



**U.S. AIR FORCE**



UNITED STATES  
**SPACE FORCE**



# AFVENTURES

A division of AFWERX

FY18–FY20 Impact Report



AFWERX

## Letter from the Director

Private capital investment in new and innovative technologies comprises over 80 percent of our nation's research and development (R&D) expenditures. Resulting innovations, powered by commercial markets, are developed quickly without the need for government funding or influence. Moreover, companies are incentivized to quickly make the results from these technological efforts available in the global marketplace. Fifty years ago, the nation's best technologies were generated inside the government—the majority funded by the Department of Defense. Today, technological innovation is the domain of global, privately backed commercial technology markets.

Despite this shift to commercial innovation, Department of Defense (DoD) spending in new and innovative technologies has remained relatively stagnant. Current acquisition and procurement models are based on the now flawed assumption that the majority of relevant, innovative technologies continue to be developed inside DoD laboratories or by DoD-financed programs. This linear-approach ties DoD's spending to "pre-determined" defense-focused requirements, rather than proactively adapting military mission sets to leverage soon-to-be available commercially derived capabilities.

AFVentures represents a counterbalance to Defense acquisition and procurement. We serve as the Department of the Air Force's (DAF) commercial investment group. Our mission: leverage commercial technology to deliver improved capabilities to the warfighter, faster. We create simple, easy to use pathways for commercial innovation to solve warfighter problems. In the pursuit of commercially derived technological development, we intend to grow the industrial base, increase the transition of commercial technology to the DoD, increase commercialization derived from our investments, and partner with private capital to enhance defense.

We measure our success by how well we met our objectives. As a taxpayer funded investment group, the public is our board. Our reports represent our results—the successes and failures—to you, the public, with the intent of achieving radical transparency. We hope that you find this report effective in representing the return on investment to our Air and Space Force. This report is the first review of our activities, covering our portfolio from the AFVentures inception in 2018 to the present.

Fiscal Year (FY) 20, in particular, was an ode to the ingenuity and determination of the DAF, DoD and the entire nation in the face of a global pandemic. AFVentures was asked to fill a significant role in the pandemic relief work, both for the DoD and the National Response. This response included establishing easy to use pathways for commercial innovation to find and fight the pandemic; implementing robust, rapid, and international evaluation teams to evaluate hundreds of PPE proposals; and establishing collaborative acquisition platforms to rapidly source and fund capabilities to address the pandemic response mission needs. Our team's National Response work occurred alongside another record-breaking year executing the SBIR/STTR Open Topic—receiving a record number of proposals, awarding a record number of contracts, and releasing our first STRATFI program—awarding contracts up to \$26M in combined SBIR/STTR and customer government funds, the largest in the history of the program. The AFVentures team was called to a radical mission above and beyond the normal DoD requirements and answered with the incredible spirit that has become their hallmark.

As we head into FY21, we remain focused on our customers, the members of the U.S. Air and Space Forces. We are incredibly thankful for all our partners: the companies, investors, government organizations and personnel who dedicated countless hours to making FY20 a success. We are especially thankful for those who took on second and third shifts to combat the COVID-19 pandemic, never asking for anything other than more work. We look forward, in FY21, to building on our lessons learned by implementing and institutionalizing new and improved processes, increasing the transition of new commercial capabilities, and pushing the bounds of the immense technological frontier we all face, together.



Dr. Jason Rathje  
Director, AFVentures

# AFVentures Program Overview

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AFVentures' core goal is to expand and maintain the Air Force's innovative capabilities by matching operator needs with private sector solutions. We primarily work with the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Program to make these connections. In collaboration with the Office of the Assistant Secretary of the Air Force for Acquisition, Technology and Logistics (SAF/AQ), Air Force Research Laboratory (AFRL), and the SBIR/STTR Center of Excellence, the Open Topic program has resulted in 2,299 SBIR/STTR contracts awarded to over 1,400 companies since 2018.

The Open Topic is built on the SBIR/STTR processes while incorporating best practices from the venture capital community to both lower the barriers to entry and scale novel capabilities into Defense and Commercial (Dual-Use) markets. The Open Topic also flipped the traditional model by enabling any qualifying commercial innovator to "openly" propose their solution, opening the aperture for the DAF to consider more diverse avenues for solving military mission challenges. Ultimately, this approach expands the opportunity space to quickly source and scale new, dual-use technologies into military capabilities.

## AFVentures SBIR/STTR program is broken into three phases:

**Phase I:** AFBventures places many small bets by awarding companies short-term \$50,000 contracts to develop concepts, test feasibility, and identify potential DAF customers. This early linkage between technology developers and DAF end-users ensures subsequent funding goes to technologies that solve real Air Force problems.

**Phase II:** AFBventures places some medium bets by awarding companies with feasible concepts up to \$750,000 to support prototyping through research, development, test and evaluation based on Air Force operator needs.

The second Phase II option, Supplemental Funding Pilot Program (SFPP), allows further prototyping, but requires matched funding. Many efforts require additional funding to help scale to meet large Air and Space Force needs, so we offer up to \$15M in this second "Phase II". However, given the scale of funding, the SFPP requires 3rd-party private (e.g., venture capital) and/or government funding, with the intent of de-risking development through syndicating with multiple transition-focused partners.

Following completion of Phases I and/or II, participating companies have the opportunity to deliver technologies to Air Force end-users by transitioning to traditional FAR-based contracts.

**Phase III:** The SBIR/STTR Phase III is often referred to as the commercialization phase. It includes work derived from an effort under a prior SBIR/STTR funding agreement, but the work is funded by a source outside the SBIR/STTR program.

If the process is effective, it will accomplish the strategic objective of growing the Industrial Base for Defense. This Defense Industrial Base growth will be a direct result of effectively expanding the companies interested in working with the Department of the Air Force, leveraging commercial technology (and investment), and most importantly, delivering (transitioning) capability to the warfighter. The following pages detail our performance in meeting the strategic objectives of AFBventures to-date.

# Open Topic Portfolio at a Glance

**83.6%** Have 25 or Less Employees  
of Companies

Average Age of Company is **8.9** Years

**37.6%**

Self-Certified Small Disadvantaged Business

**11.9%**

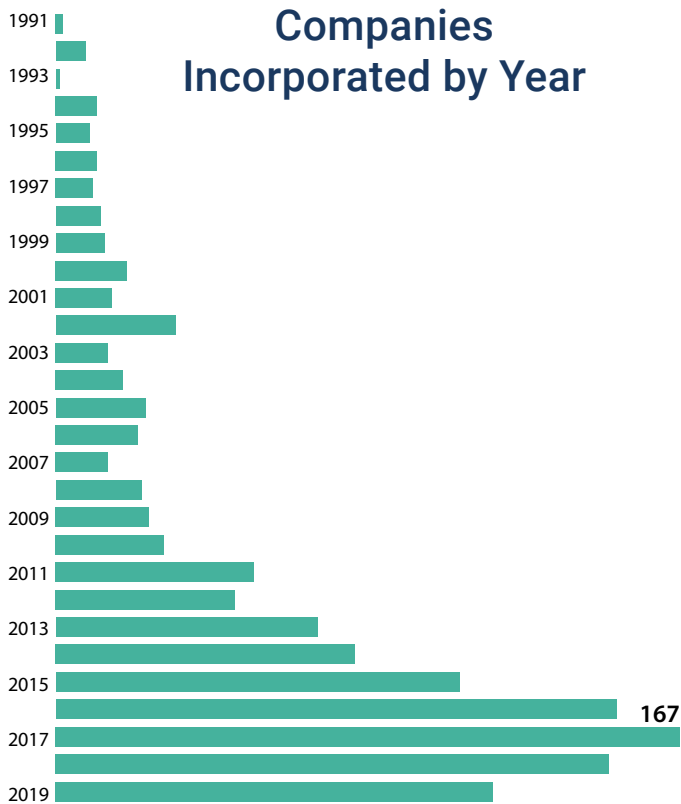
Minority Owned Business

**7.0%**

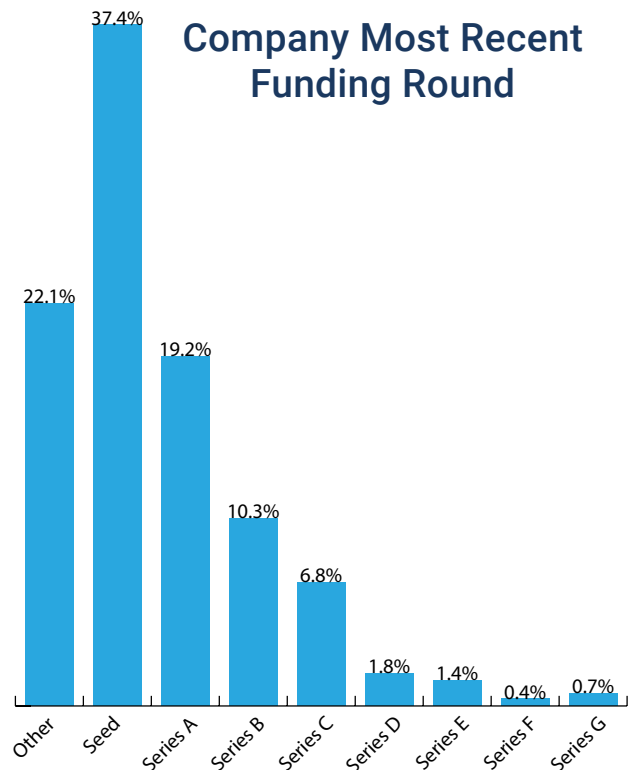
Disabled Veteran Owned Business

**>75%** received their first Air Force SBIR/STTR contract through AFVentures

**29%**  
of Companies are Receiving Private Investments



**1,433**  
Companies



**10** Companies Have Valuations Over **\$500 Million**

# Open Topic Impact

data from 2018-2020

Engaging venture backed businesses to benefit from private R&D investment

Post-Award Private Investment

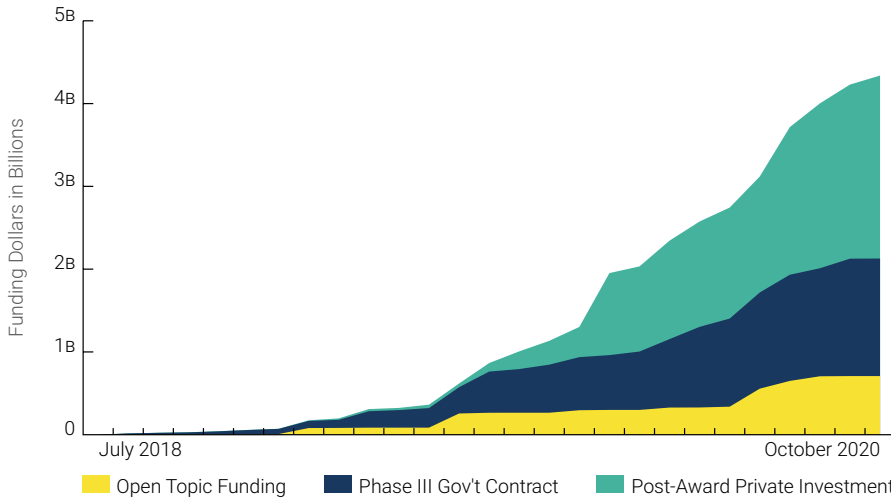
\$2.21 billion

29% of portfolio receiving private investment

5.8:1

return on investment

ROI defined as sum of post-award private investment, post-award government contracts, and public and private matched funding



Delivering capabilities to the warfighter at scale

Capabilities tested by warfighter:

538

Increasing ROI on Air Force RDT&E funding by leveraging matched funding

Private matched Funding

\$357 million

Government

\$169 million

Over 300

Air Force/DoD units supported

Accelerating award timelines

Contracts Awarded: 2,299

Total Funding: \$710 million

Proposals Received: 4,850

Avg. Time to Put Company on Contract: 72 days

Accelerating technology transition

Value Post-Award Gov't Awards:

\$1.42 billion

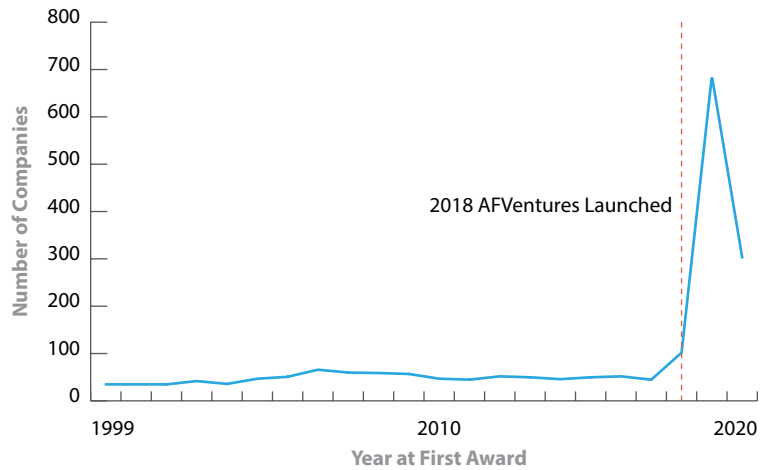
Avg. Months to Gov't Commercialization:

6 months

# AFVentures has successfully expanded the number of small businesses working with the Air Force.

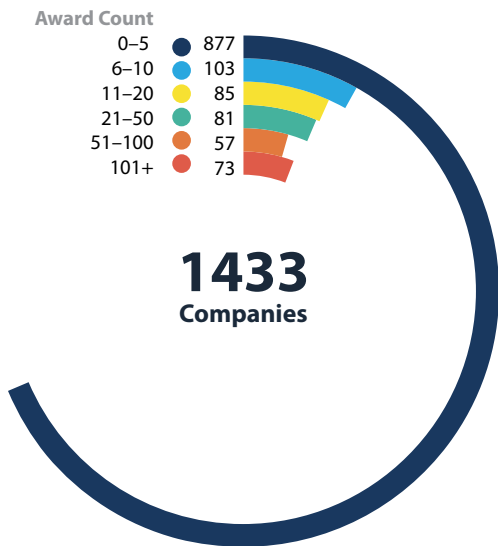
The AFVentures data team has culled historic DAF and Federal contract award data to assess the extent to which the Open Topic has been successful in awarding contracts to non-traditional businesses without prior DAF experience. We found that of the 1,433 AFVentures-funded companies, over 75% received their first Air Force SBIR/STTR award through the program. Prior to 2018, only 18% had received an Air Force prime contract. These metrics show that AFVentures is successful in expanding the number of small companies doing business with the DAF and accomplishing Defense Industrial Base growth. Figure 1 shows the distribution of years in which each of our portfolio companies received its first DAF contract.

Figure 1. AFVentures Portfolio First Air Force Contract



In analyzing DAF and Federal contract award data, two categories emerge: those companies with an extensive history of participation in the SBIR/STTR program and federal contracting, and those who are new to this process. The first group, those who have received 20 or more federal prime contracts, comprises 16%. The second group, those who have received fewer than five federal prime contracts, comprise 68%. The distinction between these two groups is important to understand when assessing the federal commercialization impact of the AFVentures portfolio (see Commercialization Section). AFVentures will continue to monitor the success of its portfolio companies new to working with the government and will refresh this analysis accordingly.

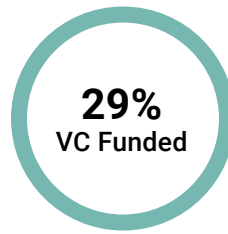
Figure 2. Number of Companies by Award Count



“As an early stage startup company, we had no plans to pursue the federal market. The process to identify and connect with DoD customers seemed complicated and lengthy. Then we heard AFVentures could get small businesses under contract in fewer than 30 days. We didn’t believe it but submitted a proposal anyway. We were under contract within 28 days. That was the beginning of our SBIR/STTR journey. Now we have an additional Phase I, multiple Phase II’s, and a Phase III contract.”

– Scott Schneider, CEO, HTX Labs, LLC, SBIR/STTR Company

# AFVentures has increased Air Force engagement with early stage, Ventures backed start-ups.

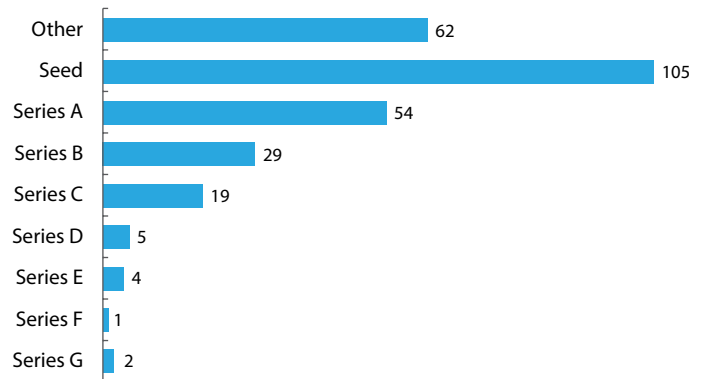


AFVentures seeks to not only increase the number of companies doing business with the DAF, but also to expand DAF engagement with venture-backed companies. Our data team has developed a novel technique to track Ventures Capital (VC) investment in our portfolio companies. Our methods are described further in Appendix C.

Using this method, we found that 29% of companies in AFDventures' portfolio received some form of VC funding. Applying the same data mining technique to all DOD SBIR/STTR recipients since 2015 to establish a baseline for comparison, we estimate that only 10% of awardees have received VC funding.

AFVentures has engaged VC-backed companies from early-stage to Series G. Of all our portfolio companies that received VC investment, 37% received seed funding as their most recent round of private investment. Because many VC recipients are early-stage companies, we expect that the total VC investment received by portfolio companies will increase over time as companies move into later funding rounds, further increasing Phase III return on investment.

Figure 3. Venture Capital Investments in AFDventures Companies



## Accelerating Award Timelines

November 5-9, 2019 contracting officials and innovators from across the Air Force awarded more than 100 small business contracts in just 40 hours.

The team was comprised of personnel from Air Education and Training Command, AFWERX, Air Force Installation Contracting Agency, Air Force Research Laboratory, the Air Force Contracting office, Air Force Life Cycle Management Center, Air Force Space Command, Air Force Personnel Center, and the Air Force Small Business Innovation Research Program office.

"Evaluations and awards have typically taken up to six months to complete." said Ryan Helbach, chief intrapreneur at the Air Force Research Laboratory. "Through our new processes, we completed evaluations in under a one week, and had companies on contract by the end of the following week."

<https://www.af.mil/News/Article-Display/Article/1700279/air-force-moves-at-the-speed-of-startups-with-100-contract-awards-in-40-hours/>

## AFVentures is working to align DAF RDT&E funding to leverage commercial investment.

Over the last two years, AFVentures has worked to target its RDT&E investments toward technologies receiving significant private sector investment. In this report, we take the opportunity to compare areas of overlap and divergence in AFVentures and private sector investment.

To generate this comparison metric, our data team categorized each Open Topic award by technology area, using a taxonomy of technology categories from Crunchbase. This enables a like-to-like comparison between private sector venture investment and Open Topic awards across technology areas. Because total volume of VC investment is orders of magnitude larger than the value of AFVentures funding, our analysis shows the percentage of total funding across technology areas rather than the absolute value.

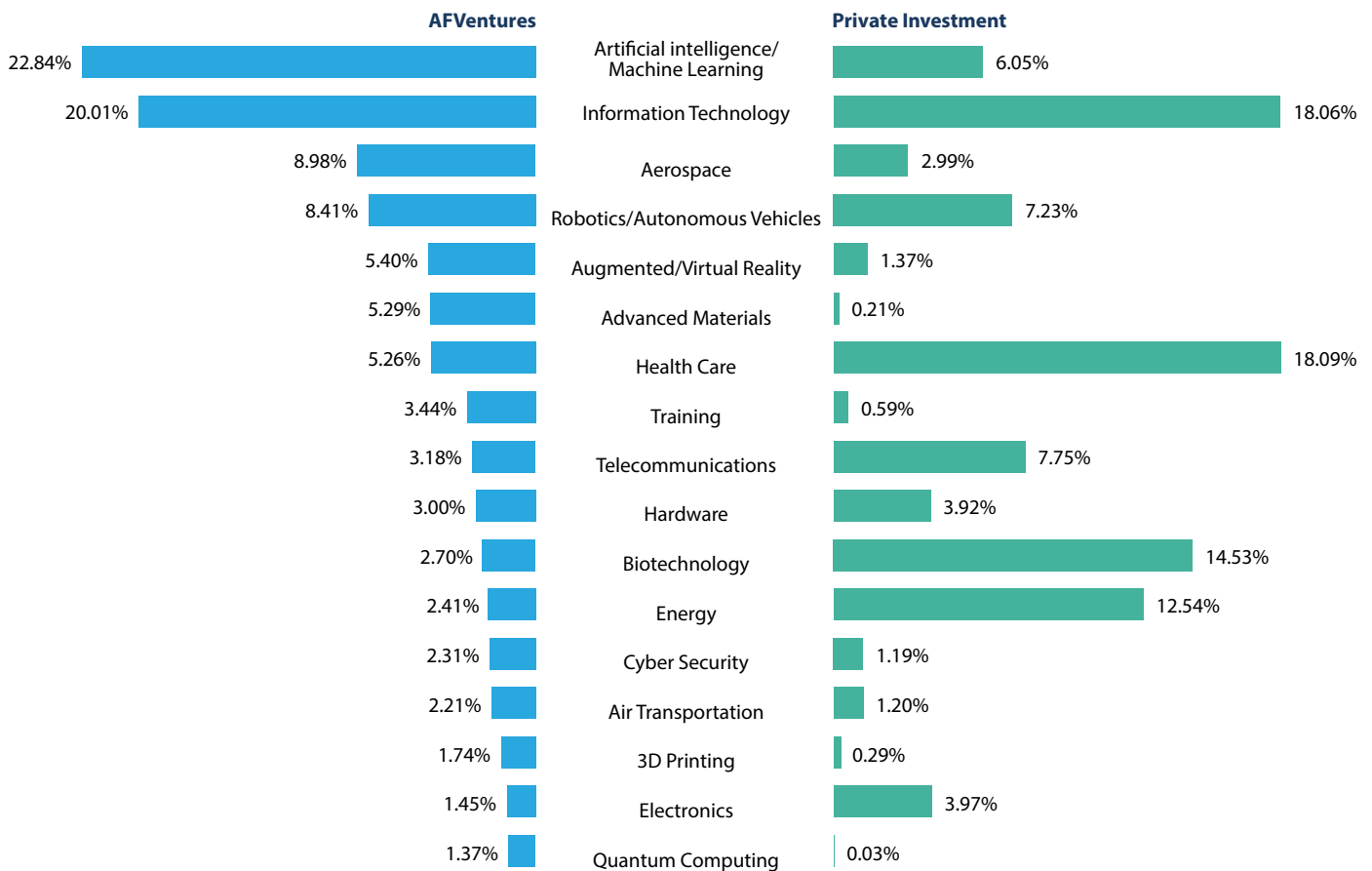
In the visual below, we see the distribution of AFVentures funding across technology areas as compared to private venture funding across those same technology areas. Because the Open Topic focuses on dual-use technologies, we exclude from our analysis private investment funding to non-defense related technology areas like e-commerce,

real estate, or agriculture which lack corresponding DAF use-cases. This allows us to compare our funding portfolio composition to the private sector across the same basket to defense-related technologies.

We see that the share of capital investment by AFVentures allocates a similar proportion of funding information technology, cyber security, and autonomy systems. In other instances, most notably artificial intelligence / machine learning, and aerospace, AFVentures has invested a significantly greater percent of its total budget compared to commercial investment. Conversely, we see that the proportion of private capital investment in Health Care, Biotechnology and Energy is significantly greater compared to AFVentures funding.

When looking at this discrepancy, it is important to understand that while the proportion of AFVentures funding to AI / ML is higher, the absolute value of private investment in these areas is still orders of magnitude larger. With this context, AFVentures' heavy investment in these sectors can be interpreted as an attempt to leverage with private-sector R&D where it most aligns with the Deep-Tech needs of the DAF.

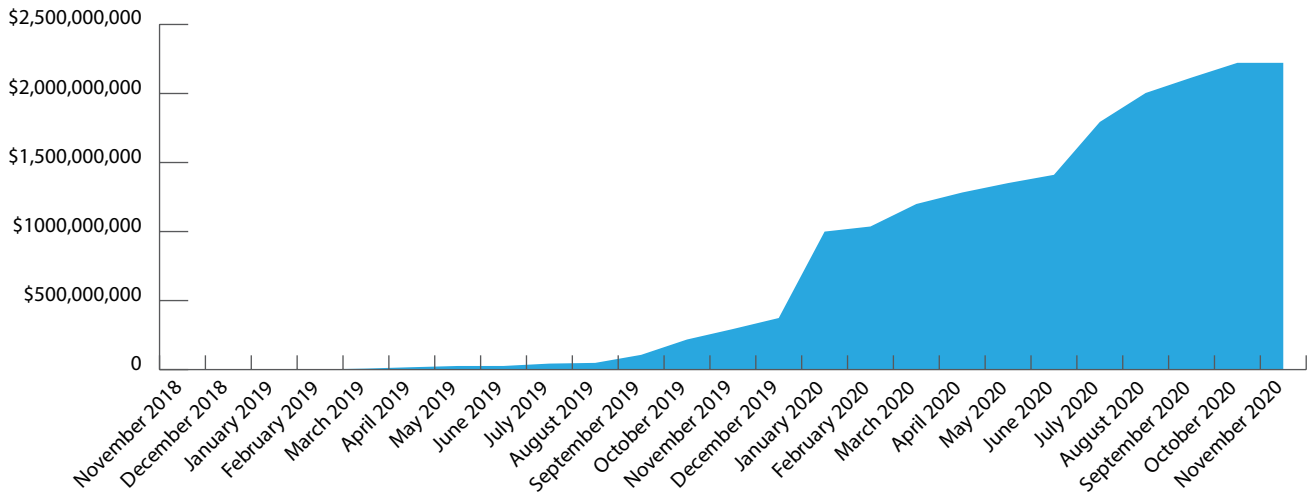
Figure 4. AFVentures Area of Investment Compared to Venture Capital's Area of Investment





# AFVentures portfolio companies have received \$2.22 billion in private sector investment following an Open Topic award, a 3:1 Private Capital ROI for the Air and Space Forces.

Figure 5. Aggregate Post-Award Private Investment



A Phase III SBIR/STTR award is any work that derives from, extends, or completes effort(s) performed under prior SBIR/STTR funding agreements, but is funded by sources other than the SBIR/STTR programs. By tracking this impact, we demonstrate that the Open Topic has supported the growth of small businesses while leveraging private sector R&D to develop technologies with Air Force applications. A core objective of AFVentures.

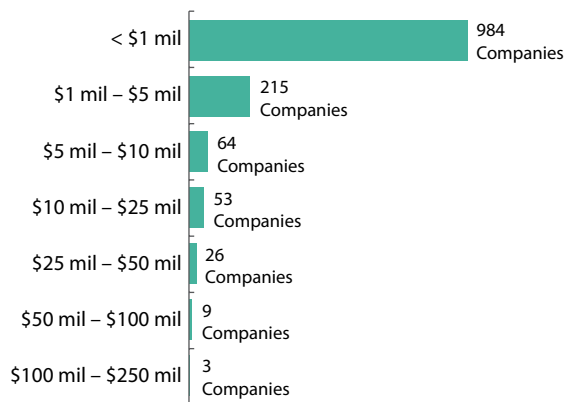
Existing tracking strategies limit the efficacy of Phase III impact reporting because they rely heavily on continuous, voluntary reporting that firms are unlikely to sustain.

To measure private sector commercialization without self-reporting, AFVentures pulls data on venture capital investment from *Crunchbase* (Appendix C for details). We separate investment occurring before a company participated in the Open Topic from investment received after participation.

AFVentures further tracks private sector commercialization impacts by incorporating company revenue data. At this point, AFVentures has not included this revenue data in current totals for Phase III commercialization impact because of the difficulty in isolating revenue specific to the Open Topic funded technology from unrelated company revenue. Nonetheless, AFVentures anticipates demonstrating yearly revenue growth by Open Topic portfolio companies.

In October 2018, Vita Technologies, LLC received its first AFVentures contract to conduct a feasibility study of its Load Stability System (LSS).

Figure 6. Revenue Range for AFVenture Portfolio Companies



The LSS is a chaotic motion control system to counteract the spinning of payloads and personnel suspended by cables below a helicopter in flight. This spin is undesirable when lifting personnel for rescue and exfiltration missions because it adds additional strain to the cables, increases risk or breakage and makes it harder to place payloads with precision.

Caleb Carr, Vita President and Chief Executive Officer said “our first Phase I contract convinced angel investors that Vita was worth investing in. Furthermore, the speed at which the Dept. of the Air Force moved to grant our contracts resulted in Vita raising over \$1 million in an angel investment round within 20 days.”

# AFVentures portfolio companies earned \$1.42 billion in government funding following participation in the Open Topic.

While private sector commercialization is an important program goal and validates the merit of AFVentures investments, follow-on federal contracts demonstrates wider capability adoption across the DAF and entire DoD.

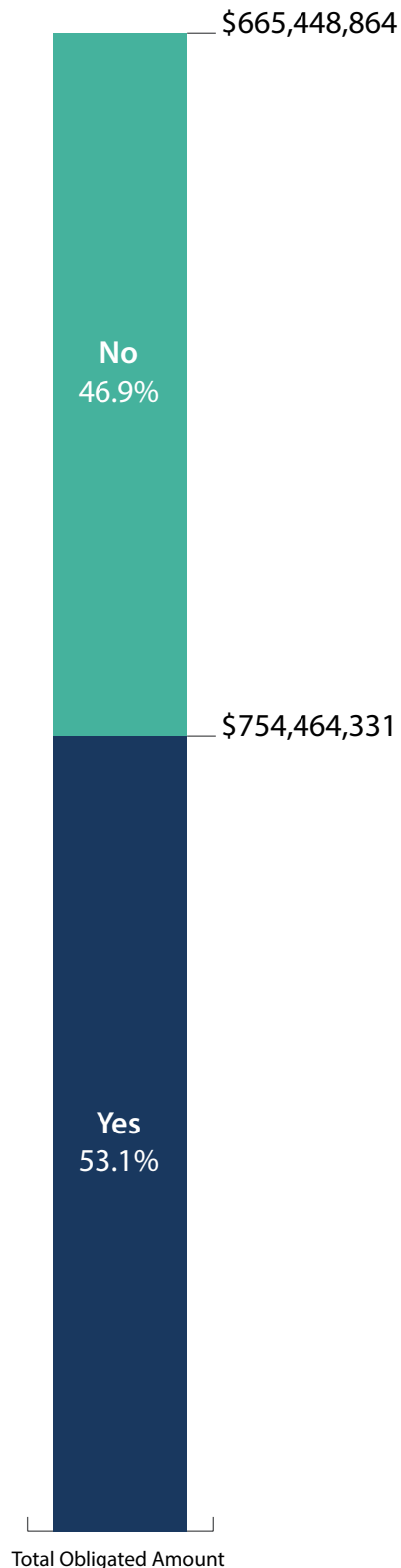
In order to capture the data about subsequent federal contracts, AFVentures pulled data from USASpending.gov, an open-source database tracking how federal money is spent. This data mining approach returned approximately 40,000 federal contracts received by our portfolio companies, 2,352 of which were non-SBIR/STTR contracts received after a company's first Open Topic award. Any award occurring after a company's first AFVentures award is tagged as potential Phase III impact. All awards a company received prior to working with AFVentures are excluded from consideration.

This data collection approach returns \$1.42 billion in government funding following an award through the Open Topic. Exploring this data further, we find that companies' receiving their first Air Force SBIR/STTR award through the Open Topic represent 53% of all post-award government funding.

## Accelerating Transition

In August 2019, as part of the 19.2 Open Topic award cycle, BrainGU, LLC received its first SBIR/STTR contract through the AFVentures program. In November 2019, the company received a sole source award of \$12,376,710 from the Cryptologic and Cyber Systems Division at Lackland Air Force Base. Because BrainGU had competed their concept and solution under the SBIR/STTR program, this process enabled the Cryptologic and Cyber Systems Division to make the sole source award with a commercialization timeline of four months.

Figure 7. Phase III Funding Divided by Past Air Force SBIR/STTR Participation



# Transition Outcomes

The Open Topic has supported 538 testing or prototyping projects with over 300 offices or units across all Air Force major commands as well as the US Space Force. The diversity of organizations participating is a strong validation of the Open Topic’s user need driven, decentralized model, and has directly contributed to the \$1.4B in follow-on non-SBIR/STTR DoD contracts.

Figure 8. Number of Supported Projects by MAJCOM

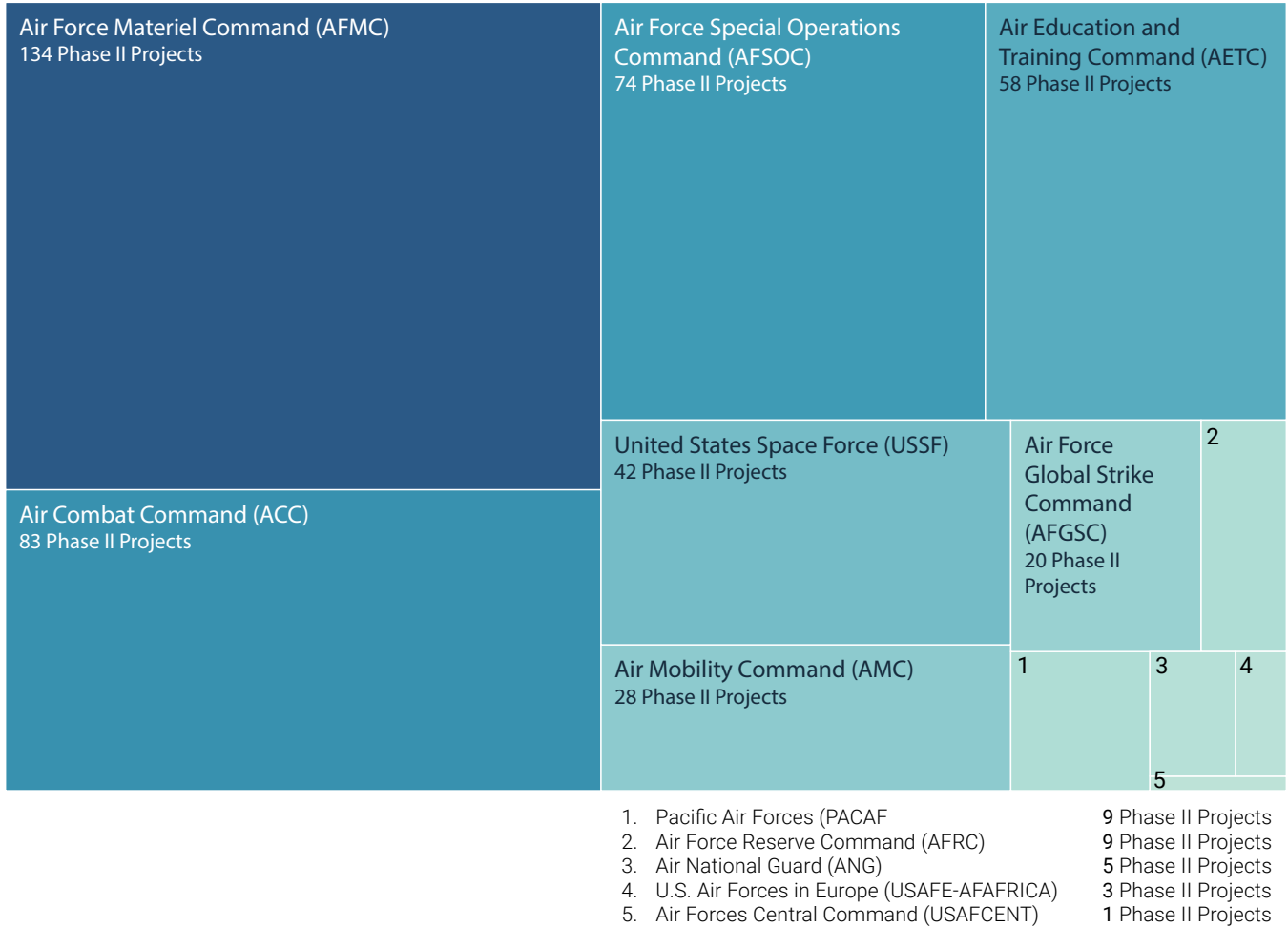
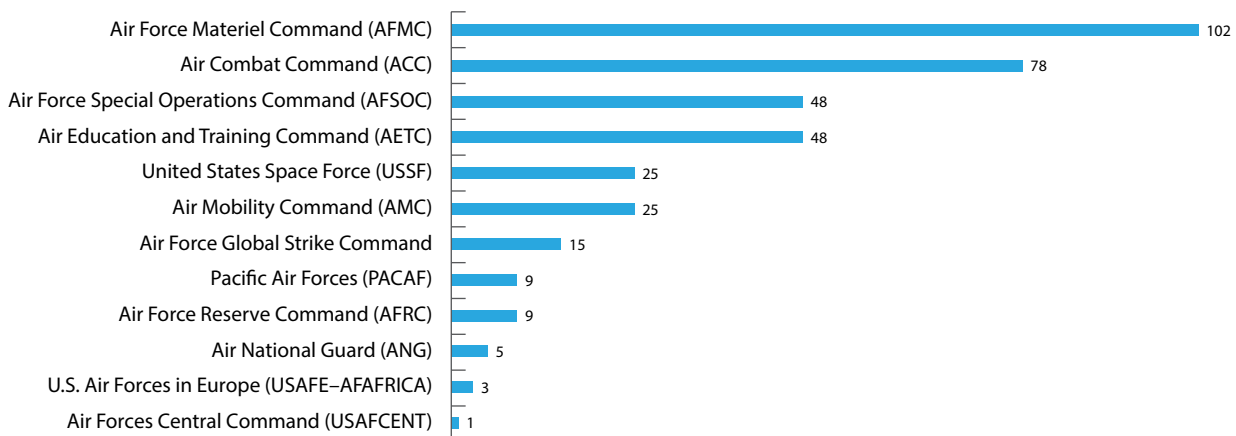
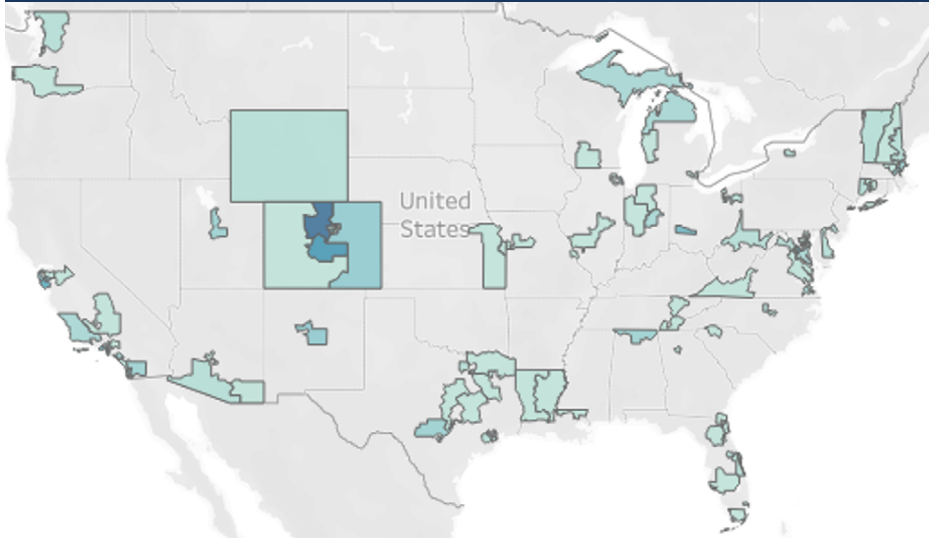


Figure 9. Number of Offices or Units Sponsoring Phase II Contracts by MAJCOM



# AFVentures Support to the Space Mission



State	Amount	Number of Awards
CA	\$31,300,793	80
CO	\$9,629,333	43
MA	\$5,395,819	20
VA	\$5,014,717	19
NH	\$3,999,825	3
TX	\$3,655,277	18
MD	\$3,245,042	8
NY	\$2,568,677	6
FL	\$2,008,257	10
IL	\$1,950,956	8

The FY20 National Defense Authorization Act approved a new, independent Space Force within the Department of the Air Force. The creation of the Space Force signals the importance of the space domain for the Air Force and Department of Defense as a whole. AVENTURES, recognizing the strategic importance of space assets, has prioritized investment in technologies with space application. Over the last two years, AVENTURES has awarded over \$90 million in contracts to 215 companies to develop space related technologies. This represents 12% of the total AVENTURES portfolio.

These awards capture a diverse range of technologies area from traditional space technologies like satellites and resilient microelectronics to machine learning, quantum computing, augmented reality, and human machine teaming.

In partnership with the newly created SpaceWERX, AVENTURES will continue to leverage the growing commercial investment in the space sector and support the development and transition of new space technologies into the DoD.

**292**

Awards  
to

**215**

Companies

**Total Funding:**

**\$90.7M**

**Post-Award Private Investment:**

**\$107.5M**

Private Matched Funding: \$133.9 million

**Post-Award Government Contracts:**

**\$390M**

Government Matched Funding: \$31.7 million

# COVID Response

In March 2020, AFVentures was humbled to serve as the RAPID Response Team in Nation's fight against COVID-19. Our "Open Front Door" approach was uniquely applicable to fight a pandemic—serving as a model to quickly source and scale innovative solutions to our country's emerging COVID-19 problems. Over the next few months, the AFVentures team used this strategy to create the COVID-19 Industry Portal—recruiting over 3,500 COVID-19 fighting concepts from across the US, making it the single largest RFI in DoD History. Similarly, we built off our work on the SBIR/STTR program to create the COVID-19 Commercial Solutions Offering (CSO), supporting the interagency and joint projects to rapidly execute over \$300M in industrial base expansion projects in screening, testing and diagnostics, pharmaceuticals, and PPE. Lastly, the diverse technical evaluation teams we've used for our SBIR/STTR program were also employed as a rapid response team by FEMA evaluate over 300 proposals, resulting in the award over \$600M in life-saving procurement contracts.

This initiative was created as one line of effort in the Department of the Air Force's Acquisition COVID-19 Taskforce, or DAF ACT, as a one-stop shop for defense industry, commercial companies and academia to share creative ideas with federal agencies to combat the virus. The AFVentures team itself generated a few novel programs from this work—including the DAF's Rapid Agile Manufacturing Platform (AFRAMP), DAF Telework Solutions Team (AFTEST), and the Pandemic Case Management Suite (PCMS), programs that overcame shortfalls in PPE, virtual work, and contact tracing. We were fortunate to have transitioned many of these programs into long term sustainment within the DAF.

Our hearts, thoughts, and prayers go out to all who were affected by this terrible Pandemic. The work is not done, and we continue to fight.

## COVID-19 Industry Portal Submissions

# 3,740

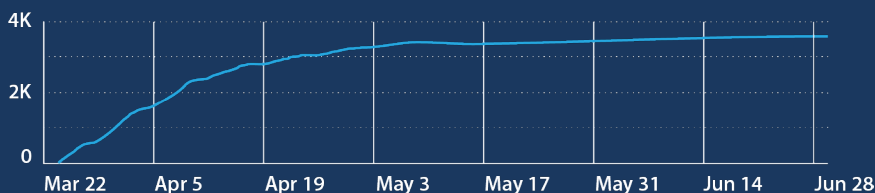
## Top 3 States by Submissions

California: **391** submissions

Virginia: **185** submissions

Texas: **177** submissions

## RFI Submissions Over Time



**\$300M for industrial base expansion**

Over 230 Air and Space Force Volunteers worked to evaluate over 300 proposals resulting in

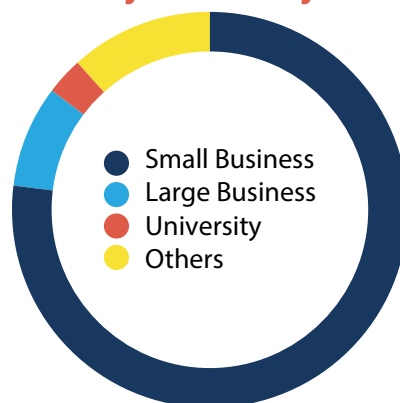


# \$640

million in contracts



## RFI Submissions by Industry



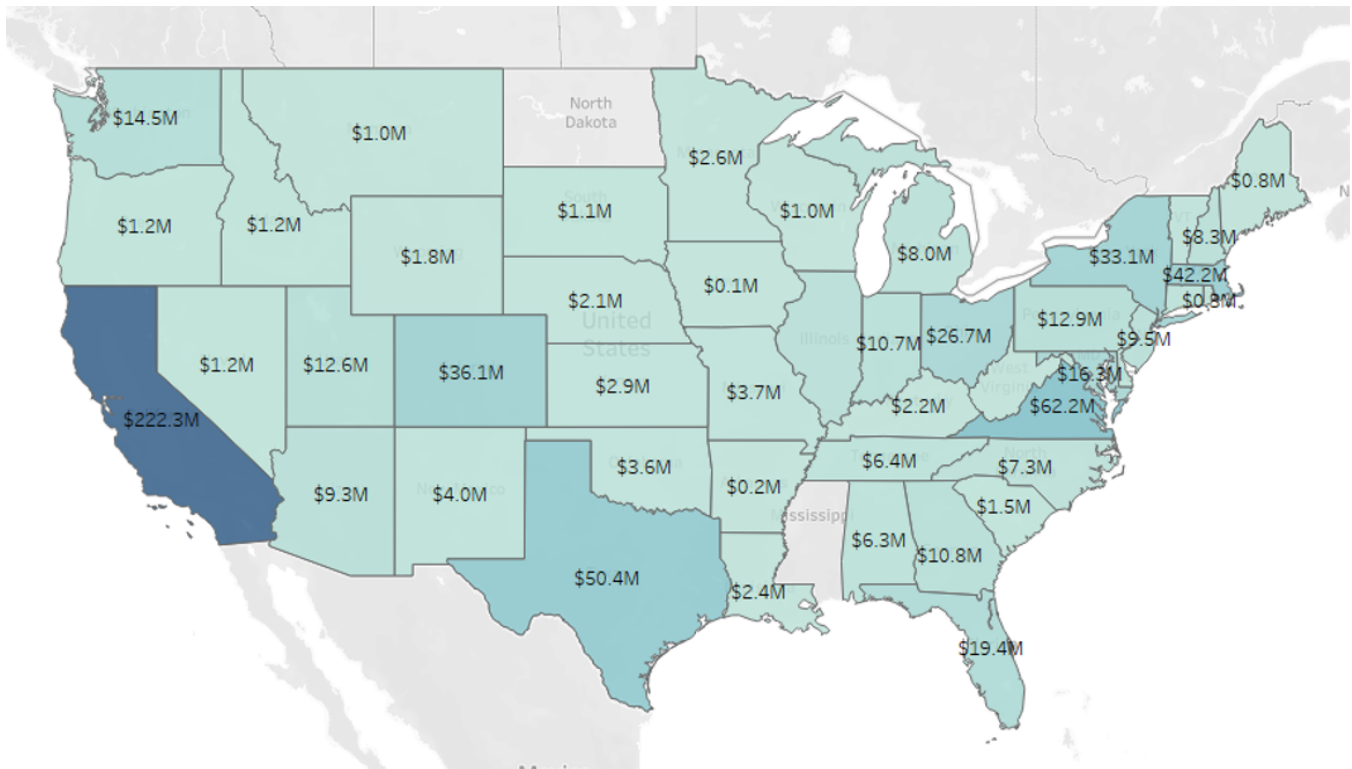
**To deliver 2 Billion+ articles of PPE**

## Conclusion:

This report represents our first attempt to provide our key stakeholders with a comprehensive look at AFVentures' approach, portfolio, and impact. The replicable, scalable, and transparent methods our team developed in writing this report will allow us to monitor and refresh our analysis on an ongoing basis. AFVentures will use this intelligence to refine our current processes and test new approaches to accelerate technology transition. We hope making this analysis available to the public will also build trust with small businesses, start-ups, and the entrepreneurial community.

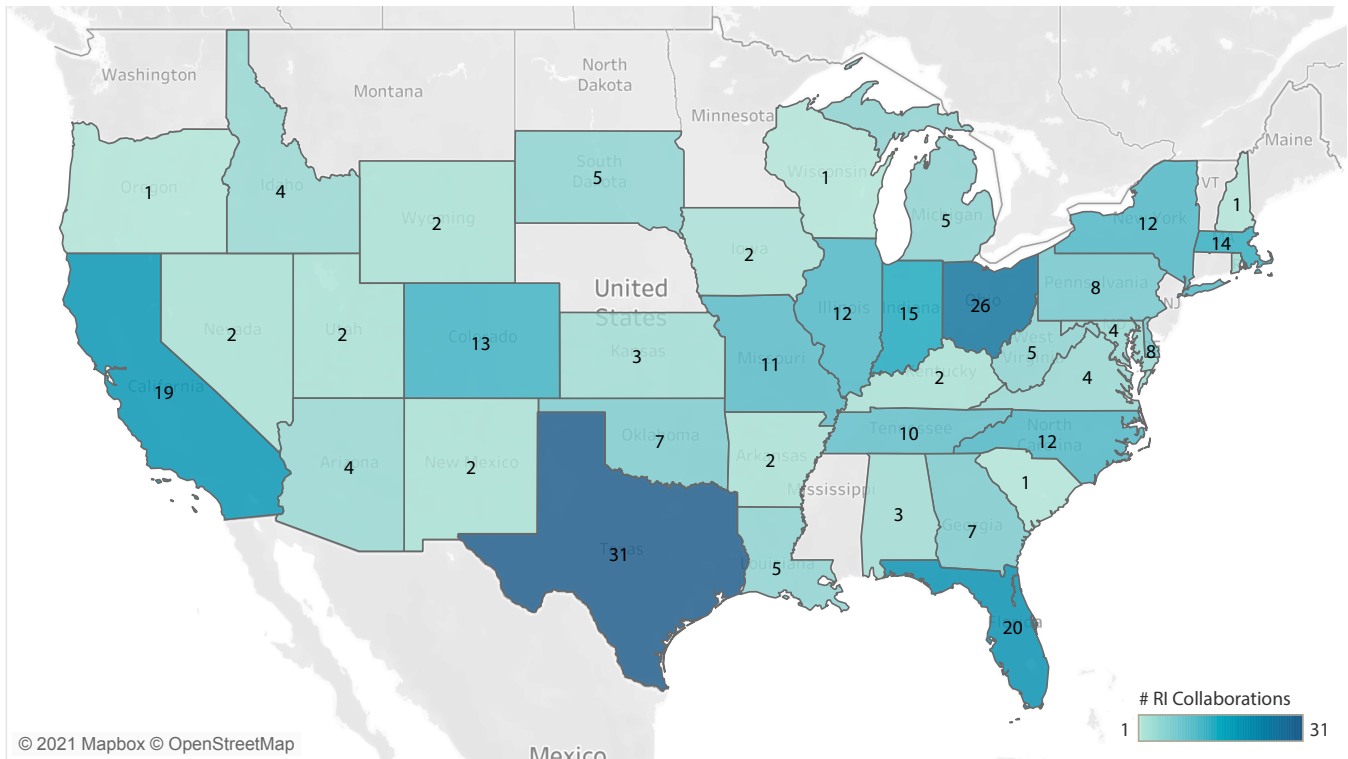
In closing, we would again like to recognize and thank the Airmen, Guardians, and government civilians who supported and championed the program since AFVentures inception. The dedication of these individuals has and will continue to be the critical factor in the growth and success of the program.

## Appendix A: Awards by State



State	# Awards	Total Funding	% Total Funding
CA	582	\$222,312,023	31.27%
VA	196	\$62,205,065	8.75%
TX	185	\$50,362,940	7.08%
MA	129	\$42,184,496	5.93%
CO	123	\$36,127,096	5.08%
NY	99	\$33,128,458	4.66%
OH	116	\$26,668,566	3.75%
MD	78	\$24,777,282	3.48%
FL	84	\$19,439,382	2.73%
DC	45	\$16,277,763	2.29%
WA	50	\$14,497,775	2.04%
PA	60	\$12,866,597	1.81%
UT	39	\$12,562,254	1.77%
GA	36	\$10,769,216	1.51%
IN	32	\$10,738,843	1.51%
IL	37	\$9,975,429	1.40%
NJ	34	\$9,541,829	1.34%
AZ	24	\$9,311,130	1.31%
NH	19	\$8,328,020	1.17%
MI	30	\$7,965,260	1.12%
NC	22	\$7,291,685	1.03%
CT	24	\$6,519,096	0.92%
TN	28	\$6,355,393	0.89%
AL	31	\$6,274,982	0.88%
NM	15	\$3,996,809	0.56%
MO	11	\$3,669,491	0.52%
OK	16	\$3,615,094	0.51%
VT	8	\$3,147,224	0.44%
HI	7	\$3,124,331	0.44%
KS	14	\$2,943,343	0.41%
MN	8	\$2,561,171	0.36%
LA	20	\$2,398,148	0.34%
KY	10	\$2,249,410	0.32%
NE	4	\$2,067,748	0.29%
WY	8	\$1,798,891	0.25%
SC	7	\$1,498,060	0.21%
AK	1	\$1,494,426	0.21%
ID	5	\$1,249,045	0.18%
OR	9	\$1,248,910	0.18%
NV	10	\$1,175,058	0.17%
SD	8	\$1,099,895	0.15%
WI	4	\$999,976	0.14%
MT	4	\$999,489	0.14%
DE	13	\$949,370	0.13%
ME	2	\$798,950	0.11%
WV	4	\$747,348	0.11%
RI	5	\$349,994	0.05%
AR	2	\$174,998	0.02%
IA	1	\$149,702	0.02%

## Appendix B: Number of STTR Research Institute Collaborations by State



### Partnering STTR Research Institutes

State	University	Awards
<b>AK</b>	University of Alaska System of Higher Education	1
<b>AL</b>	Alabama A & M University	1
	Auburn University	7
	Southern Research	1
	Southern Research Institute	1
	The University of Alabama	2
	Tuskegee University	1
	University of Alabama in Huntsville	1
<b>AR</b>	University of Arkansas	1
	University of Arkansas, Fayetteville	1
<b>AZ</b>	Arizona State University	4
	University of Arizona	2
<b>CA</b>	California Institute of Technology	1
	California Polytechnic State University - San Luis Obispo	1
	California State Polytechnic University, Pomona	1
	California State University, Los Angeles	2

State	University	Awards
	San Diego State University Foundation	2
	San Diego State University Research Foundation	1
	Stanford University	7
	University of California, Irvine	3
	University of California, San Diego	4
	University of Southern California	1
	University of Southern California – Information Sciences Institute	1
<b>CO</b>	Colorado School of Mines	3
	University of Colorado, Colorado Springs	5
	University of Colorado at Boulder	4
	University of Colorado Denver	1
	US Air Force Academy	1
<b>DC</b>	Naval Research Laboratory	1
	The Catholic University of America	1
<b>DE</b>	University of Delaware	9
<b>FL</b>	Bloodstone Division, LLC	1



State	University	Awards
	Clarkson University	1
	Embry-Riddle Aeronautical University	4
	Florida International University	5
	Institute for Human & Machine Cognition	1
	University of Central Florida - Office of Research	1
	University of Florida	2
	University of Miami	1
	University of South Florida	2
	University of West Florida	2
<b>GA</b>	Augusta University	1
	Georgia Institute of Technology	8
	Georgia Southern University	1
	Georgia Tech Applied Research Corporation	2
	GTRI Georgia Tech Research Institute	2
	Southeast Innovation Institute	1
<b>IA</b>	Iowa State University	1
	University of Iowa	1
<b>ID</b>	Boise State University	2
	University of Idaho	2
<b>IL</b>	Argonne National Laboratory	4
	Illinois Institute of Technology	6
	Northwestern University	3
	University of Illinois	3
	University of Illinois, Urbana-Champaign	2
<b>IN</b>	Purdue University	10
	University of Notre Dame	8
<b>KS</b>	Kansas State University	2
	University of Kansas Center for Research	2
	Wichita State University	8
<b>KY</b>	Murray State University	1
<b>LA</b>	Louisiana Tech University	6
<b>MA</b>	Draper Laboratories	2
	Massachusetts Institute of Technology	5

State	University	Awards
	Northeastern University Professional Advancement Network	1
	The University of Massachusetts Lowell	1
<b>MD</b>	Johns Hopkins University	1
	Maryland Advanced Development Lab (URF)	1
	Morgan State University	1
	University of Maryland	4
	University of Maryland Baltimore County	1
<b>MI</b>	Michigan State University	2
	Michigan Technological University	2
	University of Michigan	3
	Western Michigan University	1
<b>MN</b>	Mayo Clinic	1
<b>MO</b>	MRI Global	1
	University of Missouri-Kansas City	5
	Washington University	1
	Washington University in St. Louis	1
<b>NC</b>	Duke University	2
	North Carolina Agricultural and Technical State University	1
	North Carolina State University	4
	Wake Forest University	4
	Wireless Research Center of North Carolina	1
<b>ND</b>	University of North Dakota	4
<b>NM</b>	Sandia National Laboratories	1
	University of New Mexico	2
<b>NY</b>	Binghamton University, State University of New York	1
	Columbia University	2
	Cornell University	1
	Embry-Riddle Aeronautical University	1
	Rensselaer Polytechnic Institute	1
	Rochester Institute of Technology	2
	University at Buffalo	4
	University of Rochester	1
<b>OH</b>	Case Western Reserve University	1

State	University	Awards
	Delaware Entrepreneurial Center at Ohio Wesleyan University	2
	EWI	2
	Kent State University	3
	Ohio Aerospace Institute	2
	Ohio University	2
	Sinclair Community College	2
	The Ohio State University	26
	University of Cincinnati	5
	University of Dayton	1
	University of Dayton Research Institute	4
	Wright State University	1
	WRSI	1
<b>OK</b>	Oklahoma State University	7
	The University of Oklahoma	1
<b>OR</b>	Oregon State University	1
<b>PA</b>	Carnegie Mellon University	5
	Concurrent Technologies Corporation	1
	Penn State Applied Research Laboratory	1
	The Pennsylvania State University	8
	University of Delaware	2
	University of Pittsburgh	3
<b>RI</b>	The University of Rhode Island	2
<b>SC</b>	Clemson University	1
	University of South Carolina, Center for Predictive Maintenance	1
<b>SD</b>	South Dakota School of Mines & Technology	6
<b>TN</b>	Qardian Labs	1
	Tennessee Technological University	1
	University of Tenn, Knoxville	1
	University of Tennessee Space Institute (UTSI)	5
<b>TX</b>	AUTONOMY Institute	1
	Brhms LLC	1
	Southern Methodist University	1
	Southwest Research Institute	1
	Texas A&M University	10

State	University	Awards
	University of Dallas	5
	University of Houston	5
	University of North Texas	2
	University of Texas at Arlington	1
	University of Texas at Austin	13
	University of Texas at Dallas	2
	University of Texas at El Paso	1
	University of Texas at San Antonio	1
<b>UT</b>	Brigham Young University	6
	University of Utah	3
	Utah State University	1
	Weber State University	2
<b>VA</b>	Christopher Newport University (CNU)	1
	George Mason University	1
	NASA Langley	1
	Old Dominion University	3
	Virginia Polytechnic Institute and State University	3
<b>WA</b>	University of Washington	4
	Washington State University	1
<b>WI</b>	Marquette University	1
	University of Wisconsin	1
<b>WV</b>	National Energy Technology Laboratory	1
	West Virginia University Innovation Corporation	1
	West Virginia University Research Corporation	4
<b>WY</b>	University of Wyoming	2

## Appendix C: Data Sources and Methodologies

### Private Investment and Private Phase III Impact

To capture private investment following an Open Topic award, our team employed a data mining technique to pull data from Crunchbase, an industry standard database with data on companies and venture investments sourced from over 4,000+ participating venture capital firms and from crowd data submissions.

### Approach

The approach relies on automatically matching companies awarded through the Open Topic with Crunchbase company profiles, then having an analyst hand-check each match for accuracy. Once we have fused Open Topic recipients with Crunchbase company profiles, our team is able to identify and gather comprehensive data on past funding rounds each company has received. To isolate Phase III impact, we segment the data based on funding round announced date, including only funding rounds which occurred after a company received its first open topic award. Using this approach, our analytics team matched 694 Open Topic recipients with Crunchbase company profiles. Although this is only 48% of all portfolio companies, we have a high degree of confidence that this data collection approach captures the vast majority of Open Topic firms actively receiving or soliciting venture funding.

### Potential Errors

This approach contains several potential sources of measurement error our team has worked to mitigate. First, there are instances where companies received VC funding rounds with undisclosed financial values. In these instances, our analytics team attempted to find details on the funding round value by searching for news articles or other open-source data. Even with this second round of data collection, we were unable to identify financial amounts for 288 funding rounds and link them to Open Topic recipients. This means we are likely underestimating total VC investments and post-award VC investments. A second measurement error comes from announced funding rounds that fail to materialize or change in size after their initial announcement. Crunchbase's data structure allows our team to mitigate this issue by providing data on whether a funding round was modified after initial announcement. This process allows our team to cross-reference last modified data for each funding round over time to ensure we provide the most accurate information possible. Still, it is important to note that all data reported in this report captures a specific time when it was collected and is subject to change in the future.

Finally, it is important to note that while this approach is highly effective at tracking post-award venture capital investment, it does not capture private sector revenue derived from or related to Open Topic award. This means that AFW-ERX likely underestimated total private sector Phase III impact for the program.

### Federal Contract Award Data

To capture post-award public funding, our team developed a similar data mining strategy to pull government awards from the USASpending database, matching company records by the unique Data Universal Numbering System (DUNS) number. This data mining pipeline filtered out government contracts occurring before the SBIR/STTR award and, returning an approximation of Phase III impact. Our strategy is time efficient, scalable, and allows for monthly or quarterly data updates without requiring company reporting.

We capture all funding a firm has received from the federal government following an award, not just funding directly related to the SBIR/STTR award. For small businesses new to working with the federal government, this assumption is likely accurate. For small businesses with multiple lines of business or products offered to the federal government, this approach likely over-estimates public Phase III impact.

The data underlying this chart was pulled from USASpending on 10/20/2020. USASpending only provides comprehensive contract data back to 2008, so these results are an estimate of first contract award.

## Appendix D: Visualizations

Title	Page	Date	Assumption/Caveats	Source
# Awards	3	10/30/2020		AFVenture Portfolio
Total Funding	3	10/30/2020		AFVenture Portfolio
# Companies	3	10/30/2020		AFVenture Portfolio
Avg. Days to Contract	3	10/30/2020	Difference between cycle application close date and period of performance start date.	AFVenture Portfolio
Avg. Number Employee		10/30/2020		DUNS & Bradstreet
Avg. Company Age	4	11/6/2020		DUNS & Bradstreet
% VC Funded	4	11/7/2020		Crunchbase
Avg. # Employees		11/6/2020		DUNS & Bradstreet
Portfolio Set-Aside Percentages	4	12/1/2020		SAM.gov
Companies Incorporated by Year	4	11/6/2020		DUNS & Bradstreet
Companies Most recent funding round	4	11/7/2020		Crunchbase
Companies Valued above \$500 million	4	11/7/2020		Crunchbase
Total Private Sector Capital Leveraged	5	11/7/2020	This metric captures total private investment in portfolio companies reported in Crunchbase as well as private matched funding received by AFVentures Portfolio companies not captured in Crunchbase.	Crunchbase
Pre-Award Private Investment	5	11/7/2020	Private investment rounds occurring before a portfolio company's first AFVentures award	Crunchbase
Post-Award Private Investment	5	11/7/2020	Private investment rounds a portfolio company receives following its first AFVentures Award	Crunchbase
Portfolio Companies receiving first SBIR/STTR Award through AFVentures	5	12/1/2020	This metric captures whether portfolio companies received any Air Force SBIR/STTR awards prior to participation in the AFVentures program. To generate it we cross-referenced data on Air Force SBIR/STTR awards available publicly on SBIR.gov and FPDS data based on company DUNS number.	SBIR.gov, FPDS
Private Matched Funding	5	12/1/2020	Third-Party Matching funding, also referred to as "Private Matching", is defined as investment, financing, or pre-sales from eligible third parties.	AFVentures Portfolio
Government Matched Funding	5	12/1/2020	Funding contributed by another government agency to support an AFVentures SBIR/STTR award.	AFVentures Portfolio
Post-Award Government Contracts	5	10/27/2020	Count of the field "award_piid" for contracts occurring after a company's first AFVentures award	USASpending.gov
Value Post-Award Government Contracts	5	10/27/2020	Sum of the field "total_dollars_obligated" for contracts occurring after a company's first AFVentures award	USASpending.gov

Title	Page	Date	Assumption/Caveats	Source
Avg. Months to Commercialization	5	10/27/2020	This estimate for time to commercialization takes the difference between period of performance start date between a company's first AFVentures award and subsequent federal awards from USASpending.gov.	AFVentures Portfolio, USASpending.gov
Figure 1: AFVentures Portfolio First Air Force Award	6	11/1/2020	This chart captures the year each portfolio company received its first Air Force prime contract.	AFVentures Portfolio, USASpending.gov
Figure 2: Number of Companies by Award Count	6	10/27/2020	This chart captures a distribution of contract ranges received by portfolio companies.	USASpending.gov
Median Company Age	7	11/6/2020		DUNS & Bradstreet
Figure 3: Venture Capital Investments in AFVentures Companies	7	11/7/2020	This figure captures the most recent private investment funding round received by portfolio companies. The "other" category includes non-equity investments or funding rounds of an undisclosed stage.	Crunchbase
Figure 4: AFVentures Area of Investment Compared to Venture Capital's Area of Investment	8	11/7/2020	An AFVentures analyst generated this field by reviewing award title, abstract, and keywords and deciding the most relevant technology being developed. Once all 2,299 contracts were reviewed, our team matched technology areas to corresponding technology sectors from Crunchbase.  To compare the proportion of funding across tech sector to private capital trends, we generated dummy variables for each technology category in Crunchbase. Once generated we aggregated total company funding received across each technology area. It is important to note that this approach double-counts funding. For example, if a company was categorized as (Software, Biotechnology, Machine Learning) its total VC funding received would be counted three times. Because of this we do not report absolute dollars across Crunchbase technology areas, only the % of total funding.	Crunchbase, AFVentures Portfolio
Figure 5: Aggregate Post-Award Private Investment	9	11/7/2020	Because this estimate only includes investment and not revenue, reporting on private sector commercialization should be viewed as a lower, not upper bound. More robust statistical analysis will need to be performed to establish a direct causal relationship between follow-on investment and AFVentures participation, so our metric for Phase III commercialization remains an approximation.	Crunchbase
Figure 6: Revenue Range for AFVentures Portfolio Companies	9	10/30/2020		DUNS & Bradstreet
Figure 7: Phase III Funding Divided by Past Air Force SBIR/STTR Participation	10	10/27/2020	Again, we do not draw a causal relationship between an AFVentures contract and follow-on government awards in this report, only provide the total dollar value extracted from publicly available data sources.	USASpending.gov

Title	Page	Date	Assumption/Caveats	Source
Figure 8: Number of Phase II Companies Supported by MAJCOM	11	12/1/2020	Extracted based on Air Force/DOD Phase II sponsor data.	AFVentures Portfolio Data
Figure 9: Number of Offices or Units Sponsoring Phase II Contracts by MAJCOM	11	12/1/2020	Extracted based on Air Force/DOD Phase II sponsor data.	AFVentures Portfolio Data
Awards by Congressional District	12	12/1/2020	AFVentures award data filtered for Space related technologies.	AFVentures Portfolio Data
Most awarded states	12	12/1/2020	AFVentures award data filtered for Space related technologies.	AFVentures Portfolio Data
Total Funding	12	12/1/2020	AFVentures award data filtered for Space related technologies.	AFVentures Portfolio Data
Post-Award Private Investment	12	12/1/2020	AFVentures award data filtered for Space related technologies.	AFVentures Portfolio Data
Post-Award Government Funding	12	12/1/2020	AFVentures award data filtered for Space related technologies.	AFVentures Portfolio Data
Total RFI Submissions	13	12/15/2020		COVID Joint Acquisitions Task Force RFI
RFI Submissions over time	13	12/15/2020		COVID Joint Acquisitions Task Force RFI
RFI Submissions by Industry	13	12/15/2020		COVID Joint Acquisitions Task Force RFI
PPE Delivery Contracts	13	12/15/2020		COVID-19 Contract Survey Response Data
Industrial Base Expansion Contracts	13	12/15/2020		COVID-19 Contract Survey Response Data
Appendix A: Awards by State	15	12/1/2020		AFVentures Portfolio
Appendix B: Awards by Congressional District	16-25	12/1/2020		AFVentures Portfolio