Gives Boost to Near-Space Missions," June 18, 2017, The Santa Fe New Mexican, accessed October 13, 2019, https://www.lanl.gov/newsroom/science-columns/science-on-the-hill/2017/innovative-rocket-science.php

# APPENDIX B

# 6.2 NEW MEXICO BUSINESS & TAX INCENTIVES, NEW MEXICO SPACEPORT DEVELOPMENT ACT

## 6.2.1 New Mexico Business Incentives

New Mexico has many business incentives that span multiple industries including the space industry. The following list includes incentives that apply to the space industry, ranging from employee training to tax relief for various activities related to launch and operations. Below are incentives applicable for the space industry.

**Job Training Incentive Program (JTIP)**
The New Mexico Job Training Incentive Program is a state program that funds classroom training and provides on-the-job training for expanding or relocating businesses for up to six months. Customized training may be provided by a New Mexico public educational institution, company trainers, or outside trainers.

**The High Wage Jobs Tax Credit**
This credit provides businesses with a tax credit equal to 8.5% of the value of salaries for each net new job, up to $12,750 per job paying a net taxable wage of at least $60,000 per year in communities with a population of 60,000 or more. Companies located in communities with a population less than 60,000 are eligible for the same tax credit for each net new job paying a net taxable wage of at least $40,000.

**Manufacturing Investment Tax Credit**
Manufacturers may take advantage of New Mexico's investment tax credit equal to 5.125% of the value of qualified equipment and other property used directly and exclusively in a manufacturing operation. The credit can be applied against tax liabilities from the Compensating Tax, Gross Receipts Tax (GRT), and Withholding Tax.

**Military Acquisition Program Tax Deduction**
Receipts from transformational acquisition programs performing research and development, testing, and evaluation at New Mexico major range and test facility bases pursuant to contracts entered into with the US Department of Defense (DOD) may be deducted from gross receipts through June 2025.

**Technology Jobs and Research & Development Tax Credit**
Qualified taxpayers may take a credit equal to 5% of qualified research expenditures related to payroll, land, buildings, equipment, computer software and upgrades, consultants, and contractors performing work in New Mexico, technical books, manuals, and test materials against the taxpayer's Compensating Tax, Withholding Tax, or GRT, excluding the local option GRT. The tax credit is 10% in rural areas. The credit may be carried forward for up to three years. If payroll expenses increased by at least $75,000 per $1,000,000 of expenditures claimed, an additional 5%, or 10% in rural areas, may be applied against Corporate Income tax or Personal Income Tax. The credit may be carried forward for up to three years.

**Industrial Revenue Bonds (IRB)**
Sometimes called Industrial Development Bonds, IRBs have three main benefits for companies: property tax abatements, gross receipts or compensating tax exemptions, and an exemption from federal income tax on the interest paid to bondholders. Communities across New Mexico have the ability to issue IRBs to support economic development projects.

**New Mexico Small Business Innovation Research (SBIR) Matching Grant**
New Mexico's SBIR Matching Grant provides additional resources to encourage the creation and expansion of commercial enterprises based in New Mexico with the purpose of accelerating the commercialization of innovation and technologies developed with federal SBIR awards. The New Mexico SBIR Matching Program provides matching funds to New Mexican companies that have been granted federal SBIR awards.

**Local Economic Development Act (LEDA)**
LEDA (Section 5–10–1 to 5–10–13 NMSA 1978) allows the state and local governments to offer limited, discretionary financial participation in qualified economic development projects. These funds allow municipalities and counties to target private sector, economic-base businesses that can demonstrate that additional funding is needed to close a competitive cost gap. LEDA can support infrastructure improvement, job creation, and retail. LEDA funds can't be used for equipment or working capital.

## 6.2.2 Federal Incentives

**US Department of Urban Housing and Development Opportunity Zones**
The 2017 tax reform reconciliation act, commonly referred to as the Tax Cuts and Jobs Act (TCJA), created new tax incentive opportunities for private investments made in Opportunity Zones to bring economic development and create new jobs. Provisions in the TCJA encourage long-term investment in Opportunity Zones, which were created in low-income communities nationwide.

Opportunity Zones are census tracts designated by state executives to have the greatest need of private investment. The Opportunity Zone designation grants investors federal tax advantages to encourage private investment of capital to finance new projects and enterprises located within the zones. Spaceport America is located in the middle of an Opportunity Zone.

## 6.2.3 Tax Incentives

New Mexico tax laws allow for several deductions and exemptions from gross receipts, compensating tax through various statutes aimed at diminishing the liability of space launches and operations. The following list outlines the different exemptions and deductions available to the space industry; following is the statutory text for each of the statutes listed below.

7-9-26.1. Exemption; gross receipts tax and compensating tax; fuel for space vehicles.

7-9-30. Exemption; compensating tax; railroad equipment, aircraft and space vehicles.

7-9-54.1. Deduction; gross receipts from sale of aerospace services to certain organizations.

7-9-54.2. Gross receipts; deduction; spaceport operation; space operations; launching, operating, and recovering space vehicles or payloads; payload services; operationally responsive space program services.

7-9-54.4. Deduction; compensating tax; space-related test articles.

7-9-94. Deduction; gross receipts; military transformational acquisition programs.

7-9-115. Deduction; gross receipts tax; goods and services for the Department of Defense related to directed energy and satellites.

7-19D-15. Municipal regional spaceport gross receipts tax; authority to impose; rate; election required.

7-20E-25. County regional spaceport gross receipts tax; authority to impose; rate; election required.

## 6.2.4 Statutory Language

### 7-9-26.1. Exemption; gross receipts tax and compensating tax; fuel for space vehicles.

A. Exempted from the gross receipts tax are the receipts from selling fuel, oxidizer, or a substance that combines fuel and oxidizer to propel space vehicles or to operate space vehicle launchers.

B. Exempted from the compensating tax is the use of fuel, oxidizer, or a substance that combines fuel and oxidizer to propel space vehicles or to operate space vehicle launchers.

History: 1978 Comp., § 7-9-26.1, enacted by Laws 2003, ch. 62, § 1.

ANNOTATIONS

**Effective dates**. — Laws 2003, ch. 62, § 5 made Laws 2003, ch. 62, § 1 effective July 1, 2003.

### 7-9-30. Exemption; compensating tax; railroad equipment, aircraft and space vehicles.

A. Exempted from the compensating tax is the use of railroad locomotives, trailers, containers, tenders, or cars procured or bought for use in railroad transportation.

B. Exempted from the compensating tax is the use of commercial aircraft bought or leased primarily for use in the transportation of passengers or property for hire in interstate commerce.

C. Exempted from the compensating tax is the use of space vehicles for transportation of persons or property in, to, or from space.

History: 1953 Comp., § 72-16A-12.18, enacted by Laws 1969, ch. 144, § 23; 1988, ch. 148, § 1; 2003, ch. 62, § 2.

ANNOTATIONS

**The 2003 amendment**, effective July 1, 2003, substituted "aircraft and space vehicles" for "and aircraft" in the section heading and added Subsection C.

**Applicability of former provision limited** — Former 72-17-41, 1953 Comp., (now Section 7-9-30A NMSA 1978) exempting certain railroad property from the purview of the former Compensating Tax Act, applied only to railroads engaged in the transportation of persons or property for hire on established lines. Gibbons & Reed Co. v. Bureau of Revenue, 1969-NMSC-096, 80 N.M. 462, 457 P.2d 710.

### 7-9-54.1. Deduction; gross receipts from sale of aerospace services to certain organizations.

A. As used in this section:

(1) "aerospace services" means research and development services sold to or for resale to an organization for resale by the organization to the United States air force; and

(2) "organization" means an organization described in Subsection A of Section 7-9-29 NMSA 1978 other than a prime contractor operating facilities in New Mexico designated as a national laboratory by act of congress.

B. Receipts from performing or selling, on or after October 1, 1995, an aerospace service for resale may be deducted from gross receipts if the sale is made to a buyer who delivers a nontaxable transaction certificate. The buyer delivering the nontaxable transaction certificate shall separately state the value of the aerospace service purchased in the buyer's charge for the aerospace service on its subsequent sale to an organization or, if the buyer is an organization, on the organization's subsequent sale to the United States, and the subsequent sale shall be in the ordinary course of business of selling aerospace services to an organization or to the United States.

C. A percentage of the receipts from selling aerospace services to or for resale to an organization may be deducted from gross receipts in accordance with the following table:

| Receipts During the Period | Deductible Percentage |
|---|---|
| October 1, 1995 through September 30, 1996 | 10% |
| October 1, 1996 through September 30, 1997 | 25% |
| October 1, 1997 through September 30, 1999 | 50% |
| October 1, 1999 and thereafter | 100%. |

History: Laws 1992, ch. 40, § 1; 1993, ch. 310, § 1; 1994, ch. 45, § 5; 1995, ch. 183, § 1.

ANNOTATIONS

**Cross references**. — For Spaceport Development Act, see 58-31-1 NMSA 1978 et seq.

**Compiler's notes.** — Laws 1992, ch. 40, § 4, as amended by Laws 1993, ch. 310, § 2, provided that the effective date of the provisions of 7-9-54.1 NMSA 1978 was October 1, 1995. Laws 1994, ch. 45, § 8 repealed Laws 1992, ch. 40, § 4 and Laws 1993, ch. 310, § 2.

Laws 1993, ch. 31, § 13D and Laws 1993, ch. 310, § 3, repealed Laws 1992, ch. 40, § 3, which provided for the repeal of ch. 40 of Laws 1993 on August 1, 1995, if the United States hasn't announced prior to July 1, 1995, that the space systems division of the department of the air force will be relocated to New Mexico.

**The 1995 amendment**, effective July 1, 1995, rewrote Subsection A, inserted "if the buyer is an organization, on the organization's subsequent sale" in Subsection B, and substituted "or for resale to an organization" for "the United States or any agency or instrumentality thereof" in Subsection C.

**The 1994 amendment**, effective July 1, 1994, substituted "sold to or for resale to" for "performed or sold by" in Subparagraph A(1)(a) and inserted "performing or" in the first sentence in Subsection B.

**The 1993 amendment**, effective July 1, 1993, rewrote this section to the extent that a detailed comparison is impracticable.

### 7-9-54.2. Gross receipts; deduction; spaceport operation; space operations; launching, operating, and recovering space vehicles or payloads; payload services; operationally responsive space program services.

A. Receipts from launching, operating, or recovering space vehicles or payloads in New Mexico may be deducted from gross receipts.

B. Receipts from preparing a payload in New Mexico are deductible from gross receipts.

C. Receipts from operating a spaceport in New Mexico are deductible from gross receipts.

D. Receipts from the provision of research, development, testing, and evaluation services for the United States air force operationally responsive space program may be deducted from gross receipts.

E. As used in this section:

(1) "operationally responsive space program" means a program authorized pursuant to 10 U.S.2273a;

(2) "payload" means a system, subsystem, or other mechanical structure or material to be conveyed into space that is designed, constructed, or intended to perform a function in space;

(3) "space" means any location beyond altitudes of sixty thousand feet above the earth's mean sea level;

(4) "space operations" means the process of commanding and controlling payloads in space; and

(5) "spaceport" means an installation and related facilities used for the launching, landing, operating, recovering, servicing, and monitoring of vehicles capable of entering or returning from space.

F. Receipts from the sale of tangible personal property that will become an ingredient or component part of a construction project or from performing construction services may not be deducted under this section.

History: Laws 1995, ch. 183, § 2; 1997, ch. 73, § 1; 2001, ch. 18, § 1; 2003, ch. 62, § 3; 2007, ch. 172, § 5.

ANNOTATIONS

**The 2007 amendment**, effective July 1, 2007, added Subsection D and Paragraph of Subsection E.

**The 2003 amendment**, effective July 1, 2003, deleted "For the period from July 1, 2001 through June 30, 2006" at the beginning of Subsections A to C and rewrote Paragraph D(1).

**The 2001 amendment**, effective July 1, 2001, substituted "space operations; launching, operating, and recovering space vehicles or payloads" for "launching and recovery of space launch vehicles" in the section heading; added the time periods in which receipts may be deducted from gross receipts in Subsections A, B and C; substituted "launching, operating, or recovering space vehicles" for "launching or recovering space launch vehicles" in Subsection A; deleted "for launching" following "payload" in Subsection C; in Paragraph D(1), replaced the former definition of "payload" which read "includes systems, subsystems and mechanical structures required to perform or conduct research and development on or to conduct operations of space functions, such as reconnaissance, communications, navigation and target simulations, but does not include weapons"; added Paragraph D and renumbered the following subsection; and substituted "operating, recovering" for "recovery" in present Paragraph D(4).

**The 1997 amendment**, effective June 20, 1997, in Subsection A, substituted "launching or recovering space launch vehicles or payloads" for "operating a spaceport"; in Subsection B, inserted "preparing a payload for" preceding "launching" and deleted "or recovering space launch vehicles or payloads from a spaceport" following "launching"; in Subsection C, substituted "operating" for "preparing a payload for launching at"; designated former Subsection D as Paragraph D and rewrote that paragraph and added Paragraphs D and D(2).

### 7-9-54.4. Deduction; compensating tax; space-related test articles.

A. The value of space-related test articles used in New Mexico exclusively for research or testing, placing on public display after research or testing or storage for future research, testing or public display may be deducted in computing compensating tax due. This subsection does not apply to any other use of a space-related test article.

B. The value of equipment and materials used in New Mexico for research or testing, or for supporting the research or testing of, space-related test articles or for storage of

such equipment or materials for research or testing, or supporting the research and testing of, space-related test articles may be deducted in computing compensating tax due. This subsection does not apply to any other use of such equipment and materials.

C. As used in this section, a "space-related test article" is a material or device intended to be used primarily in research or testing to determine properties and qualities of the material or properties, qualities or functioning of a device or technology when the principal use of the material, device, or technology is intended to be in space or as part of, or associated with, a space vehicle.

History: 1978 Comp., § 7-9-54.4, enacted by Laws 2003, ch. 62, § 4.

ANNOTATIONS

**Effective dates**. — Laws 2003, ch. 62, § 5 made Laws 2003, ch. 62, § 4 effective July 1, 2003.

### 7-9-94. Deduction; gross receipts; military transformational acquisition programs.

A. Receipts from transformational acquisition programs performing research and development, test and evaluation at New Mexico major range and test facility bases pursuant to contracts entered into with the United States department of defense may be deducted from gross receipts through June 30, 2025.

B. As used in this section, "transformational acquisition program" means a military acquisition program authorized by the office of the secretary of defense force transformation and not physically tested in New Mexico on or before July 1, 2005.

C. The deduction provided in this section does not apply to receipts of a prime contractor operating facilities designated as a national laboratory by act of congress and is not applicable to current force programs as of July 1, 2005.

D. The department shall compile an annual report on the deduction provided by this section that shall include the number of taxpayers that claimed the deduction, the aggregate amount of deductions claimed, and any other information necessary to evaluate the effectiveness of the deduction. No later than December 1 of each year that the deduction is in effect, the department shall compile and present the annual report to the revenue stabilization and tax policy committee and the legislative finance committee with an analysis of the cost and benefit to the state of the deduction.

History: Laws 2005, ch. 104, § 23; 2006, ch. 72, § 1; 2015, ch. 18, § 1.

ANNOTATIONS

**The 2015 amendment**, effective June 19, 2015, amended the Gross Receipts and Compensating Tax Act by deferring the expiration date of the deduction from gross receipts for certain military acquisition programs and required the taxation and revenue department to compile an annual report on the deduction provided by this section; in Subsection A, deleted "2016" and added "2025"; and added Subsection D.

**The 2006 amendment**, effective May 17, 2006, changed the expiration date from June 30, 2008 to June 30, 2016.

### 7-9-115. Deduction; gross receipts tax; goods and services for the Department of Defense related to directed energy and satellites.

A. Prior to January 1, 2031, receipts from the sale by a qualified contractor of qualified research and development services and qualified directed energy and satellite-related inputs may be deducted from gross receipts when sold pursuant to a contract with the Department of Defense.

B. The purposes of the deduction allowed in this section are to promote new and sophisticated technology, enhance the viability of directed energy and satellite projects, attract new projects and employers to New Mexico, and increase high-technology employment opportunities in New Mexico.

C. A taxpayer allowed a deduction pursuant to this section shall report the amount of the deduction separately in a manner required by the department.

D. The department shall compile an annual report on the deduction provided by this section that shall include the number of taxpayers that claimed the deduction, the aggregate amount of deductions claimed, and any other information necessary to evaluate the effectiveness of the deduction. Beginning in 2017, and each year thereafter that the deduction is in effect, the department and the economic development department shall present the annual report to the revenue stabilization and tax policy committee and the legislative finance committee with an analysis of the effectiveness and cost of the deduction and whether the deduction is performing the purpose for which it was created.

E. As used in this section:

(1) "directed energy" means a system, including related services, that enables the use of the frequency spectrum, including radio waves, light, and x-rays;

(2) "inputs" means systems, subsystems, components, prototypes and demonstrators, or products and services involving optics, photonics, electronics, advanced materials, nanoelectromechanical and microelectromechanical systems, fabrication materials, and test evaluation and computer control systems related to directed energy or satellites;

(3) "qualified contractor" means a person other than an organization designated as a national laboratory by act of congress or an operator of national laboratory facilities in New Mexico; provided that the operator may be a qualified contractor with respect to the operator's receipts not connected with operating the national laboratory;

(4) "qualified directed energy and satellite-related inputs" means inputs supplied to the department of defense pursuant to a contract with that department entered into on or after January 1, 2016;

(5) "qualified research and development services" means research and development services related to directed energy or satellites provided to the Department of Defense pursuant to a contract with that department entered into on or after January 1, 2016; and

(6) "satellite" means composite systems assembled and packaged for use in space, including launch vehicles and related products and services.

History: Laws 2015 (1st S.S.), ch. 2, § 9; 2019, ch. 186, § 1.

ANNOTATIONS

**The 2019 amendment**, effective July 1, 2019, extended the gross receipts tax deduction for certain receipts derived from the sale of goods and services to the United States department of defense related to qualified directed energy and satellite-related inputs; and in Subsection A, after "January 1", changed "2021" to "2031".

### 7-19D-15. Municipal regional spaceport gross receipts tax; authority to impose; rate; election required.

A. A majority of the members of the governing body of a municipality that desires to become a member of a regional spaceport district pursuant to the Regional Spaceport District Act [5-16-1 to 5-16-13 NMSA 1978] shall impose by ordinance an excise tax at a rate not to exceed one-half percent of the gross receipts of a person engaging in business in the municipality for the privilege of engaging in business. A tax imposed pursuant to this section may be imposed by one or more ordinances, each imposing any number of tax rate increments, but an increment shall not be less than one-sixteenth percent of the gross receipts of a person engaging in business in the municipality, and the aggregate of all rates shall not exceed one-half percent of the gross receipts of a person engaging in business in the municipality. The tax may be referred to as the "municipal regional spaceport gross receipts tax".

B. A governing body, at the time of enacting an ordinance imposing a tax authorized in Subsection A of this section, shall dedicate a minimum of 75% of the revenue to a regional spaceport district for the financing, planning, designing, engineering, and construction of a regional spaceport pursuant to the Regional Spaceport District Act and may dedicate no more than 25% of the revenue for spaceport-related projects as approved by resolution of the governing body of the municipality.

C. An ordinance imposing a municipal regional spaceport gross receipts tax shall not go into effect until after an election is held and a majority of the voters of the municipality voting in the election votes in favor of imposing the tax. The governing body shall adopt a resolution calling for an election within 75 days of the date the ordinance is adopted on the question of imposing the tax. The question shall be submitted to the voters of the municipality as a separate question at a regular local election or at a special election called for that purpose by the governing body. An election shall be called, conducted, and canvassed as provided in the Local Election Act [Chapter 1, Article 22 NMSA 1978]. If a majority of the voters voting on the question approves the ordinance imposing the municipal regional spaceport gross receipts tax, the ordinance shall become effective in accordance with the provisions of the Municipal Local Option Gross Receipts Taxes Act. If the question of imposing the municipal regional spaceport gross receipts tax fails, the governing body shall not again propose the imposition of an increment of the tax for a period of one year from the date of the election.

D. The governing body of a municipality imposing the municipal regional spaceport gross receipts tax shall transfer a minimum of 75% of all proceeds from the tax to the regional spaceport district of which it is a member for regional spaceport purposes in accordance with the provisions of the Regional Spaceport District Act. The governing body of a municipality imposing the municipal regional spaceport gross receipts tax may retain no more than 25% of the municipal regional spaceport gross receipts tax for spaceport-related projects as approved by resolution of the governing body.

History: Laws 2006, ch. 15, § 14; 2018, ch. 79, § 78.

ANNOTATIONS

**The 2018 amendment**, effective July 1, 2018, provided that elections called to approve or disapprove an ordinance imposing a municipal regional spaceport gross receipts tax shall be called, conducted and canvassed as provided in the Local Election Act, and made technical and conforming changes; and in Subsection C, after "at a regular", deleted "municipal" and added "local", after "governing body", deleted "A special municipal" and added "An", and after "as provided in the", deleted "Municipal Election Code" and added "Local Election Act".

**Temporary provisions.** — Laws 2018, ch. 79, § 174 provided that references in law to the Municipal Election Code and to the School Election Law shall be deemed to be references to the Local Election Act.

### 7-20E-25. County regional spaceport gross receipts tax; authority to impose; rate; election required.

A. A majority of the members of the governing body of a county that desires to become a member of a regional spaceport district pursuant to the Regional Spaceport District Act [5-16-1 to 5-16-13 NMSA 1978] shall impose by ordinance an excise tax at a rate not to exceed one-half percent of the gross receipts of a person engaging in business in the district area of the county for the privilege of engaging in business. A tax imposed pursuant to this section may be imposed by one or more ordinances, each imposing any number of tax rate increments, but an increment shall not be less than one-sixteenth percent of the gross receipts of a person engaging in business in the district area of the county, and the aggregate of all rates shall not exceed one-half percent of the gross receipts of a person engaging in business in the district area of the county. The tax may be referred to as the "county regional spaceport gross receipts tax."

B. A governing body, at the time of enacting an ordinance imposing the tax authorized in Subsection A of this section, shall dedicate a minimum of 75% of the proceeds of the revenue to the regional spaceport district for the financing, planning, designing, and engineering and construction of a

spaceport or for projects or services of the district pursuant to the Regional Spaceport District Act and may dedicate no more than 25% of the revenue for spaceport-related projects as approved by resolution of the governing body of the county.

C. An ordinance imposing a county regional spaceport gross receipts tax shall not go into effect until after an election is held and a majority of the voters of the district area of the county voting in the election votes in favor of imposing the tax. The governing body shall adopt an ordinance calling for an election within 75 days of the date the resolution is adopted on the question of imposing the tax. The question shall be submitted to the voters of the district area of the county as a separate question at a general election or at a special election called for that purpose by the governing body. A special election shall be called, conducted, and canvassed substantially in the same manner as provided by law for general elections. If a majority of the voters voting on the question approves the ordinance imposing the county regional spaceport GRT, the ordinance shall become effective in accordance with the provisions of the County Local Option Gross Receipts Taxes Act. If the question of imposing the county regional spaceport gross receipts tax fails, the governing body shall not again propose the imposition of an increment of the tax for a period of one year from the date of the election.

D. The governing body of a county imposing a county regional spaceport gross receipts tax shall transfer a minimum of 75% of all proceeds from the tax to the regional spaceport district of which it's a member for the purposes in accordance with the provisions of the Regional Spaceport District Act. The governing body of a county imposing a county regional spaceport gross receipts tax may retain no more than 25% of the county regional spaceport gross receipts tax for spaceport-related projects as approved by the resolution of the governing body of the county.

E. As used in this section, "district area of the county" means that portion of a county that's outside the boundaries of a municipality and that's within the boundaries of a regional spaceport district of which the county is a member; provided that if no municipality within the county has imposed a municipal regional spaceport gross receipts tax, "district area of the county" may mean the area within the boundaries of the county that's within the boundaries of a regional spaceport district of which the county is a member.

History: Laws 2006, ch. 15, § 15.

ANNOTATIONS

**Cross references**. — For the Election Code, see 1-1-1 NMSA 1978.

**Effective dates**. — Laws 2006, ch. 15 contained no effective date provision, but, pursuant to N.MConst., art. IV, § 23, was effective May 17, 2006, 90 days after adjournment of the legislature.

## 6.2.5 New Mexico Spaceport Development Act

**ARTICLE 31**
**Spaceport Development**

**58-31-1. Short title.**
Chapter 58, Article 31 NMSA 1978 may be cited as the "Spaceport Development Act."

History: Laws 2005, ch. 128, § 1; 2018, ch. 61, § 2.

ANNOTATIONS

**Cross references**. — For gross receipts tax deduction for spaceport operations, see 7-9-54.2 NMSA 1978.

For gross receipts and compensating tax exemption for fuel for space vehicles, see 7-9-26.1 and 7-9-30 NMSA 1978.

**The 2018 amendment**, effective May 16, 2018, deleted "this act" and added "Chapter 58, Article 31 NMSA 1978".

**58-31-2. Purpose.**
The purpose of the Spaceport Development Act is to:

A. encourage and foster development of the state and its cities and counties by developing spaceport facilities in New Mexico;

B. actively promote and assist public and private sector infrastructure development to attract new industries and businesses, thereby creating new job opportunities in the state;

C. create the statutory framework that will enable the state to design, finance, construct, equip, and operate spaceport facilities necessary to ensure the timely, planned, and efficient development of a southwest regional spaceport; and

D. promote educational involvement in spaceport activities and education and training of the workforce to develop the skills needed for spaceport operations

History: Laws 2005, ch. 128, § 2.

ANNOTATIONS

**Effective dates**. — Laws 2005, ch. 128 contains no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, is effective June 17, 2005, 90 days after adjournment of the legislature.

**58-31-3. Definitions.**
As used in the Spaceport Development Act:

A. "authority" means the spaceport authority;

B. "project" means any land, building, or other improvements acquired as part of a spaceport or associated with a spaceport or to aid commerce in connection with a spaceport and all real and personal property deemed necessary in connection with the spaceport;

C. "revenue" means municipal regional spaceport gross receipts tax and county regional spaceport gross receipts tax revenue received from a regional spaceport district, revenue

generated by a project, and any other legally available funds of the authority;

D. "space vehicle" means a vehicle capable of being flown in space or launching a payload into space; and

E. "spaceport" means a facility in New Mexico at which space vehicles may be launched or landed, including all facilities and support infrastructure related to launch, landing or payload processing.

History: Laws 2005, ch. 128, § 3; 2006, ch. 15, § 16.

ANNOTATIONS

**Cross references**. — For the municipal regional spaceport gross receipts tax, see 7-19D-15 NMSA 1978.

For the county regional spaceport gross receipts tax, see 7-20E-25 NMSA 1978.

**The 2006 amendment**, effective May 17, 2006, adds Subsection C to define revenue.

### 58-31-4. Spaceport authority created; membership.

A. The "spaceport authority" is created. The authority is a state agency and is administratively attached to the economic development department.

B. The authority shall consist of seven voting and two nonvoting members, six of whom shall be appointed by the governor with the consent of the senate, provided that one of the appointed members shall be a resident of Sierra County. No more than three appointed members shall belong to the same political party. The seventh member shall be the secretary of economic development or the secretary's designee. The lieutenant governor shall serve as a nonvoting ex-officio member. The executive director of the authority shall serve as a nonvoting member. The chair may appoint a nonvoting advisory committee to provide advice and recommendations on authority matters.

C. The members appointed by the governor shall be residents of the state and shall serve for terms of four years, except for the initial appointees who shall be appointed so that the terms are staggered after initial appointment. Initial appointees shall serve terms as follows: two members for two years, two members for three years, and two members for four years.

D. Appointed voting members of the authority shall be reimbursed for per diem and mileage in accordance with the provisions of the Per Diem and Mileage Act [10-8-1 to 10-8-8 NMSA 1978] that apply to nonsalaried public officers, unless a different provision of that act applies to a specific member, in which case that member shall be paid under the applicable provision. Members and advisors shall receive no other compensation, perquisite, or allowance for serving as a member of or advisor to the authority.

E. The secretary of economic development or the secretary's designee shall serve as the chair of the authority. Authority members shall elect any other officers from the membership that the authority determines appropriate.

F. The chair, four other authority voting members appointed by the chair, and the executive director of the authority shall constitute the spaceport authority executive committee. The committee shall have powers and duties as delegated to it by the authority.

G. If a vacancy occurs among the appointed voting members of the authority, the governor shall appoint a replacement to serve out the term of the former member. If an appointed member's term expires, the member shall continue to serve until the member is reappointed or another person is appointed and confirmed by the senate to replace the member.

H. The authority shall meet at the call of the chair and shall meet in regular session at least once every three months.

I. The authority shall maintain written minutes of all meetings of the authority and maintain other appropriate records, including financial transaction records in compliance with law and adequate to provide an accurate record for audit purposes pursuant to the Audit Act [12-6-1 to 12-6-14 NMSA 1978].

History: Laws 2005, ch. 128, § 4.

ANNOTATIONS

**Effective dates**. — Laws 2005, ch. 128 contains no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, is effective June 17, 2005, 90 days after adjournment of the legislature.

### 58-31-5. Authority powers and duties.

A. The authority shall:

(1) hire an executive director, who shall employ the necessary professional, technical, and clerical staff to enable the authority to function efficiently and shall direct the affairs and business of the authority, subject to the direction of the authority;

(2) be located within 50 miles of a southwest regional spaceport

(3) advise the governor, the governor's staff and the New Mexico finance authority oversight committee [6-21-30 NMSA 1978] on methods, proposals, programs, and initiatives involving a southwest regional spaceport that may further stimulate space-related business and employment opportunities in New Mexico;

(4) initiate, develop, acquire, own, construct, maintain, and lease space-related projects;

(5) make and execute all contracts and other instruments necessary or convenient to the exercise of its powers and duties;

(6) create programs to expand high-technology economic opportunities within New Mexico;

(7) create avenues of communication among federal government agencies, the space industry, users of space launch services and academia concerning space business;

(8) promote legislation that will further the goals of the authority and development of space business;

(9) oversee and fund production of promotional literature related to the authority's goals;

(10) identify science and technology trends that are significant to space enterprise and the state and act as a clearinghouse for space enterprise issues and information;

(11) coordinate and expedite the involvement of the state executive branch's space-related development efforts; and

(12) perform environmental, transportation, communication, land use, and other technical studies necessary or advisable for projects and programs or to secure licensing by appropriate United States agencies.

B. The authority may:

(1) advise and cooperate with municipalities, counties, state agencies and organizations, appropriate federal agencies and organizations, and other interested persons and groups;

(2) solicit and accept federal, state, local, and private grants of funds or property and financial or other aid for the purpose of carrying out the provisions of the Spaceport Development Act;

(3) adopt rules governing the manner in which its business is transacted and the manner in which the powers of the authority are exercised and its duties performed;

(4) operate spaceport facilities, including acquisition of real property necessary for spaceport facilities and the filing of necessary documents with appropriate agencies;

(5) construct, purchase, accept donations of or lease projects located within the state;

(6) sell, lease, or otherwise dispose of a project upon terms and conditions acceptable to the authority and in the best interests of the state;

(7) issue revenue bonds and borrow money for the purpose of defraying the cost of acquiring a project by purchase or construction and of securing the payment of the bonds or repayment of a loan;

(8) enter into contracts with regional spaceport districts and issue bonds on behalf of regional spaceport districts for the purpose of financing the purchase, construction, renovation, equipping or furnishing of a regional spaceport or a spaceport-related project;

(9) refinance a project;

(10) contract with any competent private or public organization or individual to assist in the fulfillment of its duties;

(11) fix, alter, charge, and collect tolls, fees, or rentals and impose any other charges for the use of or for services rendered by any authority facility, program or service; and

(12) contract with regional spaceport districts to receive municipal spaceport gross receipts tax and county regional spaceport gross receipts tax revenues.

C. The authority shall not:

(1) incur debt as a general obligation of the state or pledge the full faith and credit of the state to repay debt; or

(2) expend funds or incur debt for the improvement, maintenance, repair, or addition to property unless it's owned by the authority, the state or a political subdivision of the state.

History: Laws 2005, ch. 128, § 5; 2006, ch. 15, § 17.

ANNOTATIONS

**Cross references**. — For the Regional Spaceport District Act, see 5-15-1 NMSA 1978.

For the municipal regional spaceport gross receipts tax, see 7-19D-15 NMSA 1978.

For the county regional spaceport gross receipts tax, see 7-20E-25 NMSA 1978.

**The 2006 amendment**, effective May 17, 2006, adds Paragraph (8) of Subsection B to authorize the spaceport authority to enter into contracts and issue bonds for spaceports or spaceport-related projects; adds Paragraph (12) of Subsection B to authorize the spaceport authority to contract with regional spaceport district to receive spaceport gross receipt tax revenues; deletes the provision of former Paragraph of Subsection C which prohibited the spaceport authority to operate a project as a business or in any manner except as lessor; and adds the provision in Paragraph of Subsection C that the spaceport authority can't expend funds or incur debt to improve, maintain, repair or add to property unless the property is owned by the spaceport authority, the state or a political subdivision of the state.

### 58-31-6. Spaceport authority; bonding authority; power to issue revenue bonds.

A. The authority may issue revenue bonds on its own behalf or on behalf of a regional spaceport district, for regional spaceport purposes and spaceport-related projects. Revenue bonds so issued may be considered appropriate investments for the severance tax permanent fund or collateral for the deposit of public funds if the bonds are rated not less than "A" by a national rating service and both the principal and interest of the bonds are fully and unconditionally guaranteed by a lease agreement executed by an agency of the United States government or by a corporation organized and operating within the United States, that corporation or the long-term debt of that corporation being rated not less than "A" by a national rating service. All bonds issued by the authority are legal and authorized investments for banks, trust companies, savings and loan associations, and insurance companies.

B. The authority may pay from the bond proceeds all expenses, premiums and commissions that the authority deems necessary or advantageous in connection with the authorization, sale and issuance of the bonds.

C. Authority revenue bonds:

(1) may have interest or appreciated principal value or any part thereof payable at intervals determined by the authority;

(2) may be subject to prior redemption or mandatory redemption at the authority's option at the time and upon such terms and conditions with or without the payment of a premium as may be provided by resolution of the authority;

(3) may mature at any time not exceeding 20 years after the date of issuance if secured by revenue from the county or municipal regional spaceport gross receipts tax or 30 years if secured by revenue from other sources;

(4) may be serial in form and maturity; consist of one or more bonds payable at one time or in installments; or may be in such other form as determined by the authority;

(5) may be in registered or bearer form or in book-entry form through facilities of a securities depository either as to principal or interest or both;

(6) shall be sold for cash at, above or below par and at a price that results in a net effective interest rate that conforms to the Public Securities Act [6-14-1 to 6-14-3 NMSA 1978]; and

(7) may be sold at public or negotiated sale.

D. Subject to the approval of the state board of finance, the authority may enter into other financial arrangements if it determines that the arrangements will assist the authority.

History: Laws 2005, ch. 128, § 6; 2006, ch. 15, § 18.

ANNOTATIONS

**Cross references**. — For the Regional Spaceport District Act, see 5-15-1 NMSA 1978.

**The 2006 amendment,** effective May 17, 2006, deletes the provision of former Subsection A, which permitted the spaceport to act as an issuing authority for purposes of the Private Activity Bond Act; adds a provision in Subsection A (former Subsection B) to permit the spaceport authority to issue revenue bonds on its own behalf or on behalf of a regional spaceport district for regional spaceport purposes and spaceport-related projects; and in Paragraph of Subsection C (former Subsection D) provides that authority revenue bonds may mature in twenty years if the bonds are secured by revenue from county or municipal regional spaceport gross receipt tax or thirty years if secured by revenue from other sources.

### 58-31-7. Authority loans; terms.

If the authority borrows money from a financial institution or other entity:

A. the interest, principal payments or any part thereof shall be payable at intervals as may be determined by the authority;

B. the loan shall mature at any time not exceeding thirty years from the date of origination;

C. the principal amount of the loan shall not exceed fair market value of the real or personal property to be acquired with the proceeds of the loan as evidenced by a certified appraisal in accordance with the Real Estate Appraisers Act [Chapter 61, Article 30 NMSA 1978]; and

D. the loan shall be subject to approval of the state board of finance.

History: Laws 2005, ch. 128, § 7.

ANNOTATIONS

**Effective dates**. — Laws 2005, ch. 128 contains no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, is effective June 17, 2005, 90 days after adjournment of the legislature.

### 58-31-8. Bonds secured by trust indenture.

The bonds issued by the authority may be secured by a trust indenture between the authority and a corporate trustee that may be either a bank having trust powers or a trust company. The trust indenture may contain reasonable provisions for protecting and enforcing the rights and remedies of bondholders, including covenants setting forth the duties of the authority in relation to the exercise of its powers and the custody, use and investment of the project revenues or other funds. The authority may provide in a trust indenture for the payment of the proceeds of the bonds and the project revenue to the trustee under the trust indenture or other depository for disbursement with any safeguards the authority determines are necessary.

History: Laws 2005, ch. 128, § 8.

ANNOTATIONS

**Effective dates**. — Laws 2005, ch. 128 contains no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, is effective June 17, 2005, 90 days after adjournment of the legislature.

### 58-31-9. Authority revenue bonds; limitations; authorization; authentication.

A. Revenue bonds or refunding bonds issued pursuant to the Spaceport Development Act and other loans to the authority are:

(1) not general obligations of the state or any other agency of the state or of the authority; and

(2) payable only from properly pledged revenues and each bond or loan shall state that it's payable solely from the properly pledged revenues and that the bondholders or lenders may not look to any other fund for the payment of the interest and principal of the bond or the loan.

B. Revenue or refunding bonds or loans may be authorized by resolution of the authority, which shall be approved by a majority of the voting members of the authority and by the state board of finance.

C. The bonds or loans shall be executed by the chair of the authority and may be authenticated by any public or private transfer agent or registrar, or its successor, named or otherwise designated by the authority. Bonds, notes, or other certificates of indebtedness of the authority may be executed as provided under the Uniform Facsimile Signature of Public Officials Act [6-9-1 to 6-9-6 NMSA 1978], and the

coupons, if any, shall bear the facsimile signature of the chair of the authority.

History: Laws 2005, ch. 128, § 9.

ANNOTATIONS

**Effective dates**. — Laws 2005, ch. 128 contains no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, is effective June 17, 2005, 90 days after adjournment of the legislature.

### 58-31-10. Security for bonds, notes or certificates of indebtedness.

The principal of and interest on any bonds, notes or other certificates of indebtedness issued pursuant to the provisions of the Spaceport Development Act shall be secured by a pledge of the revenues out of which the bonds shall be made payable, may be secured by a mortgage, deed of trust note or other certificate of indebtedness covering all or part of the project from which the revenues so pledged may be derived, and may be secured by a pledge of any lease or installment sale agreement or other fees or revenues with respect to the project. The resolution of the authority under which bonds, notes or other certificates of indebtedness are authorized to be issued or any mortgage, notes or certificates of indebtedness may contain any agreement and provisions customarily contained in instruments securing bonds, notes or certificates of indebtedness, including:

A. provisions respecting the fixing and collection of all revenues from any project covered by the proceedings or mortgage;

B. the terms to be incorporated in any lease or installment sale agreement with respect to the project;

C. the maintenance and insurance of the project; and

D. the creation and maintenance of special funds from the revenues with respect to the project and the rights and remedies available in the event of default to the bondholders, to the trustee under a mortgage, deed of trust or trust indenture or to a lender, all as the authority deems advisable and not in conflict with the provisions of the Spaceport Development Act. In making the agreements or provisions, the authority shall not have the power to obligate itself except with respect to the project and the application of the revenues from the project and shall not have the power to incur a pecuniary liability or charge upon the state general credit or against the state taxing powers. The resolution authorizing any bonds and any mortgage securing such bonds, any note or other certificate of indebtedness shall set forth the procedure and remedies in the event of default in payment of the principal of or the interest on the bond, note or certificate of indebtedness or in the performance of any agreement. A breach of any agreement shall not impose any pecuniary liability upon the state or any charge upon its general credit or against its taxing powers.

History: Laws 2005, ch. 128, § 10.

ANNOTATIONS

**Effective dates**. — Laws 2005, ch. 128 contains no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, is effective June 17, 2005, 90 days after adjournment of the legislature.

### 58-31-11. Requirements respecting resolution and lease.

A. A resolution for the issuance of bonds shall set forth the determinations and findings of the authority required by this section.

B. Prior to approving a resolution for the issuance of bonds or the closing of a loan for any project, the authority shall determine and find that:

(1) the resolution is for the issuance of bonds and the principal and interest of the bonds to be issued shall be fully secured by:

(a) a lease agreement or installment sale agreement executed by an agency of the United States government;

(b) a state or local public agency or institution;

(c) a corporation organized and operating within the United States;

(d) an irrevocable letter of credit issued by a chartered financial institution approved for this purpose by the state board of finance;

(e) a bond insurance policy issued by an insurance company rated not less than "AA" by a national rating service; or

(f) revenue received by the authority pursuant to a contract entered into by and between the authority and a regional spaceport district;

(2) revenues are available in an amount necessary in each year to pay the principal of and interest on the bonds proposed to be issued or the loan proposed to be obtained to finance the project; and

(3) revenues are available in an amount necessary to be paid each year into any reserve funds that the authority may deem advisable to establish in connection with the retirement of the proposed bonds or the repayment of the loan or the maintenance of the project.

C. Unless the terms under which the project is to be leased or sold provide that the lessee or purchaser shall maintain the project and carry all proper insurance with respect to the project, the resolution shall set forth the estimated cost of maintaining the project in good repair and keeping it properly insured.

D. Prior to the issuance of the bonds or the closing of the loan, the authority may lease or sell the project to a lessee or purchaser under an agreement conditioned upon completion of the project and providing for payment to the authority of such rentals or payments as, upon the basis of such determinations and findings pursuant to provisions of this section, will be sufficient to:

(1) pay the principal of and interest on the bonds issued or on the loan to be obtained to finance the project;

(2) build up and maintain any reserve deemed by the authority to be advisable in connection with the financing of the project; and

(3) pay the costs of maintaining the project in good repair and keep it properly insured, unless the agreement of lease obligates the lessee to pay for the maintenance and insurance of the project.

E. With prior approval of the state board of finance, the authority may borrow funds to purchase, lease, acquire, or develop water rights, a water system, a wastewater collection and treatment system, a natural gas distribution system, an electrical distribution system, or other infrastructure needed to support the project, provided that the authority doesn't obligate itself or the state to any debt or obligation that can't be paid from funds derived from the project.

F. Upon prior approval of the state board of finance, the authority may obtain commitment from a financial institution to borrow money, provided that closing of the loan and disbursement of the proceeds is conditional upon compliance with the requirements of the Spaceport Development Act. Nothing in this section shall be deemed to authorize the authority to incur any debt obligation of the authority in connection with a loan commitment prior to the closing of the loan.

History: Laws 2005, ch. 128, § 11; 2006, ch. 15, § 19.

ANNOTATIONS

**The 2006 amendment**, effective May 17, 2006, deletes the qualification in Subparagraph (c) of Paragraph (1) of Subsection B that authority bonds be secured by a corporation whose long term-term debt is rated not less that "A" by a national rating service; and adds Subparagraph (f) of Paragraph (1) of Subsection B to provide that authority bonds shall be secured by revenue received pursuant to a contract between the authority and a regional spaceport district.

### 58-31-12. Use of proceeds from sale of bonds.

A. The proceeds from the sale of any bonds issued pursuant to the Spaceport Development Act shall be applied only for the purpose for which the bonds were issued; provided that:

(1) any accrued interest and premiums received in any sale shall be applied to the payment of the principal of or the interest on the bonds sold;

(2) if for any reason any portion of such proceeds aren't needed for the purpose for which the bonds were issued, the balance of the proceeds shall be applied to the payment of the principal of or the interest on the bonds; and

(3) any portion of the proceeds from the sale of the bonds or any accrued interest and premium received in any such sale may, in the event the money won't be needed or can't be used effectively to the advantage of the authority for the purposes provided pursuant to the Spaceport Development Act, be invested in short-term interest-bearing securities if such investment will not interfere with the use of the funds for the primary purpose of the project.

B. The cost of acquiring any project shall be deemed to include the following:

(1) the actual cost of construction of any part of a project, including architect, attorney and engineer fees;

(2) the purchase price of any part of a project that may be acquired by purchase;

(3) the actual cost of the extension of any utility to the project site and all expenses in connection with the authorization, sale and issuance of the bonds to finance such acquisition; and

(4) the interest on those bonds for a reasonable time prior to construction, during construction and not exceeding six months after completion of construction.

History: Laws 2005, ch. 128, § 12.

ANNOTATIONS

**Effective dates**. — Laws 2005, ch. 128 contains no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, is effective June 17, 2005, 90 days after adjournment of the legislature.

### 58-31-13. Spaceport authority revenue bonds; refunding authorization.

A. The authority may issue refunding revenue bonds for the purpose of refinancing, paying and discharging all or any part of outstanding authority revenue bonds:

(1) for the acceleration, deceleration or other modification of payment of such obligations, including, without limitation, any capitalization of any interest in arrears or about to become due for any period not exceeding one year from the date of the refunding bonds;

(2) of reducing interest costs or effecting other economies; or

(3) of modifying or eliminating restrictive contractual limitations pertaining to the issuance of additional bonds, otherwise concerning the outstanding bonds or to any facilities relating to the bonds.

B. The authority may pledge irrevocably for the payment of interest and principal on refunding bonds the appropriate pledged revenues that may be pledged to an original issue of bonds.

C. Bonds for refunding and bonds for any purpose permitted by the Spaceport Development Act may be issued separately or issued in a combination of one series or more.

History: Laws 2005, ch. 128, § 13.

ANNOTATIONS

**Effective dates**. — Laws 2005, ch. 128 contains no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, is effective June 17, 2005, 90 days after adjournment of the legislature.

**58-31-14. Spaceport authority refunding bonds; escrow.**

A. Refunding bonds issued pursuant to the Spaceport Development Act shall be authorized by resolution of the authority. Any bonds that are refunded under the provisions of this section shall be paid at maturity or on any permitted prior redemption date in the amounts, at the time and places and, if called prior to maturity, in accordance with any applicable notice provisions, all as provided in the proceedings authorizing the issuance of the refunded bonds or otherwise pertaining thereto, except for any such bond that's voluntarily surrendered for exchange or payment by the holder or owner.

B. Provision shall be made for paying the bonds refunded at the time provided in this section. The principal amount of the refunding bonds may exceed the principal amount of the refunded bonds and may also be less than or the same as the principal amount of the bonds being refunded; provided that provision is duly and sufficiently made for payment of the refunded bonds.

C. The proceeds of refunding bonds, including any accrued interest and premium pertaining to the sale of refunding bonds, shall either be immediately applied to the retirement of the bonds being refunded or be placed in escrow in a commercial bank or trust company that possesses and is exercising trust powers and that's a member of the federal deposit insurance corporation, to be applied to the payment of the principal of, interest on and any prior redemption premium due in connection with the bonds being refunded; provided that, such refunding bond proceeds, including any accrued interest and any premium pertaining to a sale of refunding bonds, may be applied to the establishment and maintenance of a reserve fund and to the payment of expenses incidental to the refunding and the issuance of the refunding bonds, the interest thereon, the principal thereof or both interest and principal as the authority may determine. Nothing in this section requires the establishment of an escrow if the refunded bonds become due and payable within one year from the date of the refunding bonds and if the amounts necessary to retire the refunded bonds within that time are deposited with the paying agent for the refunded bonds. Any such escrow shall not necessarily be limited to proceeds of refunding bonds but may include other money available for its purpose. Any proceeds in escrow pending such use may be invested or reinvested in bills, certificates of indebtedness, notes, or bonds that are direct obligations of or the principal and interest of which obligations are unconditionally guaranteed by the United States or in certificates of deposit of banks that are members of the federal deposit insurance corporation. Such proceeds and investments in escrow, together with any interest or other income to be derived from any such investment, shall be in an amount at all times sufficient as to principal, interest, any prior redemption premium due and any charges of the escrow agent payable to pay the bonds being refunded as they become due at their respective maturities or due at any designated prior redemption date in connection with which the authority shall exercise a prior redemption option. Any purchaser of any refunding bond issued under the Spaceport Development Act is in no manner responsible for the application of the proceeds by the authority or any of its officers, agents, or employees.

D. Refunding bonds may bear such additional terms and provisions as may be determined by the authority subject to the limitations in this section.

History: Laws 2005, ch. 128, § 14.

ANNOTATIONS

**Effective dates**. — Laws 2005, ch. 128 contains no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, is effective June 17, 2005, 90 days after adjournment of the legislature.

**58-31-15. Authority refunding revenue bonds; terms.**

[The] authority [when] refunding revenue bonds:

A. may have interest or appreciated principal value payable at intervals or at maturity;

B. may be subject to prior redemption at the authority's option at such time or times and upon such terms and conditions with or without the payment of premiums;

C. may be serial in form and maturity;

D. may consist of a single bond payable in one or more installments; and

E. shall be exchanged for the bonds and any mature unpaid interest being refunded at not less than par or sold at public or negotiated sale at, above or below par and at a price that results in a net effective interest rate that doesn't exceed the maximum permitted by the Public Securities Act [6-14-1 to 6-14-3 NMSA 1978].

History: Laws 2005, ch. 128, § 15.

ANNOTATIONS

**Effective dates**. — Laws 2005, ch. 128 contains no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, is effective June 17, 2005, 90 days after adjournment of the legislature.

**58-31-16. Exemption from taxation.**

Bonds authorized pursuant to the Spaceport Development Act and the income from those bonds, all mortgages, or other security instruments executed as security for those bonds, all lease, and installment purchase agreements made pursuant to the provisions of that act and revenue derived from any lease or sale by the authority shall be exempt from all taxation by the state or any subdivision thereof.

History: Laws 2005, ch. 128, § 16.

ANNOTATIONS

**Effective dates**. — Laws 2005, ch. 128 contains no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, is effective June 17, 2005, 90 days after adjournment of the legislature.

**58-31-17. Spaceport authority fund created.**

A. The "spaceport authority fund" is created in the state treasury. Separate accounts within the fund may be created for any project. Money in the fund is appropriated to the authority for the purposes of carrying out the provisions of the Spaceport Development Act. Money in the fund shall not revert at the end of a fiscal year.

B. Except as provided in this section, money received by the authority shall be deposited in the fund, including, but not limited to:

(1) the proceeds of bonds issued by the authority or from a loan to the authority made pursuant to the Spaceport Development Act;

(2) interest earned upon money in the fund;

(3) property or securities acquired through the use of money belonging to the fund;

(4) all earnings of property or securities acquired pursuant to Paragraph of this subsection;

(5) all lease or rental payments received from the authority from a project;

(6) all of the money received by the authority from a public or private source; and

(7) fees, rents or other charges imposed and collected by the authority.

C. Fees, rents or other charges imposed and collected by the authority in excess of those imposed and collected for an approved project and for all debt service and reserves for the bonds that financed the project may be expended only as appropriated pursuant to vouchers signed by the executive director of the authority or the director's designee pursuant to the Spaceport Development Act; provided that, in the event the position of executive director is vacant, vouchers may be signed by the chair of the authority.

D. Earnings on the balance in the fund shall be credited to the fund. In addition, in the event that the proceeds from the issuance of bonds or from money borrowed by the authority are deposited in the state treasury, interest earned on that money during the period commencing with the deposit in the state treasury until actual transfer of the money to the fund shall be credited to the fund.

E. All proceeds from issuing revenue bonds shall be placed in such funds as shall be established in the resolution of the authority authorizing the issuance of the bonds.

History: Laws 2005, ch. 128, § 17; 2006, ch. 15, § 20.

ANNOTATIONS

**Cross references**. — For the Regional Spaceport District Act, see 5-15-1 NMSA 1978.

**The 2006 amendment**, effective May 17, 2006, adds the provision in Paragraph of Subsection B that earnings acquired pursuant to Paragraph of Subsection B shall be deposited in the spaceport authority fund; and adds Subsection E to provide that proceeds from revenue bonds shall be placed in funds established by the authority authorizing the issuance of the bonds.

**58-31-18. Information not subject to inspection.**

A. The following information obtained by the authority isn't subject to inspection pursuant to the Inspection of Public Records Act [Chapter 14, Article 2 NMSA 1978]:

(1) proprietary technical or business information, or information that's related to the possible relocation, expansion or operations of its aerospace customers, for which it is demonstrated, based on specific factual evidence, that disclosure of the information would cause substantial competitive harm to the aerospace customer;

(2) trade secrets, as defined in Subsection D of Section 57-3A-2 NMSA 1978; and

(3) information that would compromise the physical security or cybersecurity of authority facilities or an aerospace customer of the authority.

B. The presence in a record of information that need not be disclosed pursuant to Subsection A of this section doesn't exempt the record from disclosure.

History: Laws 2018, ch. 61, § 3.

ANNOTATIONS

**Effective dates**. — Laws 2018, ch. 61 contained no effective date provision, but, pursuant to N.M. Const., art. IV, § 23, was effective May 16, 2018, 90 days after the adjournment of the legislature.

# APPENDIX C

## 6.3 INDUSTRIAL BASE CAPABILITY TECHNICAL PROFILE[23]

*Producing spacecraft, satellites, and other space-related products involves a complex web of activities that rely on goods and services found across the entire economy.*[24]

Industrial Base Capability (IBC) identifies the ecosystem of industries in the regional economy that specialize in goods and services for highly-technical and highly-specialized operations. In the context of responding to opportunities in the Space 2.0 economy, IBC also characterizes the breadth and robustness of a regional economy's ability to react when specific opportunities arise.

Industrial Base Capability may be defined as the public and private skills, knowledge, processes, facilities, material, and equipment needed to design, develop, manufacture, repair, and support space launch resources.

Industrial Base Capability refers to ***what*** can be done, as opposed to capacity which refers to ***how much*** can be done.[25] These industries provide the skilled personnel, information, and material essential for space-related operations. Some of the activities performed by these industries include radar tracking, optical tracking, telemetry uplink, and meteorological services, among other services.

### 6.3.1 Scope of Analysis

To illustrate the IBC concept, we surveyed three areas in which different levels of maturity and scope for the aerospace-based industry's development can be identified. As noted in the body of the report, there's significant IBC support to the scope of aerospace research and development centered around Kirkland Air Force Base (KAFB), Sandia National Laboratories (SNL), and Los Alamos National Laboratory (LANL), largely located in Bernalillo County, New Mexico.

There has been much greater development of the IBC resource associated with the aerospace industry in Washington state, while there's a mature IBC associated with the six decades of aerospace activities in the state of Florida.

We summarize the respective maturity of the IBC sectors in each of these three examples, providing greater details evidencing the economic profiles of these IBC resources. The analyses demonstrate how the IBC can evolve and integrate into the foundations of a regional economy.

**Bernalillo & Los Alamos Counties, New Mexico**
Home to SNL and KAFB, Bernalillo County is the most populous county in New Mexico. LANL is located less than 100 miles north in Los Alamos County, and draws substantially from the industrial base resources found in Bernalillo County.

Over the years, an IBC has developed in support of various defense-related space programs, such as satellites and weapons, along with significant other research and weapons program activities undertaken by these federal government entities within the scope of their missions.

This complex of industries has matured over the years and provides a robust high-technology systems environment for support, development, and deployment of advanced technologies. Acknowledging the broader missions of these federal research and development facilities, it is relevant for the purposes of the Spaceport America investigation to provide some context of the current presence of IBC in the New Mexico economy.

For this analysis, we identified industries in Bernalillo and Los Alamos counties believed to be capable of supporting the production and operation of space-related activities.[26] Building on the industries analyzed in the Washington State Space Economy report compiled by BERK in 2018, our investigations also analyzed additional industries that could provide auxiliary support to space operations.

A set of industries was identified as being directly related to commercial space operations. These five industries were identified by BERK in 2018 and serve as the foundation of this IBC analysis. These industries were chosen because the production and operation of space vehicles requires a network of industries across the economy that provides products and services essential to successful launches. This selection also recognizes the commercial applications of space missions ranging from TV and radio to global positioning system (GPS) navigation and telecommunications.[27]

23 Industrial Base Capability concepts are adapted from Tom D. Miller, *The Defense Sustainment Industrial Base–A Primer*, 21st Century Defense Policy Paper, Foreign Policy At Brookings, Brookings Institute, June 30, 2010, accessed September 21, 2019, https://www.brookings.edu/wp-content/uploads/2016/06/0630_defense_industrial_base_miller.pdf (Miller, 2010).
24 BERK Consulting, Inc., *Washington State Space Economy* prepared for the Puget Sound Regional Council, September 2018, accessed October 7, 2019, https://www.psrc.org/sites/default/files/the_washington_state_space_economy-nov2018.pdf (BERK, 2018).
25 Miller, 2010, p. 23.
26 We have excluded Santa Fe County, which physically lies between Bernalillo and Los Alamos counties, due to the predominance of government sector activities concentrated in Santa Fe County. That's not to say that there's no IBC-related activities supporting the federal laboratories and military activities, but that Santa Fe County has such a unique state government function as to distort the role of the IBC-related activities investigated.
27 BERK, 2018, p. 13.

These industries, and their accompanying North American Industry Classification System (NAICS) codes, include:

- Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing (NAICS 334220)
- Propulsion Units and Parts for Space Vehicles and Guided Missiles (NAICS 33641)
- Nonscheduled Chartered Freight Air Transportation (NAICS 481212)
- Satellite Telecommunications (NAICS 517410)
- Government-Related Space Research and Technology (NAICS 927)

Additionally, our report adds industries assumed to be important sectors of the IBC around the national laboratories and US Air Force base in Bernalillo and Los Alamos counties. The following industries were added to our analysis of the IBC in New Mexico:

- Engineering Services (NAICS 541330)
- Testing Laboratories (NAICS 541380)
- Custom Computer Programming Services (NAICS 541511)
- Computer Systems Design and Related Services (NAICS 54151)
- Scientific Research and Development Services (NAICS 5417)

The collection of these industrial sectors generally provides products and services to the national laboratories and the Air Force base.

SNL subcontracts to various businesses in the local economy. The economic impact report for SNL lists the top five subcontracting industries, which include Engineering Services, Computer Related Services, and Electronic Computer Manufacturing.[28] The report identifies these industries as being contracted from across New Mexico, but we assume that a significant portion of this is located in Bernalillo County. In similar fashion, LANL is assumed to rely on local businesses that provide engineering services captured in our selection of industries.

## 6.3.2 Supporting Sectors

The two key characteristics analyzed in each industry are the number of establishments and average employment. Using data from the Bureau of Labor Statistics (BLS), [29] we analyzed the industries that make up the IBC.

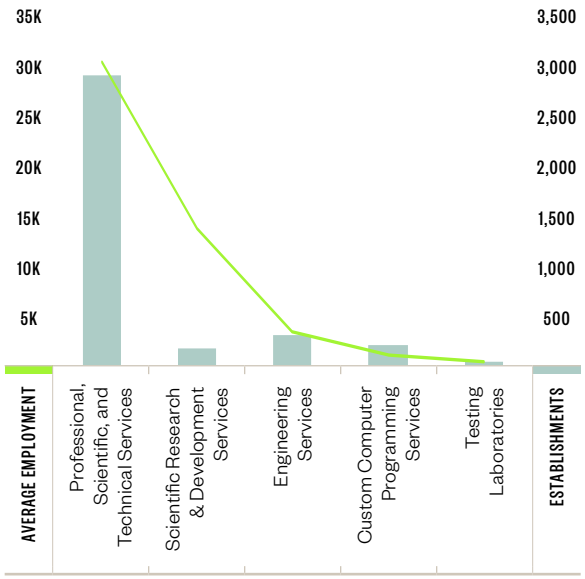
### 6.3.2.1 BERNALILLO & LOS ALAMOS COUNTIES

Bernalillo and Los Alamos counties are home to various industries that provide goods and services to SNL, KAFB, and LANL. From the list of industries previously discussed, Professional, Scientific, and Technical Services has the highest levels of employment averaging 29,583 jobs between 2016 and 2019, with an employee concentration ratio of 4.5% in 2019. The concentration ratio measures the number of employees in one industry against the number of employees in all industries. The number of establishments averaged 2,776 over the same time period. It is worth noting that employment in this industry has increased at an annual rate of 3%.

The second industry with highest levels of employment in the IBC complex is Scientific Research and Development Services. This industry provided employment to an average of 12,823 individuals between 2016 and 2019 with an employee concentration ratio of 1.9%. The number of establishments over the same period averaged 153. Employment in this industry also experienced considerable annual growth, averaging a 5.2% increase.

The following chart illustrates the economic presence of the top five industries in the New Mexico IBC.

FIGURE 41: Top Five Industrial Base Capability Industries by Employment
Bernalillo and Los Alamos Counties, 2019




The data shown in the figure above tells the story of an IBC that has developed around SNL, KAFB, and LANL. The IBC industries with the largest footprint in the New Mexico economy of these counties provide highly-technical goods and services related to computer design, scientific research and development, laboratories, and a wide array of engineering services.

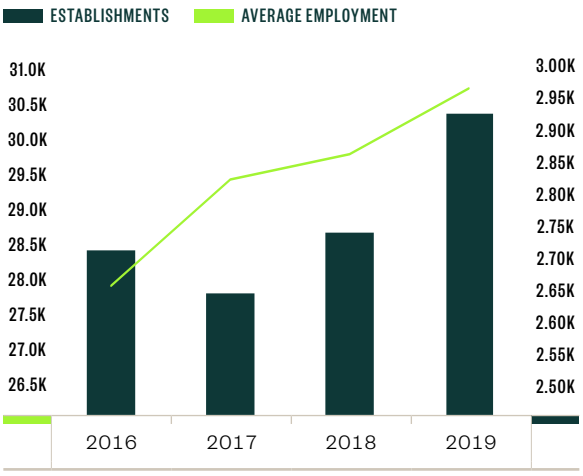
Not only do these industries provide support to the operations at the SNL, KAFB, and LANL, they also provide a highly-qualified labor force trained in highly-advanced fields at the forefront of scientific and engineering research.

A historic overview of the top two industries in Bernalillo and Los Alamos counties' IBCs are shown in the figures below. The Professional, Scientific, and Technical Services sector (Figure 41) shows an increasing trend in both number of establishments

28 Sandia National Laboratories, Economic Impact, 2018. (SNL, 2018).
29 Unless noted otherwise, all BLS data comes from the Quarterly Census of Employment and Wages (QCEW). Full citation is provided at the end of this section.

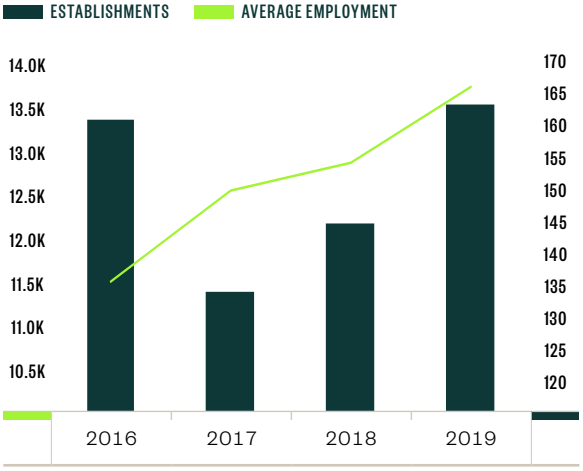
and the number of employees, albeit with a temporary dip in the number of establishments in 2017.

FIGURE 42: Professional, Scientific & Technical Services
Bernalillo and Los Alamos Counties, 2016–2019




The second sector with the largest footprint in the IBC complex is the Scientific Research and Development Services sector. Figure 42 shows the number of establishments and employees in these sectors during the same time period of 2016–2019.

FIGURE 43: Scientific Research & Development Services
Bernalillo and Los Alamos Counties, 2016–2019

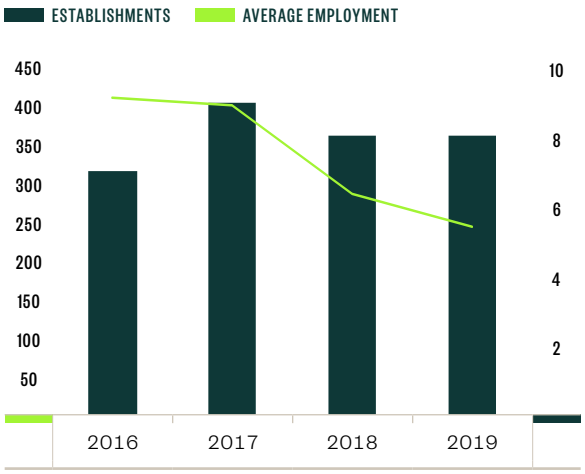



Engineering Services is a broad sector and includes many subsectors within it, not all of which are relevant for the space industry. Nonetheless, it serves as a good indicator of the science, technology, engineering, and mathematics (STEM) industrial base in Bernalillo County, which is a critical predecessor to a more specialized space industrial base.

## 6.3.3 Aerospace Sectors

A sector that is particularly relevant to the space industry and was identified in BERK 2018 as a key aerospace sector is the Propulsion Units & Parts for Space Vehicles & Guided Missiles. As this is still an emergent sector in New Mexico, there are fewer than 10 establishments within it. However, it is present in New Mexico and has been mostly consistent in the last four years.

FIGURE 44: Propulsion Units & Parts for Space Vehicles and Guided Missiles
Bernalillo and Los Alamos Counties, 2016–2019




Two other noteworthy aerospace sectors are Satellite Telecommunications and Nonscheduled Chartered Freight Air Transportation. These sectors are still new to the New Mexico industrial base, therefore, few establishments currently exist in support of them; for those that do, employment data has been redacted. According to the BLS, there's been one establishment supporting the Satellite Telecommunications sector since 2018, and two establishments supporting the Nonscheduled Chartered Freight Air Transportation sector.[30]

### 6.3.3.1 WASHINGTON STATE

This section of the IBC analysis takes us to areas with more-developed industry complexes around space launch activities. The state of Washington has developed an IBC over the last 50 years around research and development and manufacturing for the US national aerospace program.

This endeavor has resulted in the creation of private companies in the region providing a range of goods and services related to space exploration. After 50 years of development, the state now has a mix of high-tech manufacturing resources and assets, which bring significant opportunities to commercial space exploration.[31]

It is important to note that the state of Washington does not, at this time, have a FAA-licensed spaceport within its borders. Yet, as will be shown, substantial commercial IBC resources

30 Quarterly Census of Employment and Wages, Bureau of Labor Statistics, accessed November 10, 2019, https://www.bls.gov/cew/, accessed November 10, 2019.
31 BERK, 2018, p. 1.

support an otherwise robust and well-established space-related economy.

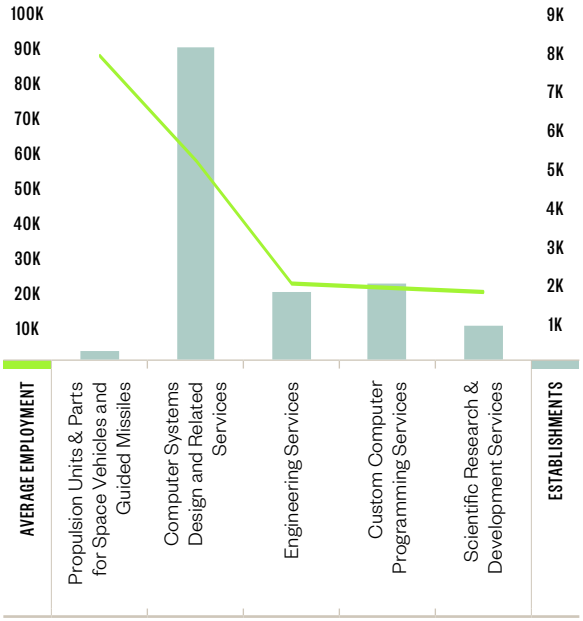
Washington is positioned to provide products for commercial space operations. The state has businesses that specialize in the manufacturing of aerospace tooling, components, systems, landing gear, propulsion systems for satellites, and other advanced technologies.[32] The IBC that has formed in Washington enables it to support the commercial space operations of tomorrow.

The story of the robust space IBC in Washington is told by the average employment in highly-specialized industries. The IBC industry with the highest levels of employment was the Propulsion Units and Parts for Space Vehicles and Guided Missiles, averaging more than 87,000 employees in 2019. This figure represents an employee concentration ratio of 2.9% in the economy of Washington. The number of establishments in 2019 was 196, representing an establishment concentration ratio of 0.08%.

The IBC industry with the second highest employment in 2019 was Computer Systems Design and Related Services. This sector showed average employment slightly more than 57,000 individuals in 8,149 establishments. The respective concentration ratios were 3.3% and 1.6% in 2019. It is worth mentioning that employment in this sector has grown on average by 5% between 2016 and 2019.

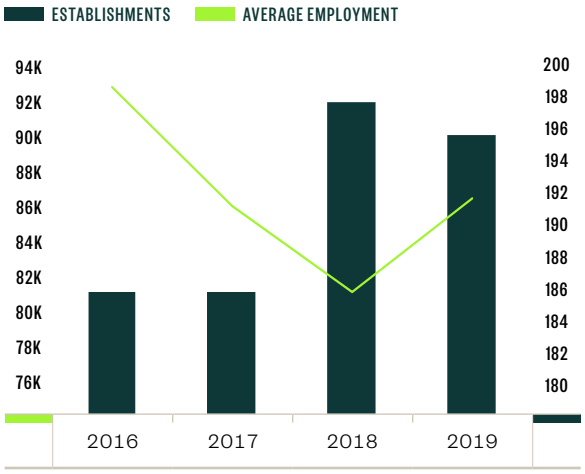
The top five IBC industries are summarized in the figure below, and show the robust IBC complex that has formed in the state of Washington.

FIGURE 45: Top Five Industrial Base Capability Industries by Employment
Washington, 2019




The sector in Washington's IBC with the strongest employment figures is the Propulsion Units and Parts for Space Vehicles and Guided Missiles.

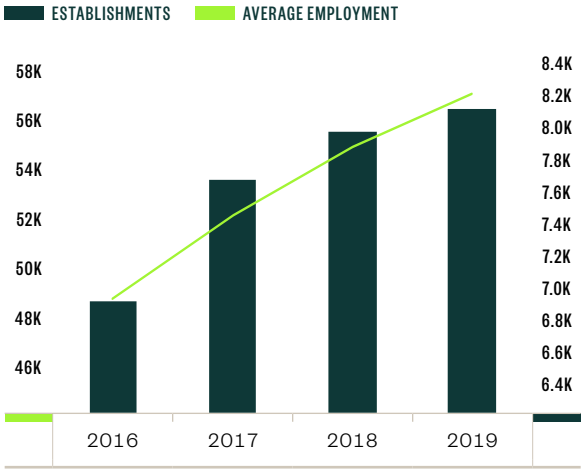
FIGURE 46: Propulsion Units & Parts for Space Vehicles and Guided Missiles
Washington, 2016–2019




2019 saw a turning point in employment levels for this industry. Employment experienced a steady decline between 2016 and 2018, but it rebounded in 2019. This negative trend wasn't reflected in the number of establishments, which actually increased over this period, perhaps reflecting a fragmentation in the industry.

The second largest IBC industry in terms of employment is the Computer Systems Design and Related Services.

FIGURE 47: Computer Systems Design & Related Services
Washington, 2016–2019




This industry experienced steady growth in the study period seen reflected in both number of establishments and average employment. Employment and number of establishments have both grown at an annual average of 5% over the study period.

32 BERK, 2018, p. 4.

### 6.3.3.2 FLORIDA

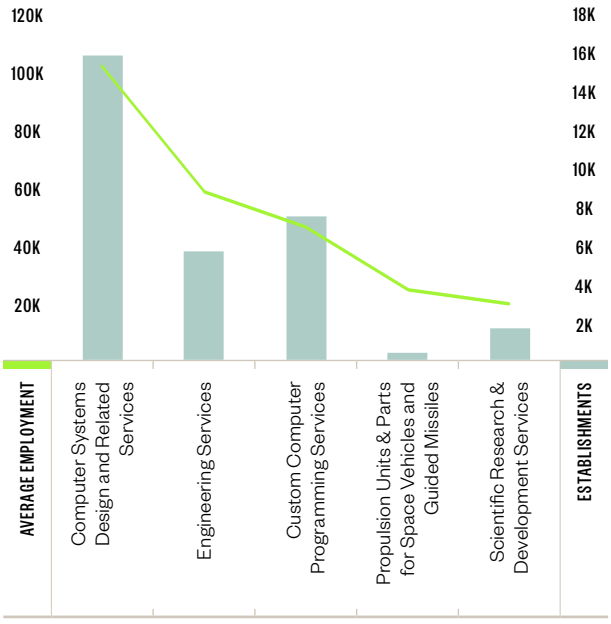
The last area in our IBC analysis is perhaps the most developed in the country, if not the world. Florida has been witness to multitude of space launches as it is the home of the Kennedy Space Center, which saw launch operations for the Mercury, Gemini, Apollo, Skylab, and Space Shuttle programs. Its history proves that Florida possesses the most mature space-launch ecosystem in the nation, and this is supported by data.

The top IBC industry in terms of employment in 2019 was Computer Systems Design and Related Services. Average employment reported by BLS in 2019 came in at 101,349, representing an employee concentration ratio of just under 1%. The number of establishments for the same period shows 15,847 with an establishment concentration ratio of 2.2%. Employment in this sector has increased on average by 7% each year, indicating robustness in this industry.

The second-highest IBC industry in 2019 was Engineering Services. Average employment as reported by BLS came in at 57,841 at 5,636 establishments. The respective concentration ratios were 0.6% and 0.8%. This sector has also seen steady growth in both establishments and employment averaging 3% between 2016 and 2019.

The following figure shows the levels of employment in the top five IBC-industries in Florida.

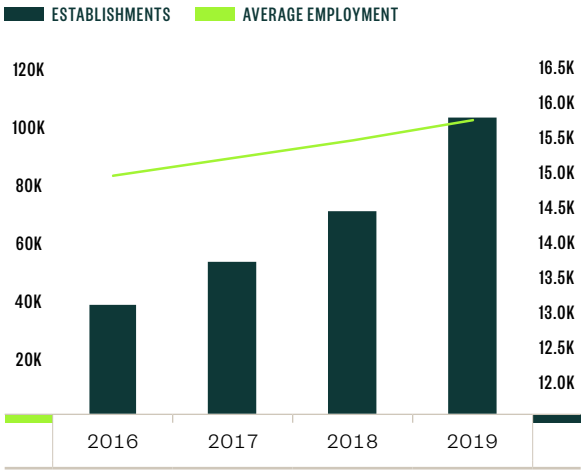
FIGURE 48: Top Five Industrial Base Capability Industries by Employment
Florida, 2019




Lastly, while not included in the top five IBC industries, the Government-Related Space Research and Technology industry is part of the IBC complex. In 2019, this industry showed average employment of 1,985 at eight federal establishments. Although this IBC-industry has less impressive numbers than others in the complex, it indicates that the IBC complex in Florida is a mixture of commercial and federal operations.

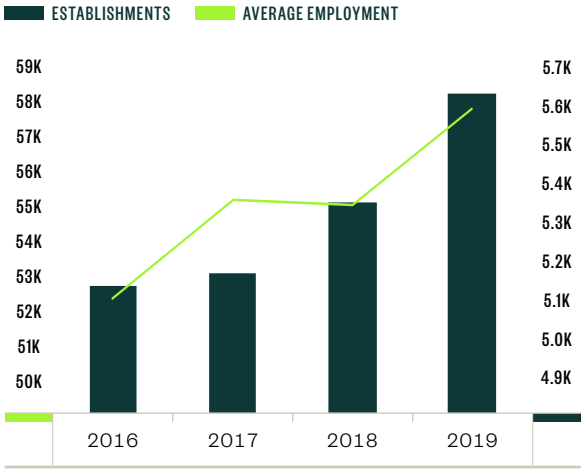
A brief overview of employment and establishment levels in the top two IBC sectors is summarized in the following figures. The Computer Systems Design and Related Services industry has experienced steady growth in employment averaging 7% year-over-year growth. Similarly, the number of establishments grew by 6% over the study period.

FIGURE 49: Computer Systems Design & Related Services
Florida, 2016–2019



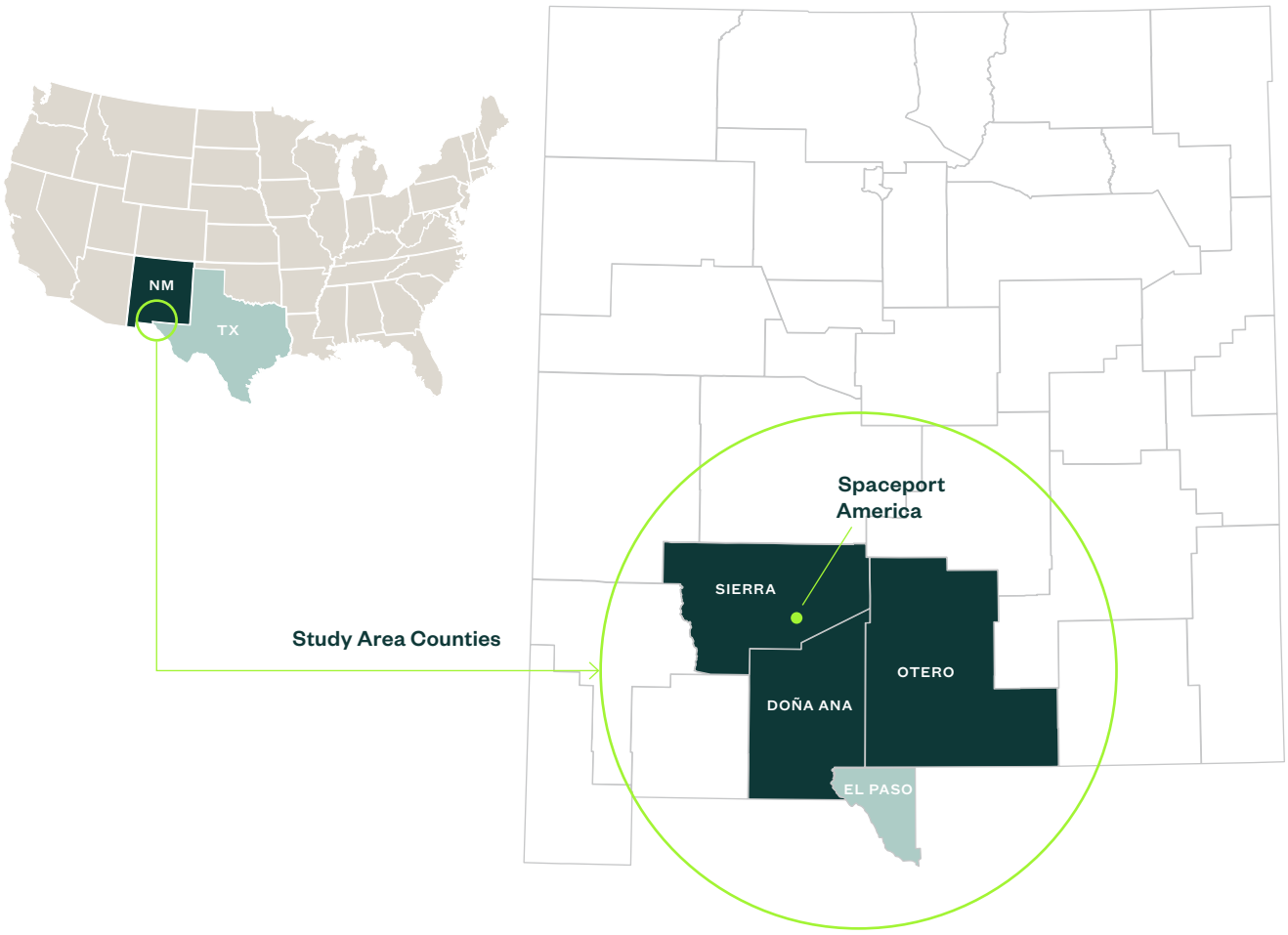

The second largest industry in terms of employment is Engineering Services. This IBC sector also experienced moderate growth in employment and the number of establishments, both averaging a 3% increase between 2016 and 2019.

FIGURE 50: Engineering Services
Florida, 2016–2019



# APPENDIX D

## 6.4 SPACEPORT AMERICA STUDY AREA PROFILES



## 6.4.1 Sierra County, NM

Sierra County is located in South-Central New Mexico and encompasses 4,179 square miles with a population density of 2.9 people per square mile.[33] Truth or Consequences is the county seat and makes up the majority of the county's total population. Other significant communities include Elephant Butte, Williamsburg, and Arrey. A current demographic profile is provided in Figure 51.

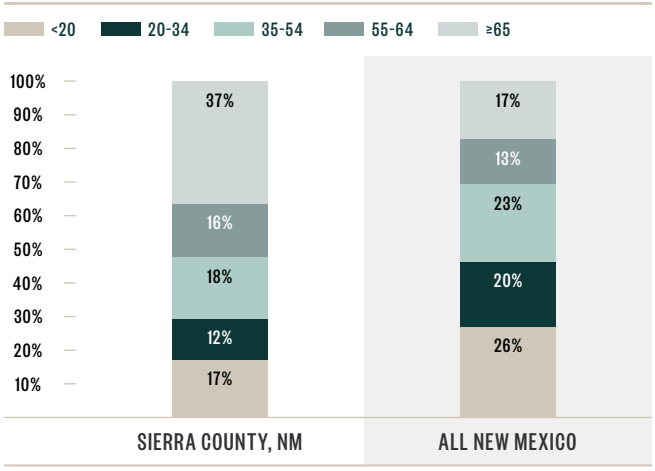
**FIGURE 51: Population & Employment**[34]
Sierra County, NM, 2013 and 2017

| POPULATION | | |
|---|---|---|
| 2018 Estimate | | 10,968 |
| % of New Mexico | | 0.5% |
| 2010–2018 Growth Rate | | -8.92% |
| **CITY AND VILLAGE** | **2013** | **2017** |
| Truth or Consequences | 6,430 | 6,029 |
| Elephant Butte | 1,450 | 1,393 |
| Williamsburg | 553 | 374 |
| Arrey | 525 | 83 |
| **EMPLOYMENT**[35] | | |
| Labor Force | | 4,097 |
| Employment | | 3,808 |
| Unemployment | | 7.1% |
| NM Unemployment | | 4.6% |

33 US Census Bureau, QuickFacts, 2018.
34 US Census Bureau, 2017 American Community Survey 2013-2017 and US Census Bureau, QuickFacts, 2018.
35 New Mexico Department of Workforce Solutions, Labor Force, Employment, and Unemployment in 2018, accessed on January 16, 2020, https://www.jobs.state.nm.us/.

With approximately 37% of the population falling into the 65 years old and over cohort, Sierra County's population is relatively older than that of New Mexico as a whole as can be seen in Figure 52.[36]

**FIGURE 52:** Percentage of Population by Age
Sierra County, NM, 2018 Estimate (years old)




In terms of total value, agriculture in Sierra County is dominated by livestock and poultry production, which accounts for more than 69% of total market value. The average farm size was more than one million acres in 2017, although that's down somewhat from 2012. An agricultural profile is provided in Figure 53.

**FIGURE 53:** Agricultural Profile[37]
Sierra County, NM, 2012 and 2017

| FARM DEMOGRAPHICS | | |
|---|---|---|
| | 2012 | 2017 |
| Number of Farms | 256 | 257 |
| Average Farm Size (acres)[38] | 3,939 | 4,883 |

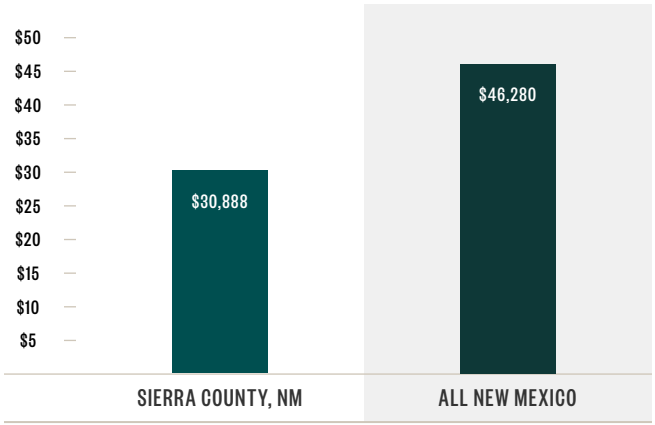
| PRODUCTS SOLD | | |
|---|---|---|
| MARKET VALUE | % | $MILLION |
| Crops | 30.81% | $9.83 |
| Livestock and Poultry | 69.19% | $22.07 |
| **Total** | **100%** | **$31.89** |

| SALES VALUE BY COMMODITY GROUP | $MILLION |
|---|---|
| Vegetables, melons, potatoes, sweet potatoes | $4.06 |
| Other crops and hay | $2.52 |
| Grains, oilseeds, dry beans, dry peas | $1.61 |
| Horses, ponies, mules, burros, donkeys | $0.05 |
| Sheep, goats, wool, mohair, milk | $0.01 |

36 US Census Bureau, 2017 American Community Survey 2013-2017.
37 US Department of Agriculture, 2017 Census of Agriculture, County Profiles.
38 Weighted average of farm size by number of farms.

The US Bureau of Labor Statistics 2019 average wages and salaries for all industries in Sierra County provides an estimated average annual pay of $30,888 per employee. The New Mexico statewide average compensation is $46,280 per year, reflecting that reported wages and salaries in Sierra County are approximately 67% of the state average. See Figure 54. [39]

FIGURE 54: Average Annual Compensation
Sierra County, NM, 2019 ($ thousand)




Additionally, the US Census Bureau estimates a per capita income of $22,749 for Sierra County, as compared with $25,257 for the state of New Mexico,[40] confirming that income in Sierra County tends to be somewhat lower than in the rest of the state.

According to Department of Workforce Solutions data, there was an average of 352 establishments providing employment in Sierra County in the first quarter (Q1) of 2019, with 279 (79.26%) of those private firms, 18 (5.11%) state government establishments, 16 (4.55%) federal government establishments, and 39 (11.08%) local government establishments. The largest sector by employment was Health Care and Social Assistance, with a total employee count of 841 in 2018, followed by Retail Trade (431), Accommodation and Food Service (426), and Public Administration (319).[41] A summary of establishments, employment, and wages by industry is provided in Figure 55.

FIGURE 55: Average Employment & Wages by Major Industry[42]
Sierra County, NM, 2019

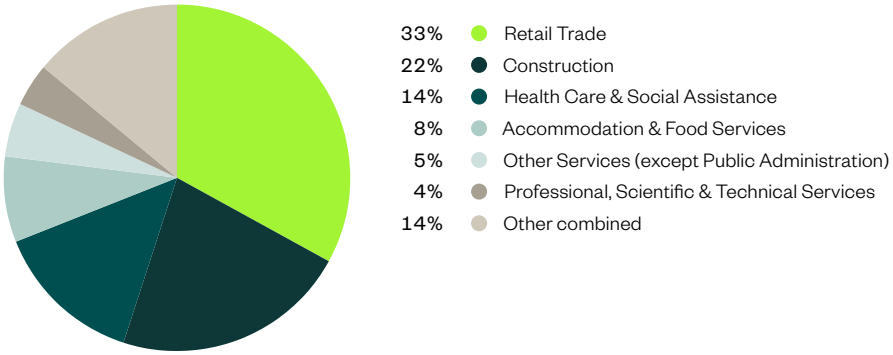
| SECTOR | ESTABLISHMENTS | | EMPLOYEES | | ANNUAL WAGES |
|---|---|---|---|---|---|
| Health Care & Social Assistance | 68 | 19.3% | 841 | 26.1% | $35,308 |
| Retail Trade | 37 | 10.5% | 431 | 13.4% | $24,180 |
| Accommodation & Food Services | 43 | 12.2% | 426 | 13.2% | $13,780 |
| Public Administration | 37 | 10.5% | 319 | 9.9% | $43,472 |
| Educational Services | 3 | 0.9% | 239 | 7.4% | $36,400 |
| **Total, All Industries** | **352** | **100.0%** | **3,221** | **100.0%** | **$30,888** |

The Sierra County economic sector reporting the highest levels of Gross Receipts Tax (GRT) in the 2019 fiscal year (FY) was the Retail Trade sector, with GRT revenues from this sector making up 33% of the total GRT followed by Construction and

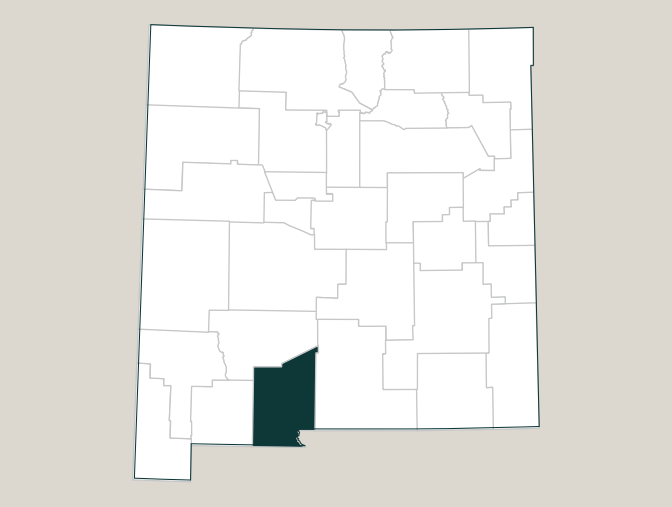
39 New Mexico Department of Workforce Solutions, Quarterly Census of Employment and Wages, 2019 Q1.
40 US Census Bureau, American Community Survey 2013-2017.
41 New Mexico Department of Workforce Solutions, Quarterly Census of Employment and Wages, 2019 Q1.
42 New Mexico Department of Workforce Solutions, Quarterly Census of Employment and Wages, 2019 Q1.

Accommodation and Food Services, with 22% and 14%, respectively. See Figure 56. Sierra County had a total of nearly $14 million in GRT in FY2019.[43]

**FIGURE 56:** Gross Receipts Taxes by Sector
Sierra County, NM, FY2019




## 6.4.2 Doña Ana County, NM



Doña Ana County was created in 1852 and is the second-most populated county in New Mexico.[44] The county is located in southern New Mexico and encompasses a total area of 3,807 square miles with a population density of 55 people per square mile.[45]

Las Cruces is the county seat. Other significant communities within the county include Sunland Park, Anthony, and Mesilla, but Las Cruces is by far the most populated community in the county. A current demographic profile is provided in Figure 57.

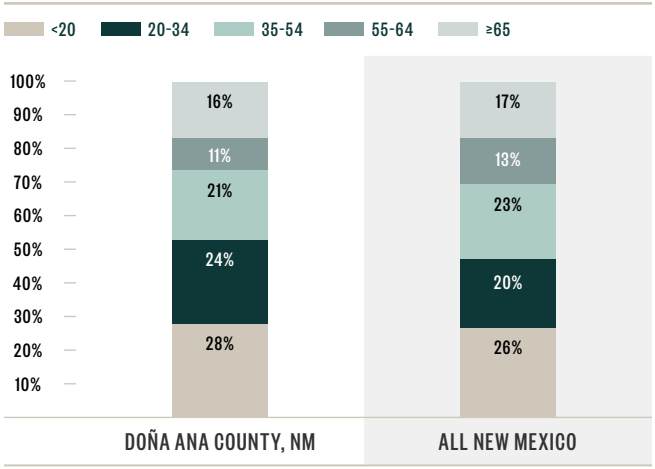
43 New Mexico Taxation and Revenue Department RP80 Report.
44 About the County, Doña Ana County, https://www.donaanacounty.org/about/.
45 US Census Bureau, QuickFacts, 2018.

FIGURE 57: Population & Employment[46]
Doña Ana County, NM, 2013 & 2017

| POPULATION | | |
|---|---|---|
| 2018 Estimate | | 217,522 |
| % of New Mexico | | 10.4% |
| 2010–2018 Growth Rate | | 3.53% |
| **CITY AND VILLAGE** | **2013** | **2017** |
| Las Cruces | 99,186 | 101,014 |
| Sunland Park | 14,517 | 16,051 |
| Anthony | 8,838 | 9,397 |
| Mesilla | 2,168 | 2,485 |
| **EMPLOYMENT[47]** | | |
| Labor Force | | 96,769 |
| Employment | | 91,299 |
| Unemployment | | 5.7% |
| NM Unemployment | | 4.6% |

Figure 58 demonstrates that the population by age in Doña Ana County is roughly representative of New Mexico as a whole.[48]

FIGURE 58: Percentage of Population by Age
Doña Ana County, NM, 2018 Estimate (years old)




Agriculture is a significant economic sector that is dominated by farming activities. An agricultural profile is provided in Figure 59.

46 US Census Bureau, 2017 American Community Survey 2013-2017 and US Census Bureau, QuickFacts, 2018.
47 New Mexico Department of Workforce Solutions, Labor Force, Employment, and Unemployment in 2018, accessed on January 16, 2020, https://www.jobs.state.nm.us/.
48 US Census Bureau, 2017 American Community Survey 2013-2017.

FIGURE 59: Agricultural Profile[49]
Doña Ana County, NM, 2012 and 2017

| FARM DEMOGRAPHICS | | |
|---|---|---|
| | 2012 | 2017 |
| Number of Farms | 2,184 | 1,946 |
| Average Farm Size (acres)[50] | 302 | 271 |

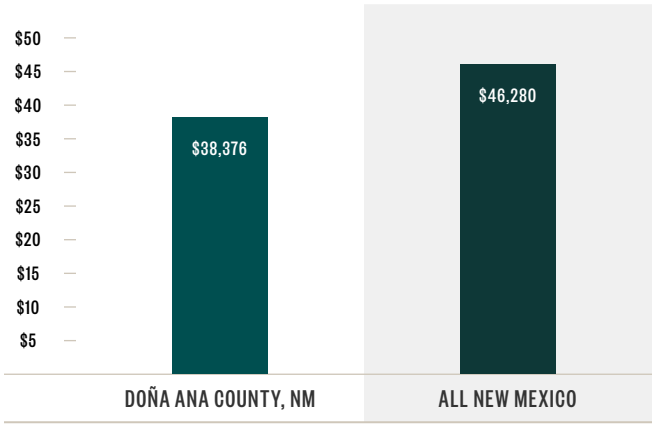
| PRODUCTS SOLD | | |
|---|---|---|
| MARKET VALUE | % | $MILLION |
| Crops | 61.82% | $228.90 |
| Livestock and Poultry | 38.18% | $141.39 |
| **Total** | **100%** | **$370.29** |

| SALES VALUE BY COMMODITY GROUP | $MILLION |
|---|---|
| Fruit, tree nuts, berries | $147.13 |
| Milk from cows | $130.73 |
| Vegetables, melons, potatoes, sweet potatoes | $32.81 |
| Nursery, greenhouse, floriculture, sod | $21.51 |
| Cotton and cottonseed | $14.42 |

New Mexico Department of Workforce Solutions Q1 2019 average wages and salaries for all industries in Doña Ana County provides an estimated average annual pay of $38,376 per employee. The New Mexico statewide average compensation is $46,280 per year, reflecting that reported wages and salaries in Doña Ana County are approximately 83% of the state average. See Figure 60.[51]

The US Census Bureau estimates a per capita income of $21,050 for Doña Ana County, as compared with $25,257 for the state of New Mexico.[52]

FIGURE 60: Average Annual Compensation
Doña Ana County, NM, 2019 ($thousand)




49 US Department of Agriculture, 2017 Census of Agriculture, County Profiles.
50 Weighted average of farm size by number of farms.
51 New Mexico Department of Workforce Solutions, Quarterly Census of Employment and Wages, 2019 Q1.
52 US Census Bureau, American Community Survey 2013-2017.

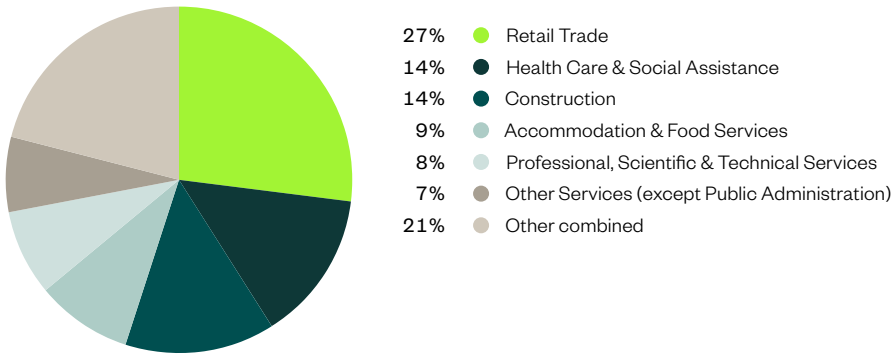
According to Department of Workforce Solutions Q1 2019 data, there was an average of 4,931 establishments providing employment in Doña Ana County in 2019, with 4,626 (93.81%) of those private firms, 102 (2.07%) state government establishments, 72 (1.46%) federal government establishments, and 131 (2.66%) local government establishments. The largest sector by employment was Healthcare and Social Assistance with a total employee count of 15,016 in Q1 2019, followed by Educational Services (10,359), Accommodation and Food Services (7,661), Retail Trade (7,264), and Public Administration (5,778).[53] A summary of establishments, employment, and wages by industry is provided in Figure 61.

FIGURE 61: Average Employment & Wages by Major Industry[54]
Doña Ana County, NM, 2019

| SECTOR | ESTABLISHMENTS | | EMPLOYEES | | ANNUAL WAGES |
|---|---|---|---|---|---|
| Health Care and Social Assistance | 1,115 | 22.6% | 15,016 | 20.7% | $36,244 |
| Educational Services | 110 | 2.2% | 10,359 | 14.3% | $42,016 |
| Accommodation and Food Services | 327 | 6.6% | 7,661 | 10.6% | $16,276 |
| Retail Trade | 470 | 9.5% | 7,264 | 10.0% | $26,364 |
| Public Administration | 158 | 3.2% | 5,778 | 8.0% | $71,552 |
| **Total, All Industries** | **4,931** | **100.0%** | **72,459** | **100.0%** | **$38,376** |

The Doña Ana County economic sector reporting the highest levels of GRT in FY2019 was the Retail Trade sector, with GRT revenues from this sector making up 27% of the total GRT, followed by Health Care and Social Assistance and Construction, both at 14%. See Figure 62. Doña Ana County had a total of more than $312 million in GRT in FY2019.[55]

FIGURE 62: Gross Receipts Taxes by Sector
Doña Ana County, NM, 2019




53 New Mexico Department of Workforce Solutions, Quarterly Census of Employment and Wages, 2019 Q1.
54 New Mexico Department of Workforce Solutions, Quarterly Census of Employment and Wages, 2019 Q1.
55 New Mexico Taxation and Revenue Department RP80 Report.

## 6.4.3 Otero County, NM

Otero County is located in southern New Mexico and encompasses 6,613 square miles with a population density of 9.6 people per square mile.[56] Alamogordo is the county seat. Another significant community within the county is Tularosa. A current demographic profile is provided in Figure 63.

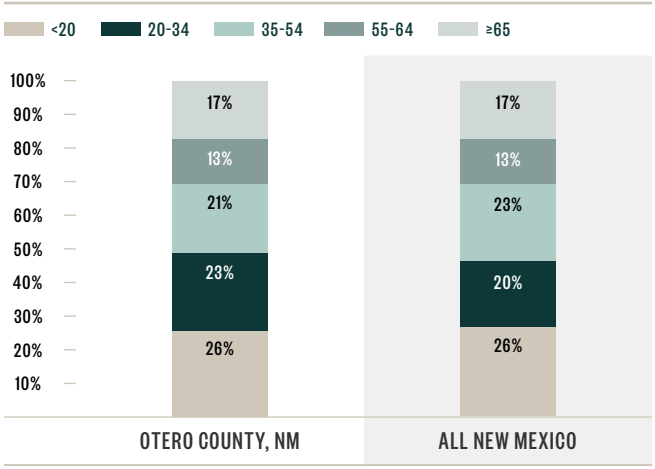
**FIGURE 63: Population & Employment**[57]
Otero County, NM, 2013 and 2017

| POPULATION | | |
|---|---|---|
| 2018 Estimate | | 66,781 |
| 2010–2018 Growth Rate | | 3.70% |
| **CITY AND VILLAGE** | **2013** | **2017** |
| Alamogordo | 30,903 | 30,963 |
| Tularosa | 2,884 | 2,902 |
| Cloudcroft | 630 | 613 |
| Bent | 157 | 22 |
| **EMPLOYMENT**[58] | | |
| Labor Force | | 24,601 |
| Employment | | 23,398 |
| Unemployment | | 4.9% |
| NM Unemployment | | 4.6% |

Otero County's population is relatively similar to that of New Mexico as a whole as can be seen in Figure 64.[59]

56 US Census Bureau, QuickFacts, 2018.
57 US Census Bureau, American Community Survey 2013-2017 and US Census Bureau, QuickFacts, 2018.
58 New Mexico Department of Workforce Solutions, Labor Force, Employment, and Unemployment in 2018, accessed on January 16, 2020, https://www.jobs.state.nm.us/.
59 US Census Bureau, 2017 American Community Survey 2013-2017.

FIGURE 64: Percentage of Population by Age
Otero County, NM, 2018 Estimate (years old)




Otero County's agricultural profile is dominated by livestock and poultry production, which accounts for about 69% of total market value. An agricultural profile is provided in Figure 65.

FIGURE 65: Agricultural Profile[60]
Otero County, NM, 2012 and 2017

| FARM DEMOGRAPHICS | | |
|---|---|---|
| | 2012 | 2017 |
| Number of Farms | 486 | 473 |
| Average Farm Size (acres)[61] | 2,518 | 2,155 |

| PRODUCTS SOLD | | |
|---|---|---|
| MARKET VALUE | % | $MILLION |
| Crops | 51.80% | $9.41 |
| Livestock and Poultry | 48.20% | $8.75 |
| **Total** | **100%** | **$18.16** |

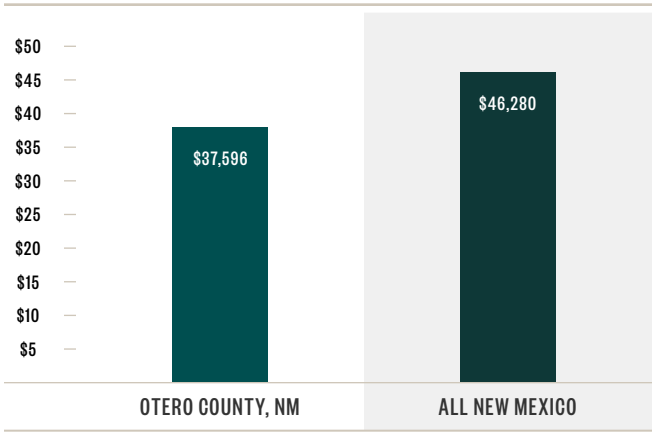
| SALES VALUE BY COMMODITY GROUP | $MILLION |
|---|---|
| Cattle and calves | $9.41 |
| Fruits, tree nuts, berries | $8.75 |
| Other crops and hay | $18.16 |
| Horses, ponies, mules, burros, donkeys | $0.05 |
| Grains, oilseeds, dry beans, dry peas | $0.01 |

New Mexico Department of Workforce Solutions average wages and salaries for all industries in Bernalillo County provides an estimated average annual pay of $37,596 per employee. The New Mexico statewide average compensation is $46,280 per year,

60 US Department of Agriculture, 2017 Census of Agriculture, County Profiles.
61 Weighted average of farm size by number of farms.

reflecting that reported wages and salaries in Otero County are approximately 81% of the state average. See Figure 66.[62]

FIGURE 66: Average Annual Compensation
Otero County, NM, 2019 ($thousand)




Additionally, the US Census Bureau estimates a per capita income of $21,876 for Otero County, as compared with $25,257 for the state of New Mexico,[63] consistent with the county's disparity in statewide wage and salary income levels.

According to Department of Workforce Solutions Q1 2019 data, there was an average of 1,206 establishments providing employment in Otero County in 2019, with 1,069 (88.64%) of those private firms, 27 (2.24%) state government establishments, 47 (3.90%) federal government establishments, and 63 (5.22%) local government establishments.[64] The largest sector by employment was Health Care and Social Assistance with a total employee count of 3,122 in Q1 2019, followed by Accommodation and Food Services (2,786), Public Administration (2,301), Retail Trade (2,247), and Educational Services (1,794).[65] A summary of establishments, employment, and wages by industry is provided in Figure 67.

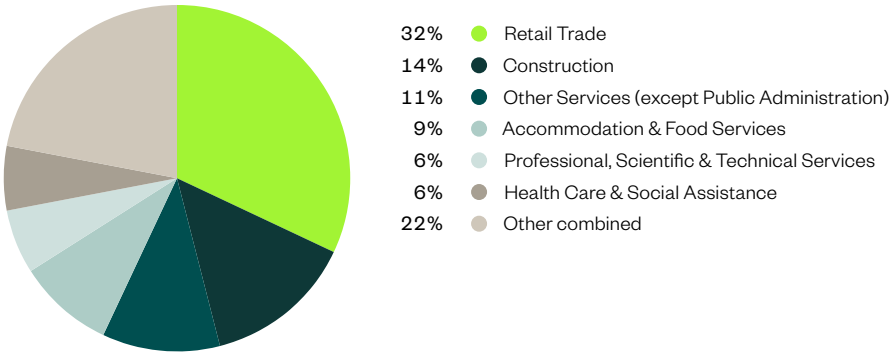
FIGURE 67: Average Employment & Wages by Major Industry
Otero County, NM, 2019

| SECTOR | ESTABLISHMENTS | | EMPLOYEES | | ANNUAL WAGES |
|---|---|---|---|---|---|
| Health Care and Social Assistance | 210 | 17.4% | 3,122 | 18.0% | $41,184 |
| Accommodation and Food Services | 106 | 8.8% | 2,786 | 16.1% | $20,904 |
| Public Administration | 52 | 4.3% | 2,301 | 13.3% | $53,716 |
| Retail Trade | 163 | 13.5% | 2,247 | 13.0% | $25,116 |
| Educational Services | 19 | 1.6% | 1,794 | 10.4% | $41,132 |
| **Total, All Industries** | **1,206** | **100.0%** | **17,306** | **100.0%** | **$37,596** |

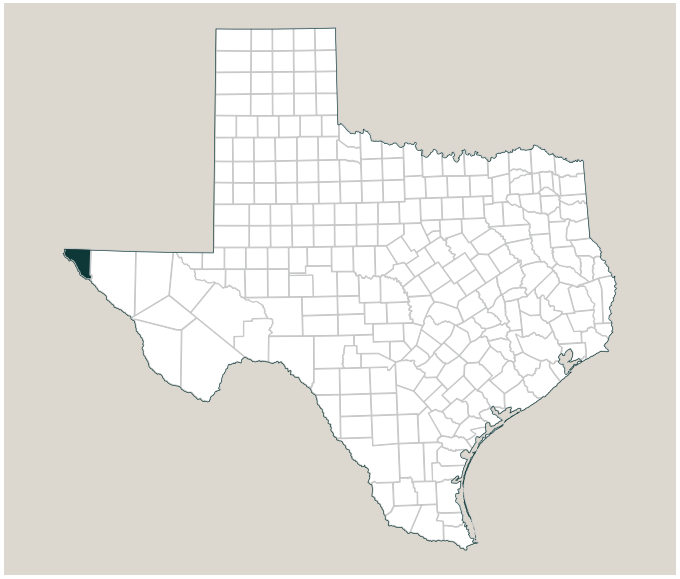
The economic sector reporting the highest levels of GRT in the FY2019 was the Retail Trade sector, with GRT revenues from the sales in this sector constituting 32% of the total GRT, followed by Construction with 14%. Otero had a total of more than $73 million in GRT in FY2019. See Figure 68.[66]

62 New Mexico Department of Workforce Solutions, Quarterly Census of Employment and Wages, 2019 Q1.
63 US Census Bureau, American Community Survey 2013-2017.
64 New Mexico Department of Workforce Solutions, Quarterly Census of Employment and Wages, 2019 Q1.
65 New Mexico Department of Workforce Solutions, Quarterly Census of Employment and Wages, 2019 Q1.
66 New Mexico Taxation and Revenue Department RP80 Report.

**FIGURE 68:** Gross Receipts Taxes by Sector
Otero County, NM, FY2019




## 6.4.4 El Paso County, TX



El Paso County is located in the western part of Texas on the New Mexico border and encompasses a total area of 1,013 square miles with a population density of 790.6 people per square mile.[67] The city of El Paso is the county seat and the most populous community in the county. The city of El Paso is also the sixth-most populous city in Texas. A current demographic profile is provided in Figure 69.

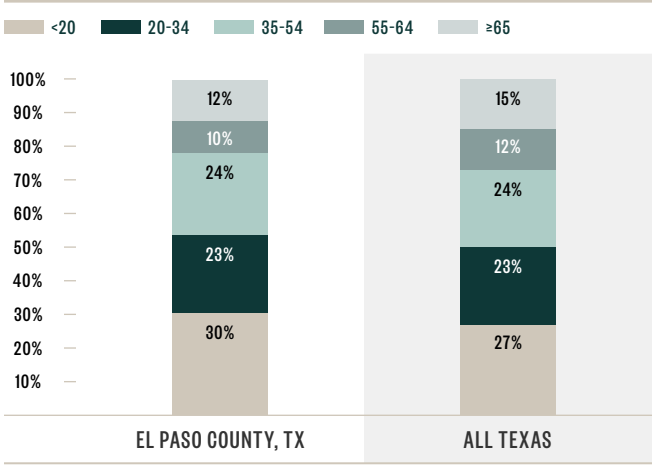
67 US Census Bureau, QuickFacts, 2018.

FIGURE 69: Population & Employment[68]
El Paso County, TX, 2013 and 2017

| POPULATION | | |
|---|---|---|
| 2018 Estimate | | 840,758 |
| 2010–2018 Growth Rate | | 4.62% |
| **CITY AND VILLAGE** | **2013** | **2017** |
| El Paso | 660,795 | 678,266 |
| Socorro | 32,227 | 33,587 |
| Horizon City | 17,736 | 19,331 |
| Anthony | 5,102 | 5,503 |
| **EMPLOYMENT[69]** | | |
| Labor Force | | 359,136 |
| Employment | | 343,915 |
| Unemployment | | 4.2% |
| NM Unemployment | | 3.9% |

From Figure 70, it can be seen that El Paso County is fairly representative of the study area as a whole.[70]

FIGURE 70: Percentage of Population by Age
El Paso County, TX, 2018 Estimate (years old)




The market value of the agricultural sector in El Paso County is dominated by crops, at over 86% of total value. An agricultural profile is provided in Figure 71.

68 US Census Bureau, American Community Survey 2013-2017 and US Census Bureau, QuickFacts, 2018.
69 Texas Workforce Commission, Local Area Unemployment Statistics 2018, accessed January 16, 2020, https://texaslmi.com/LMIbyCategory/LAUS.
70 US Census Bureau, 2017 American Community Survey 2013-2017.

FIGURE 71: Agricultural Profile[71]
El Paso County, TX, 2012 and 2017

| FARM DEMOGRAPHICS | | |
|---|---|---|
| | 2012 | 2017 |
| Number of Farms | 657 | 656 |
| Average Farm Size (acres)[72] | 217 | 319 |

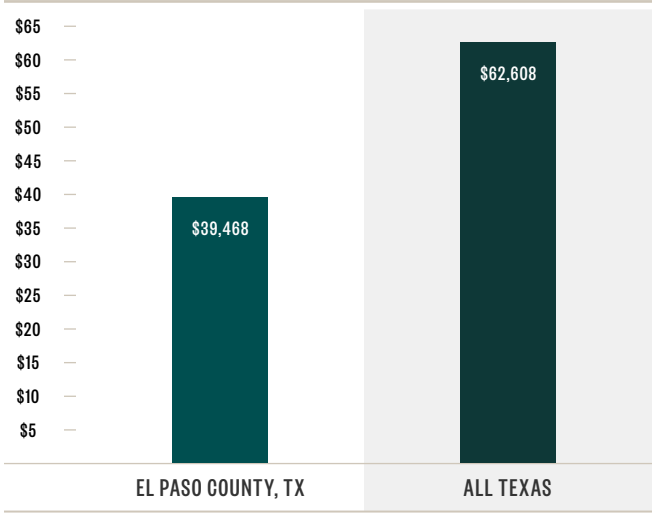
| PRODUCTS SOLD | | |
|---|---|---|
| MARKET VALUE | % | $MILLION |
| Crops | 86.40% | $40.38 |
| Livestock and Poultry | 13.60% | $6.36 |
| **Total** | **100%** | **$46.74** |

| SALES VALUE BY COMMODITY GROUP | $MILLION |
|---|---|
| Fruits, tree nuts, berries | $22.05 |
| Cotton and cottonseed | $15.29 |
| Cattle and calves | $5.56 |
| Other crops and hay | $1.87 |
| Vegetables, melons, potatoes, sweet potatoes | $1.12 |

Texas Workforce Commission Quarterly Census of Employment and Wages average wages and salaries for all industries in El Paso County provides an estimated average annual pay of $39,468 per employee. Texas average compensation is $62,608 per year, reflecting that reported wages and salaries in El Paso County are approximately 63% of the Texas area average. See Figure 72.[73]

The US Census Bureau estimates a per capita income of $19,950 for El Paso County.[74]

FIGURE 72: Average Annual Compensation
El Paso County, TX, 2019 ($thousand)




71 US Department of Agriculture, 2017 Census of Agriculture, County Profiles.
72 Weighted average of farm size by number of farms.
73 Texas Workforce Commission, Quarterly Census of Employment and Wages, 2019 Q1.
74 US Census Bureau, American Community Survey 2013-2017.

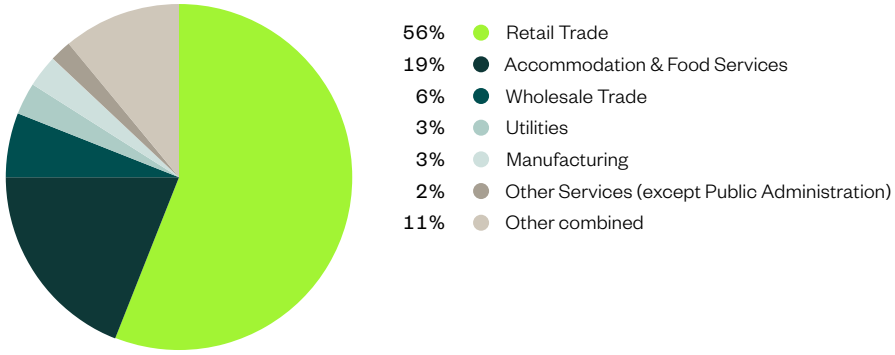
According to Texas Workforce Commission Statistics, there was an average of 15,533 establishments providing employment in El Paso County in Q1 2019, with 15,320 (98.5%) of those private firms, 39 (0.3%) state government establishments, 99 (0.6%) federal government establishments, and 95 (0.6%) local government establishments.[75] The largest sector by employment was Heath Care and Social Assistance with a total employee count of 51,995 in 2018, followed by Educational Services (39,261), Retail Trade (39,070), Accommodation and Food Services (35,530), and Administrative and Support and Waste Management and Remediation Services (25,338). A summary of establishments, employment, and wages by industry is provided in Figure 73.

**FIGURE 73:** Average Employment & Wages by Major Industry[76]
El Paso County, TX, 2019

| SECTOR | ESTABLISHMENTS | | EMPLOYEES | | ANNUAL WAGES |
|---|---|---|---|---|---|
| Health Care and Social Assistance | 1,804 | 11.6% | 51,995 | 16.8% | $39,936 |
| Educational Services | 187 | 1.2% | 39,261 | 12.7% | $41,600 |
| Retail Trade | 2,108 | 13.6% | 39,070 | 12.6% | $28,288 |
| Accommodation and Food Services | 1,544 | 9.9% | 35,530 | 11.5% | $16,276 |
| Administrative and Support and Waste Management and Remediation Services | 759 | 4.9% | 25,338 | 8.2% | $32,708 |
| **Total, All Industries** | **15,553** | **100.0%** | **309,379** | **100.0%** | **$39,468** |

The economic sector reporting the highest levels of sales tax in FY2019 was the Retail Trade sector, representing 56% of the total amount of sales subject to tax that year followed by Accommodation and Food Services with 19%. El Paso County had a total of over $7.7 billion in sales subject to state tax. See Figure 74.[77]

**FIGURE 74:** Sales Taxes by Sector
El Paso County, TX, FY2019




75 Texas Workforce Commission, Quarterly Census of Employment and Wages, 2019 Q1.
76 Texas Workforce Commission, Quarterly Census of Employment and Wages, 2019 Q1.
77 Texas Office of the Comptroller, Quarterly Sales Tax Historical Data by City or County, 2019.

# APPENDIX E:

# 6.5 ECONOMIC IMPACT MODEL–MULTIPLIER SELECTION

When economists discuss the benefits of the expansion of an economic activity, they also recognize that direct economic benefits create an indirect benefit associated with the additional economic activity from industries buying from other local business sectors. These are referred to as indirect impacts, or Type I economic multipliers.

A further extension of the economic multiplier analysis takes into account the increased economic activities on the social institutions such as households, state and local government, federal government, and capital that first obtain direct and indirect benefits. The analysis then recognizes that every dollar collected locally by that institution will be re-spent for that local institution's operations. Including the induced effects in the economic multiplier analysis provides a Type Social Account Matrix (SAM) multiplier.

This appendix addresses the challenges of identifying economic multipliers for emerging, developing commercial space technologies sector.

## 6.5.1 Multiplier Selection

Selecting the specific multipliers to use for economic impact analysis is typically straightforward. Multipliers, whether the source is IMPLAN©,[78] RIMS II,[79] or another model, are industry-specific. Each sector in either RIMS or IMPLAN is a grouping of other industrial classifications, such as North American Industry Classification System (NAICS) codes.

The groupings are sometimes small or even one-to-one, and sometimes broad, containing hundreds of more specific industries. For example, RIMS contains only three sectors related to construction activities, as opposed to 10 in IMPLAN sectors, and hundreds of NAICS codes.

The multiplier is selected as the industry group most closely representing the activity being measured. Sometimes the match is precise, and sometimes a broader category is necessary. In some cases, particularly with emerging industries, even where a multiplier can be found that closely matches the subject activities, the industry may be too small, or nonexistent, in the region being measured for there to be a usable multiplier.[80]

This analysis contains compromises in both of these areas. As an example, in the United States, manned spaceflight has, as of the publication of this study, traditionally been undertaken by government entities, such as the National Aeronautics and Space Administration (NASA). A NAICS code (927110) exists for "government entities primarily engaged in the administration and operations of space flights, space research, and space exploration. Included in this industry are government establishments operating space flight centers."

While this is intended to capture the activities of federal government agencies to date, this code seems to be the best available NAICS code to describe the manned spaceflight activities that will take place at Spaceport America. Unfortunately, this NAICS code isn't included in any IMPLAN or RIMS multiplier.

The NAICS manual, however, does specifically state that, "Private establishments primarily engaged in providing space freight transportation are classified in US Industry 481212, Nonscheduled Chartered Freight Air Transportation," which is included in Air Transportation multipliers in both RIMS and IMPLAN models.

The compromise is that Air Transportation also contains a lot of other activities unrelated to spaceflight, such as airline transportation and chartered helicopters. Nevertheless, Air Transportation appears to be the closest available match to spaceflight activities, manned or not.

The other type of compromise here is in regard to multipliers for sectors that exist, but aren't established enough in the study area region to have a meaningful multiplier. The choice, however, becomes the same: selecting the next best sector.

An example for this scenario is the manufacturing sector for "propulsion units and parts for space vehicles and guided missiles," which is a direct match to one of the activities we will model—the manufacture of rocket motors, which at least one customer of the spaceport currently does.

Unfortunately, for both IMPLAN© and RIMS models, this sector has multipliers of zero, or one, respectively. The next best sector that has usable multipliers is "guided missile and space vehicle manufacturing," which is a relatively close match, but not quite as direct a match as "propulsion units."

Figure 18 in the body of the report contains a list of the activities we're modelling with the multipliers selected for each activity.

78 IMPLAN Group LLC., Huntersville, NC.
79 Bureau of Economic Analysis, US Department of Commerce, Regional Input-Output Modeling System (RIMS II), Washington, DC.
80 Different models treat this situation differently. In the IMPLAN model, for an industry that has no activity in a region, all of the impact multipliers are listed as zero. The implication of this is that $1.00 spent in that industry has a $0.00 impact—no direct, indirect, or induced effects. RIMS, on the other hand, includes a direct impact of $1.00, and zero multiplier effects. This seems like a more practical approach, as the initial $1.00 spent has a $1.00 direct impact and no further multiplier impact.

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Moss Adams has undertaken to investigate and analyze an emerging commercial market in this report on the *Economic and Fiscal Impact of Spaceport America*. Unlike many analyses of commercial markets, the uncertainties and risks associated with the developing commercial space technologies sets this analysis apart from most. In short, we were requested to forecast future conditions in a commercial market that is poorly defined and subject to continuous change. We have developed this analysis around recent history of Spaceport America and other existing spaceports and rely on wide-ranging research of commercial and technology forecasts related to these space technologies and economic opportunities.

We acknowledge that these uncertainties, risks, and technological evolution virtually assure that no forecasting precision should be expected, but we have endeavored to provide rigorous support for our analyses and conclusions.

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