

**Douglas Campbell, CEO
Roccor, LLC & Solid Power, Inc.
December 3, 2018**

***Opportunities and Challenges in
Using Federal Funding for New
Product Development &
Commercialization***

About Me

- An Albuquerque, NM native
 - Degrees in Civil Engineering from the University of New Mexico
 - Advanced tech career began as Research Assistant at Air Force Research Laboratory, Kirtland AFB, NM
 - Relocated to Colorado in 2002 to start my career in private industry
- My entrepreneurial journey...
 - A gradual transition from research engineer to lead engineer/PM to business development
 - Became quite expert in SBIR; secured >\$30M over the past 15 years...
 - ...however, became increasingly frustrated with a lack of commercial success

UNM SCHOOL OF ENGINEERING

DEPARTMENTS RESEARCH ACADEMICS

UNM > Home > Alumni and Supporters > News and Events > 2016 > Civil Engineering alumnus finds success in entrepreneurship

Civil Engineering alumnus finds success in entrepreneurship

June 21, 2016



Doug Campbell is an engineer by training, but he considers himself an entrepreneur first. The president and CEO of Solid Power Inc. and Roccor, LLC, both based in Colorado, said the technical background he received at UNM's Department of Civil Engineering (he earned both a bachelor's and master's from the department) has been invaluable in his career, but his personality pushed him more toward the business world.

"I worked as an aerospace engineer for a brief time, but I quickly realized I was a 'close enough' engineer," he said. "Engineers like to answer 'How?', but I like to answer the question, 'Why?'"

Campbell co-founded Solid Power, which is developing ultra high-energy, low-cost rechargeable batteries and was recently named the fastest growing private company in the Boulder Valley. He also co-founded Roccor, which specializes in innovative, high-performance, deployable structures and thermal management solutions for satellite and terrestrial military and commercial markets. Each company has about 20 employees.

Campbell, an Albuquerque native, chose UNM because it was nearby, but he stayed around for graduate school because of the connections he made both in the School of Engineering and in the nearby technical community. He worked on structural mechanics and aerospace-related projects with Arup Maji in Civil Engineering, who connected him with the Air Force Research Laboratory (AFRL), where he worked while a graduate student.

"The thing that I really liked about UNM was the fairly close-knit community in Civil Engineering, which is possible because the class sizes are fairly small," he said. "Also, the proximity to AFRL and Sandia provided a great opportunity to gain experience and get off campus."

ALBUQUERQUE BUSINESS FIRST

INDUSTRIES & TOPICS

Exclusive: ABQ native recounts how his roots helped his companies succeed, but why they're not based here

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Doug Campbell, an Albuquerque native, said the city has played an important role in the founding of his two Colorado-based companies. COURTESY OF DOUG CAMPBELL

IN THIS ARTICLE

Air Force Research Lab Company

Energy Industry

Kirtland Air Force Base Company

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By May Ortega - Reporter, Albuquerque Business First
Aug 29, 2017, 6:19am

Albuquerque native and Colorado-based entrepreneur Doug Campbell credits the Duke City with leading him to where he is today: running two fast-growing startups.

SBIR From an Entrepreneur's Perspective

- Any startup is challenged with funding:

Friends &
Family:
Tricky

Debt:
Only for Very
Low Risk
Businesses

Angels:

- Very expensive
- Can go early-stage but may have limited funds

VCs:

- Very expensive
- Loss of control
- Trending away from early-stage

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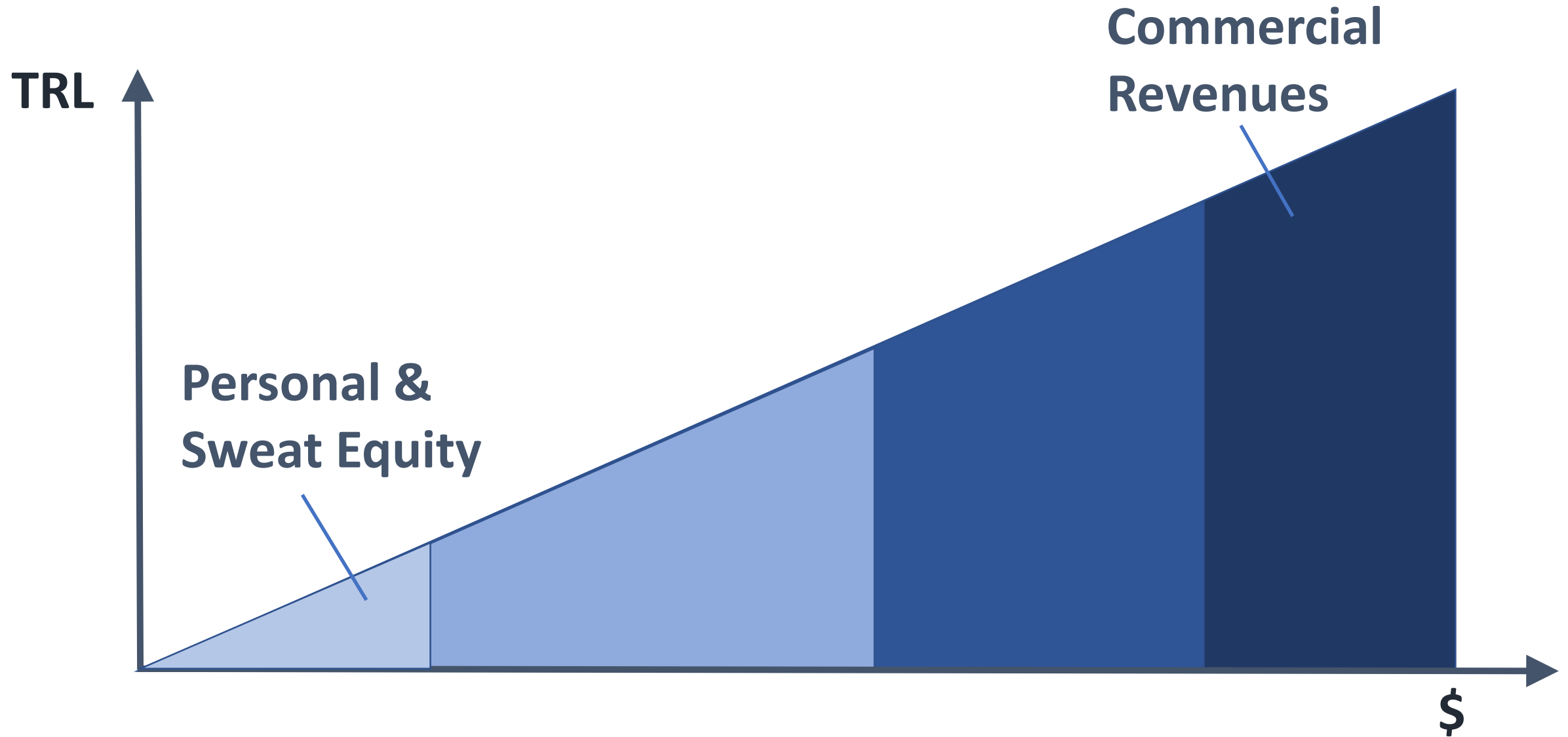
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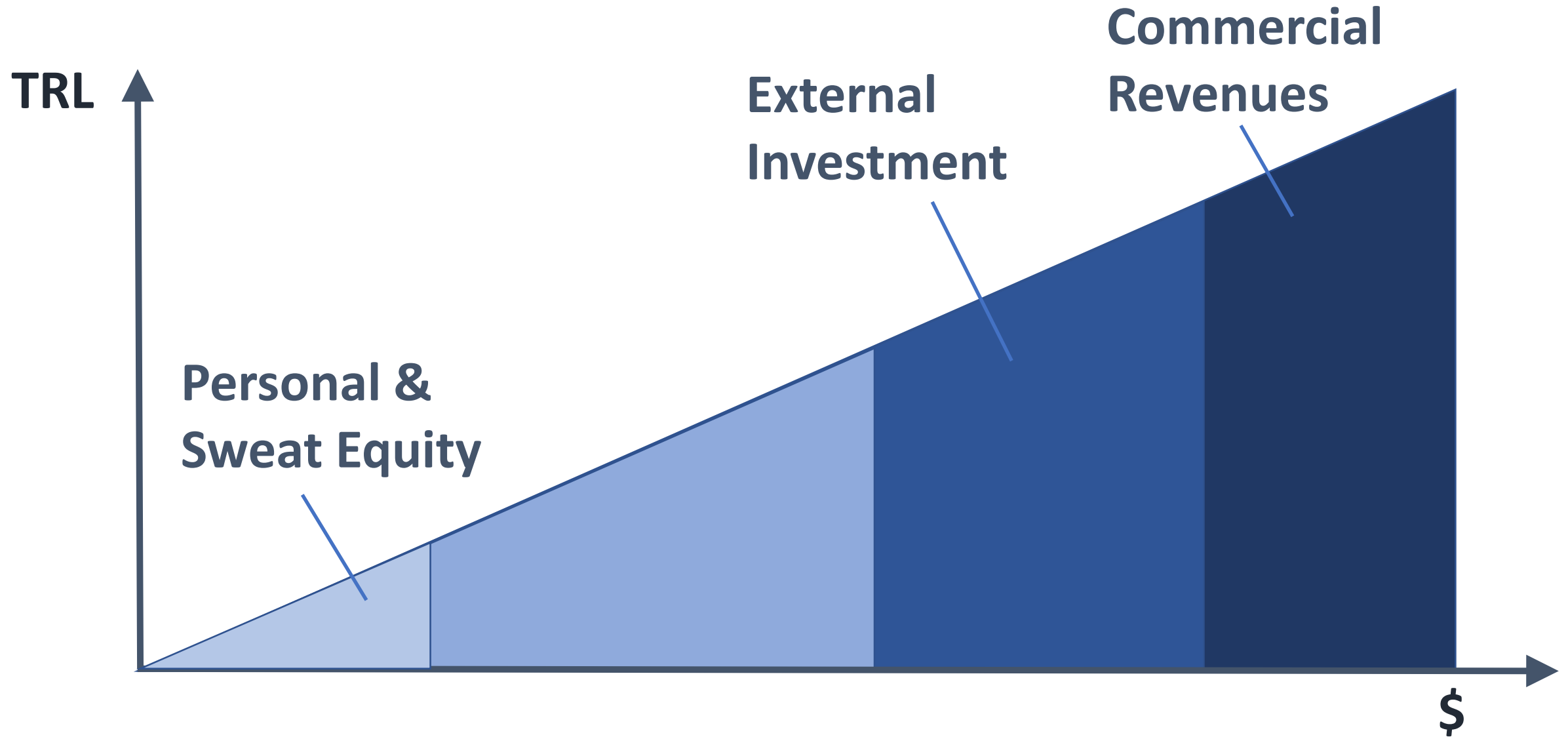
- SBIR is a very powerful program!!!
 - May be the only source for startup capital
 - Very patient capital
 - Critical to maintaining the the US' International competitiveness

“Our Program is similar to SBIR in the US except it's missing a few zeros”
- Innovate UK

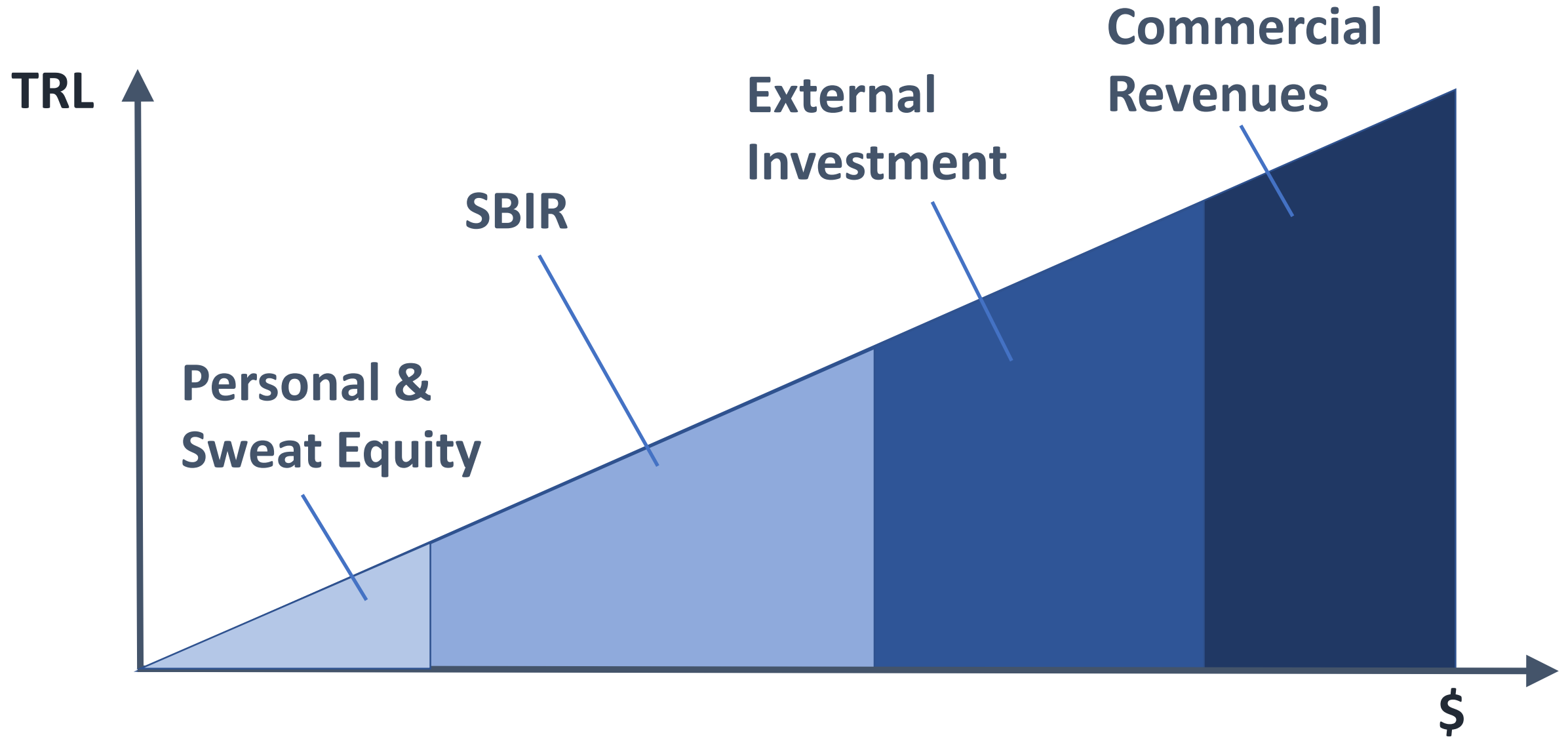
SBIR's Role in Product Commercialization



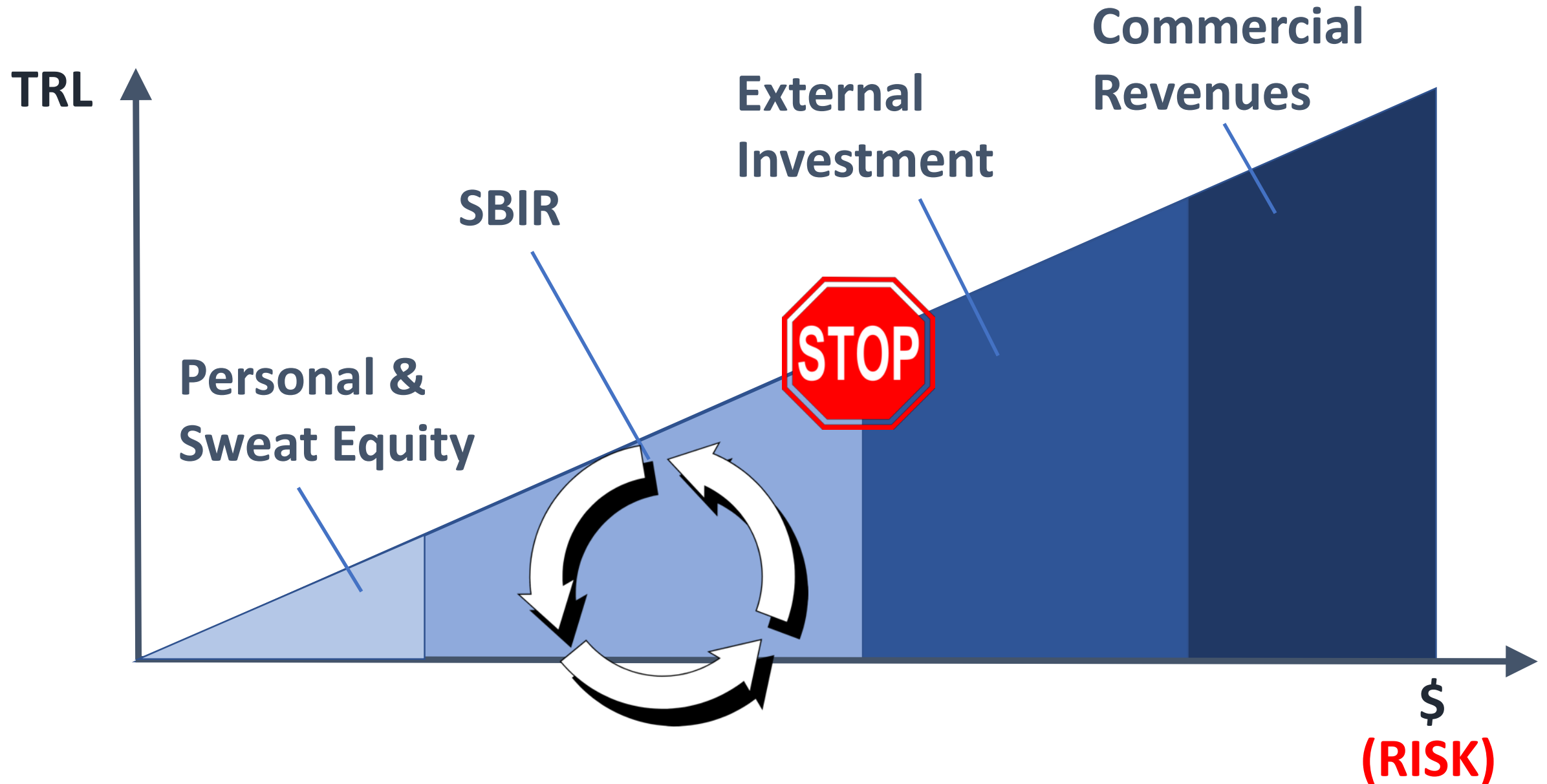
SBIR's Role in Product Commercialization



SBIR's Role in Product Commercialization

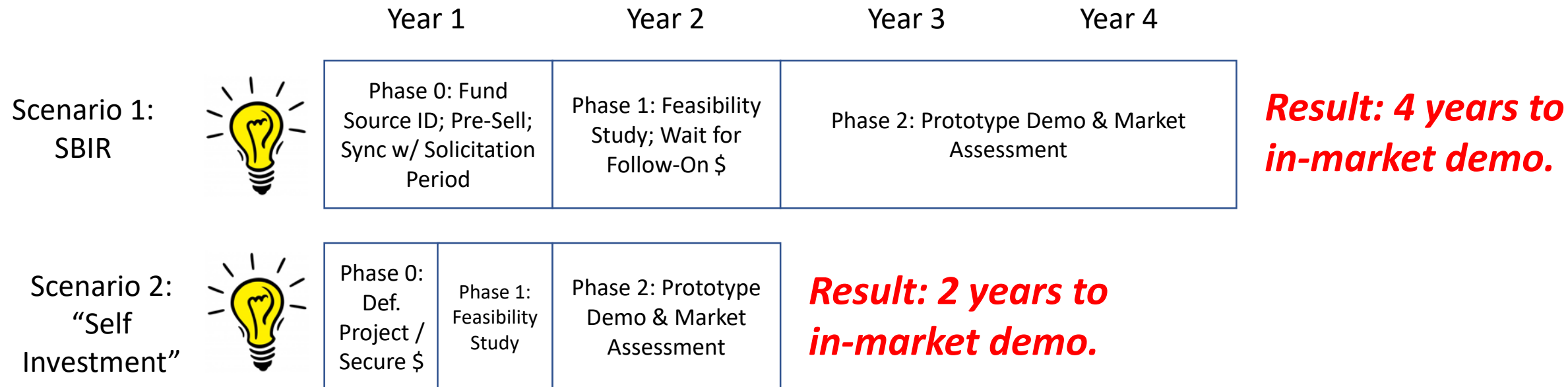


The Danger of SBIR: Overreliance



The Danger of SBIR: Time to Market

- Yes, non-dilution and high risk tolerance of SBIR is great...
- ...However, it comes with a key risk, which is time:
 - SBIR follows a prescribed process and this may be considerably slower than market forces
- Thus, it's imperative that the entrepreneur wisely chooses which product development course to pursue via SBIR



SBIR Pros & Cons

Pros:

- May be the only source of early-stage capital for critically-needed technologies
- Non-dilutive; Federal gov't is not on your Board
- Very generous IP rights
- Contract vehicle for acquisition (e.g., Phase IIIs for DoD)

Cons:

- Brings an overhead tax
- Moves slow; great for unproven technologies; not so great for market windows
- Can encourage “bad behavior” if over relied upon (i.e., become a lifestyle businesses)
- Investment circles may “discount” SBIR \$

My Approach With SBIR

- Left my last “real job” in 2011
- Joined a collection of consultants doing a variety of engineering, program management and business development support
- Established a “for-profit technology incubator” in 2012
 - Mine Universities and Nat’l labs for emerging tech
 - Utilize SBIR as seed-stage funding
- What emerged:
 - Roccoor, LLC: Small satellite components
 - Solid Power Inc: All solid-state batteries for future electric vehicles



My Passion: Disrupting Markets

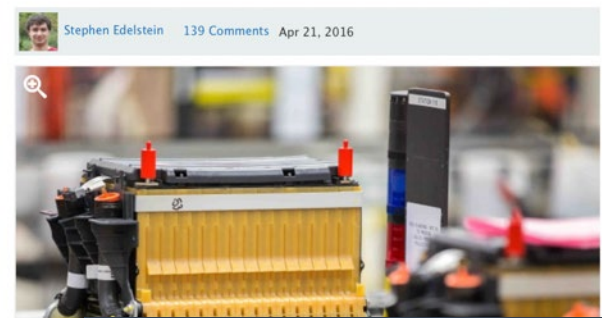
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Home / News / Electric Cars / Have battery makers become more important for electric cars than carmakers?

Have battery makers become more important for electric cars than carmakers?

Stephen Edelstein 139 Comments Apr 21, 2016



Forbes Billionaires Innovation Leadership

28,941 views | May 28, 2018, 10:10am

Electric Car Sales Set To Accelerate As Costs Fall And Production Scales Up

Battery pack in Michigan, p
When it co
barring th



The Chinese-made \$1.5million NIO EP9 at the Shanghai auto show. AP Photo/Ng Han Guan

The electrification of the transport system is set to accelerate in the late 2020s, with electric buses leading the way, a new report claims. Electric vehicle sales will surge thanks to tumbling battery costs and increasing scale in manufacturing.

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Electric cars may stall without a battery revolution

Car companies are committing to an electric future, but the success of the sector depends on better batteries



Electric vehicles plugged into a charging station in a workplace car park. Photograph: Alamy

All around the world, countries are sounding the death knell for the internal combustion engine. Earlier this month, France announced that it wanted to end the sale of petrol and diesel cars by 2040, joining India (2030) and Norway (2025) in envisioning an all-electric future.

Car-makers are racing to meet demand, with Volvo promising that from 2019, all of its new models will feature an electric motor.

Modern electric motors are compact, extremely efficient and emissions-free at

HOME / TECH TOPICS / COMMUNICATIONS

How Small Satellites Are Providing Low-Cost Access to Space

Commercial interests and educational institutions among those launching tiny payloads

By KATHY PRETZ 12 November 2018

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Photo: JPL-Caltech/NASA
An engineer at the Jet Propulsion Lab uses sunlight to test one of the Mars Cube One spacecraft.

SPACENEWS

NEWS OPINION VIDEO LAUNCH BUSINESS MISSIONS POLICY & POLITICS

LEO and MEO broadband constellations mega source of consternation

by Caleb Henry — March 13, 2018

Divining what the stars hold in store for broadband megaconstellations

LEO & MEO Broadband Constellations

As of 2018, 10 constellations have been announced for launch in the next few years. Most of these constellations are in the LEO or MEO orbits. LEO orbits are between 160 and 2,000 km, while MEO orbits are between 2,000 and 35,786 km. The table below lists the constellations and their launch dates.

Constellation	Launch Date
OneWeb	2019
Starlink	2019
Telesat	2019
SES	2019
Orbcomm	2019
Planet	2019
Spacecom	2019
Swarm	2019
Amazonia-1	2019
Boeing X-band	2019
Comcast	2019

SPACENEWS

NEWS OPINION VIDEO LAUNCH BUSINESS MISSIONS POLICY & POLITICS

Op-ed | Launching the Small-satellite Revolution

by George Whitesides — May 11, 2015



Virgin Galactic's LauncherOne spacecraft shown in low Earth orbit after payload separation. Credit Virgin Galactic

Smaller and cheaper satellites are important for national security, for the space industry and for our planet. They also happen to be great investments.

Innovators in industry, academia and government have already proved that small satellites can be built quickly and affordably while still being capable of doing significant things. Such satellites are now in space sending back high-definition video, providing important climate data, helping to track the world's maritime shipping assets, expanding our knowledge of the universe and helping test advanced technologies that will someday be used in the biggest satellites.

The data generated from these smaller, cheaper satellites will greatly benefit life on Earth, and could form the basis for a new layer of information infrastructure essential to our way of life. That new infrastructure will have to be constantly replenished, thus creating a persistent need for lower-priced small satellites and their accompanying launch vehicles.

Solid Power

- Located in Colorado, USA
- Established in 2012 as spin-out business from CU-Boulder
- Exclusive license agreements with CU-Boulder & ORNL around cathode and electrolyte materials
- Initial operations supported via ~\$13M non-dilutive capital
- Completed \$26M Series A investment in 2018
- Extensive cooperation with auto OEMs



Technology:

1. High Energy: Combine highly loaded SOTA cathodes with metallic Li anode
2. Safety: Benign failures under abuse conditions

Manufacturing & Cost:

1. Compatible with industry-standard roll-to-roll manufacturing
2. Cost competitiveness w/ Li-ion via supply chain developments

Solid Power's Value Proposition

ASSBs are a leading candidate to surpass Li-ion in energy, safety and cost:

Energy:

Greater vehicle
range / device life

Safety:

Improved Product
Reliability

Cost:

1. Eliminate battery cooling systems
2. Simplified cell- and pack-level designs
3. Abuse & manufacturing quality tolerance

Benefits of ASSB Over Li-ion:

- Higher energy (1.5-2X)
- Higher safety, hence lower cost
- Pack-level simplicity, hence lower cost
- High temperature stability – eliminates the need for pack cooling, hence lower cost
- Little to no self-discharge – opens new markets

“Solid-state batteries can be a game-changer...[in mobile power markets]...where better safety, longer cycle life potential higher energy density are required”

- IDTechEx Market Report

If solid-state batteries actually present a viable alternative at some point, it could completely change the game, since a whole new level of energy density would be possible”

- Daimler

Solid Power's Recent Success

Solid Power, BMW partner to develop next-generation EV batteries

Reuters Staff

2 MIN READ

(Reuters) - U.S. EV battery company Solid Power said on Monday it had partnered with Germany's BMW AG (BMWG.DE) to develop the next-generation solid-state battery technology for use in electric vehicles (EVs).



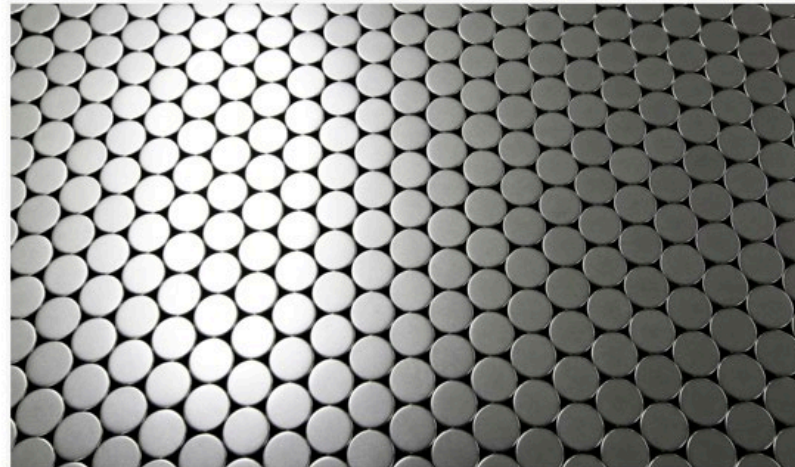
FILE PHOTO: The logo of BMW before the company's annual news conference in Munich, southern Germany, March 23, 2017. REUTERS/Michael Poldos/EPA Photo

QUARTZ

CHARGE AHEAD

Solid Power raises \$20 million in the race to build all-solid-state batteries

By Akshat Rathi · September 10, 2018



The race to build the next revolutionary battery is heating up. Just in the first half of 2018, investors have pumped into battery startups double the amount they invested in all of 2017.

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ENERGY STORAGE

Industry Giants Samsung and Hyundai Invest in Solid-State Batteries

Solid Power wins \$20 million from automotive and electronics players.

ERIC WESOFF | SEPTEMBER 11, 2018



Industry Giants Samsung and Hyundai Invest in Solid-State Batteries

Photo Credit: Shutterstock.com

Automotive and electronics giants are flooding the battery ecosystem with strategic investments.

Solid-state battery startup Solid Power, based in Louisville, Colorado, just won \$20 million in a Series A investment round from Hyundai, Samsung Venture Investment, Sanoh Industrial,

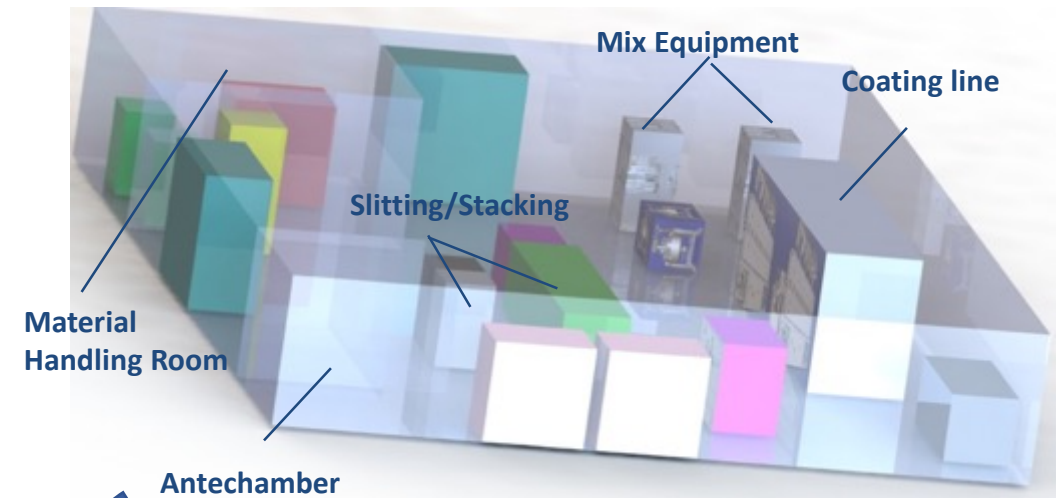
Next Steps: Production Scale-Up

- MWh-scale production line installed by Q4 2018
- EV full-scale prototype cell production by Q3 2019
- Series A cell production by Q2 2020
- True SOP by 2022

Slot die coater install, Nov. 2018

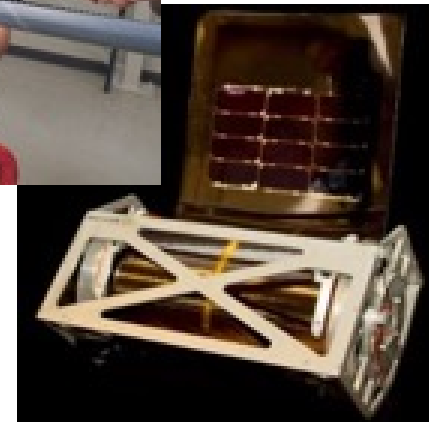
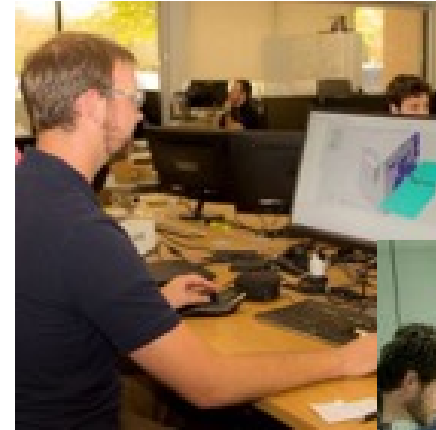


MWh-Scale Production Line



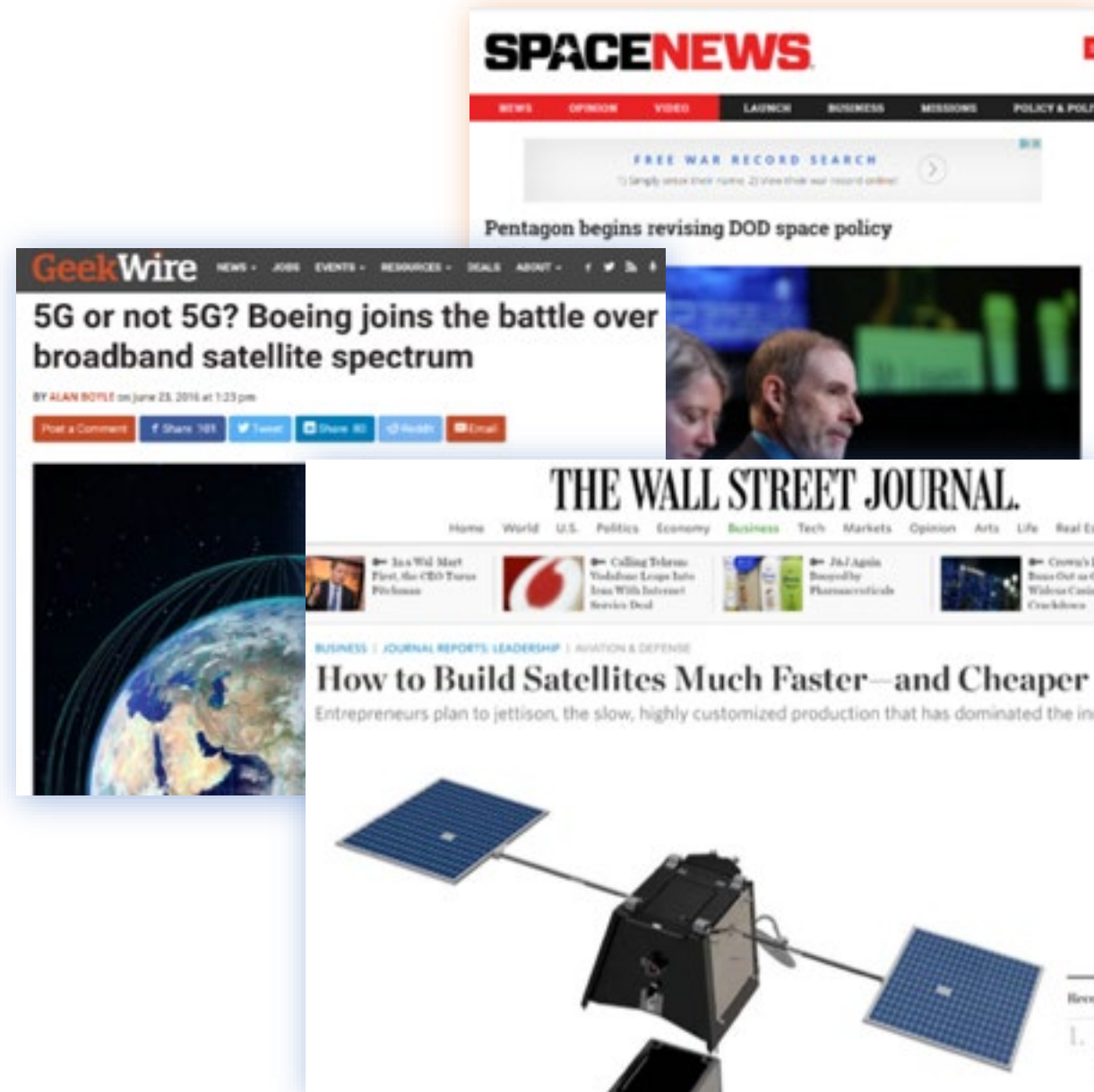
Roccor

- 100% Employee owned, Colorado limited liability company
 - Active in space & terrestrial military markets
 - 40+employees, ISO compliant production facility
- Competencies include deployable space structures & thermal management for satellite & military systems
 - Commercial (US & European) and US Government customers
 - In late 2018/early 2019, more than 25 Roccor supplied antenna, solar array and deorbit products will be launched



Disrupting an Industry: “Space 2.0”

- The “Old” Space industry is not driven by free market forces:
 - Focused on government customers
 - Vertically integrated supply chain
 - Price/cost is only a secondary concern
- New Space is the result of disruption by free market forces:
 - Focused on commercial customers
 - Diverse supply chain
 - Price/cost is equal to performance
- As a consequence...
 - Satellite costs are plummeting; recurring unit costs has become essential
 - New businesses are emerging to capitalize

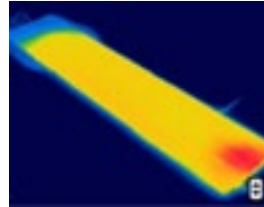


Roccor Product Portfolio Evolution

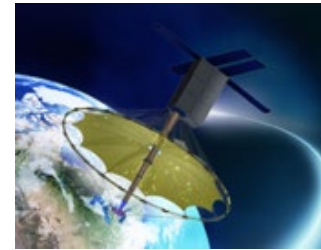
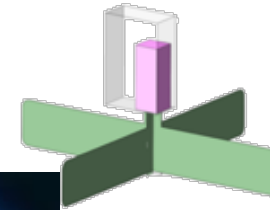
2013:
Deployable
Boom
Systems



2014:
Thermal
Management
Solutions



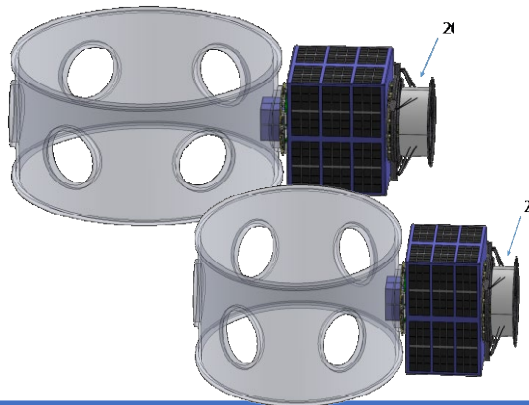
2015: Cubesat
– Class
Deployable
Antennas



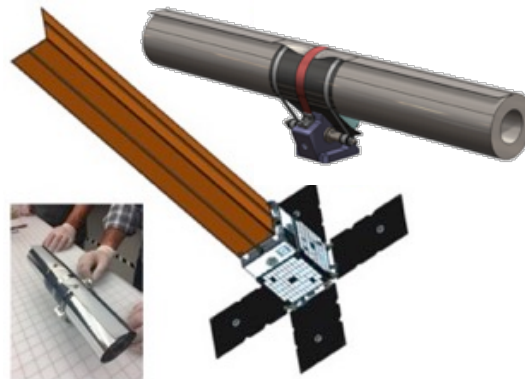
2016: Solar Array
Deployment Systems
(SADS) for ESPA-class
Satellites



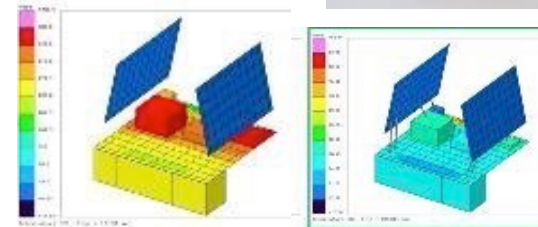
2017: Deployable Sails
for ESPA-Class Satellites



2017: Deorbit Systems
for ESPA-Class Satellites



2017:
Deployable
Radiators



2018:
Deployable
Solar Arrays
for ESPA-
Class
Satellites



Roccor's Success

Via Satellite

Roccor Exec on Supporting 900-Satellite LEO Constellation

By Kendall Russell | May 24, 2017



Rendition of CubeSats in orbit. Photo: NASA.

Aerospace supplier **Roccor** has secured a contract with an undisclosed satellite operator to provide components for its fleet of more than 900 Low Earth Orbit (LEO) satellites. According to Chris Pearson, Roccor's vice president of space programs, the company will contribute High Strain Component (HSC) technologies to support Roccor's new Solar Array Development Systems (SADS).

Roccor developed its HSC technology under the U.S. government's Small Business Innovation Research (SBIR) program before finalizing an agreement to license its patents with the Air Force Research Laboratory (AFRL) last month. As such, the six-year-old company reflects the commercial potential of developing new technology alongside the government.



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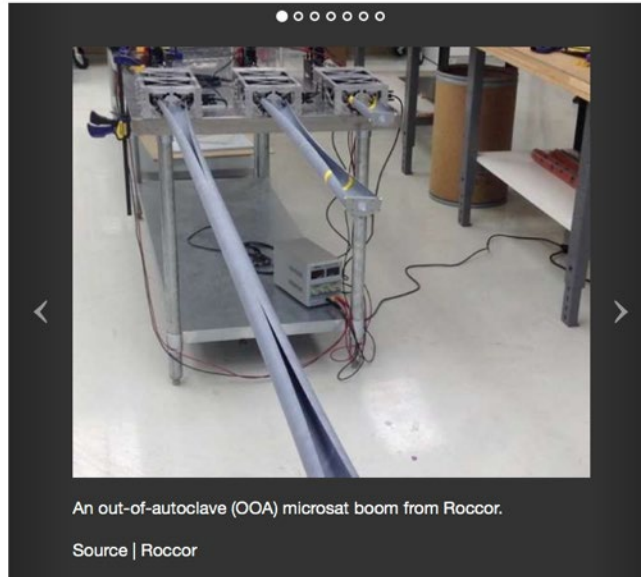
High strain composites for satellite applications



Carbon fiber takes deployable satellite mechanisms to new heights.



Blog Post: 9/27/2018
SCOTT FRANCIS
Senior Editor, *CompositesWorld*



An out-of-autoclave (OOA) microsat boom from Roccor.

Source | Roccor

On my third day on the job as digital editor for *CompositesWorld*, editor Jeff Sloan introduced me to Frank Roundy of Ability Composites in Loveland, CO, US. Frank was kind enough to give me a tour of his facility and share his insights into an industry that was completely new to me. At one point he handed me a rolled-up piece of material that looked kind of like the inside of a tape measure — or maybe a grey fruit roll-up.

SPACENEWS

NEWS OPINION VIDEO LAUNCH BUSINESS MISSIONS POLICY & POLITICS

Electric propulsion to send smallsats from LEO to GEO orbit, moon

By Debra Werner — August 8, 2018



Roccor CEO Doug Campbell at the Small Satellite Conference at Utah State University in Logan, Utah Aug. 7, 2018. Roccor specializes in power and communications for satellites. Credit: Keith Johnson for SpaceNews.

LOGAN, Utah — In an effort to cut launch costs, companies are looking to technology to transport small satellites from low Earth orbit to geostationary orbit and to the moon.

Roccor, a small company based in Longmont, Colorado, that specializes in deployable space structures, kicked off a program recently to produce a solar array for one such mission. After a rocket drops the spacecraft off in low Earth orbit, Roccor solar arrays will generate "several kilowatts of power" to move it to geostationary orbit, said Doug Campbell, Roccor chief executive. Campbell declined to name the customer due to a nondisclosure agreement.

"It is expensive to launch satellites to geostationary orbit," Campbell told SpaceNews during an interview at the Small Satellite Conference here. "We see this as a huge unmet need."

By participating in this project, Roccor has developed a new product it intends to market: a full solar wing that can be stowed compactly for launch and deployed in orbit, Campbell said.

Roccor & Solid Power: "The SBIR Scorecard"

ROCCOR, LLC

Company Information

Address

2602 CLOVER BASIN DRI STE D
LONGMONT, CO, 80503-7555

<http://www.roccor.com>

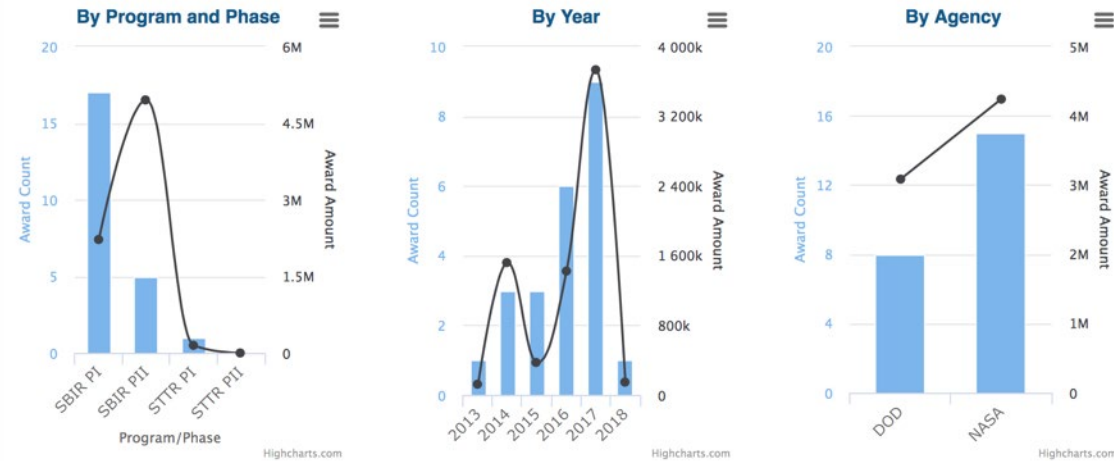
Information

DUNS: 968249636
of Employees: 48

Ownership Information

HUBZone Owned: N
Socially and Economically Disadvantaged: N
Woman Owned: N

Award Charts



Roccor:

- SBIR investment: ~\$7M since 2013
- Industry investment: ~15M since 2013
- Product sales: ~\$15M since 2013 & growing
- Contributing to US' position as leader in satellite technology

Solid Power:

- SBIR investment: ~\$5M since 2013
- Industry investment: ~30M since 2013
- Contributing to US industry's efforts in being at the forefront of vehicle electrification

Sold Power, Inc.

Company Information

Address

CO
Louisville, CO, 80027-3000

<http://www.solidpowerbattery.com>

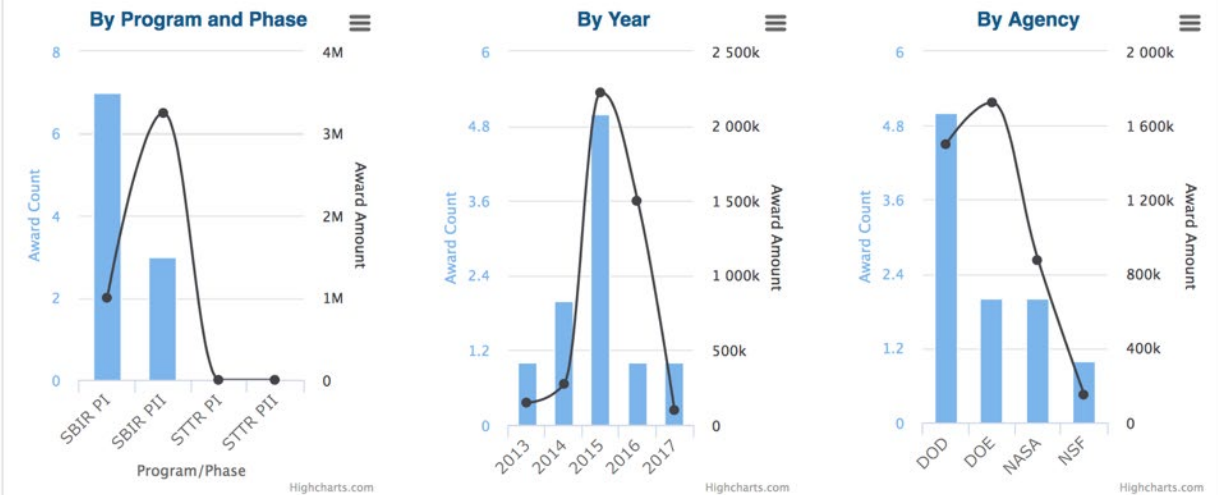
Information

DUNS: 078313639
of Employees: 4

Ownership Information

HUBZone Owned: N
Socially and Economically Disadvantaged: N
Woman Owned: N

Award Charts



Today's Take Home Messages

The SBIR Program is an Exceptionally Powerful Program that Contributes to Keeping the US at the Forefront of Technology Innovation

For entrepreneurs:

- SBIR is powerful but be cautious:
 - It is not “free money”
 - It is not suited to all product development efforts; choose wisely
- You have a responsibility to US taxpayers for long-term ROI

For USG:

- Refine the program for improved speed & agility. Consider more non-traditional mechanisms – e.g., direct to Phase II, CRPs, etc.
- Improve accountability metrics to weed-out low performing companies