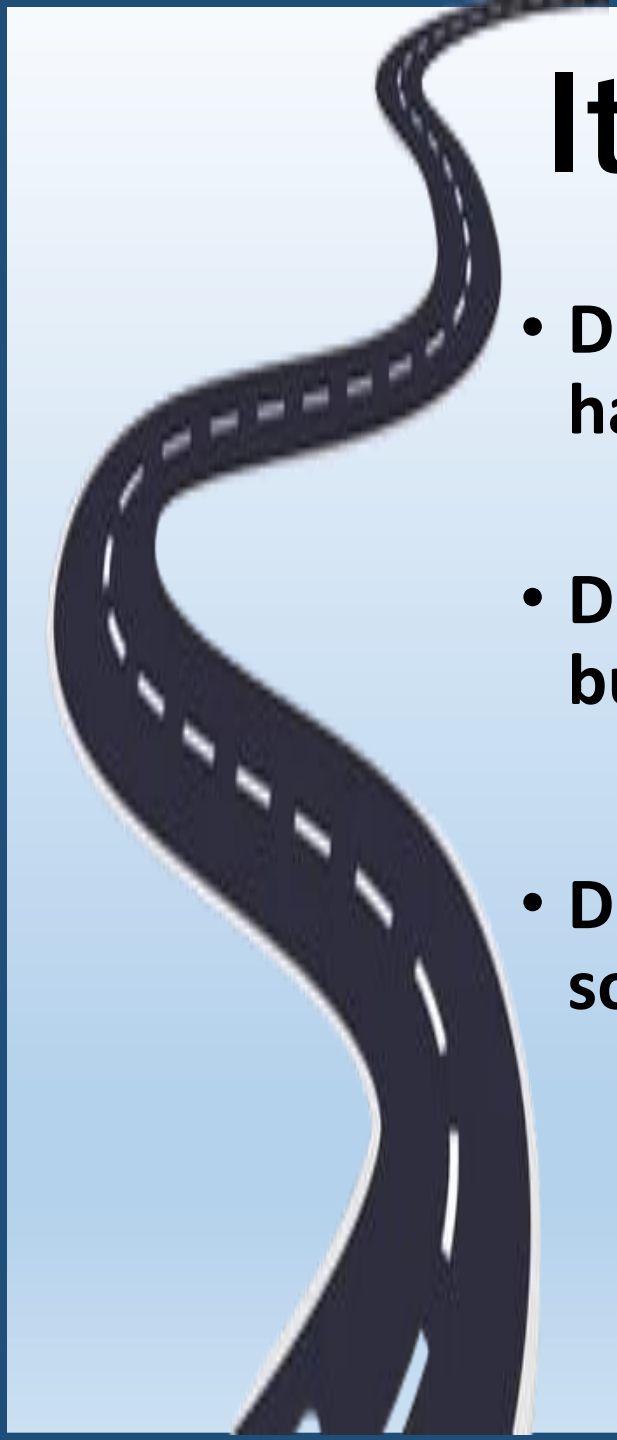

Innovation in Partnership with the National Security Innovation Network (NSIN)



It started with a conversation…

- **Do you have problems on your installation for which you don't have a solution?**
  - **Yes… Of course!**
- **Do you have problems that you have a concept for a solution but don't know how to execute it?**
  - **Yes…Often!!**
- **Do you want to work with talented students and professors to solve these issues?**
  - **YES PLEASE!!!**

And we were off and running…

Mission

We build networks of innovators to generate new solutions to national security problems.

- The Department of Defense's (DoD) current model for problem-solving is expensive and inefficient.
- The complexity of problems the DoD faces and the speed at which solutions are required means new problem solvers are critical.
- Adding intellectual diversity from non-traditional solution providers (e.g. the academic and early-stage venture communities) is necessary to solve problems more economically, faster, and better.
- A networked approach enables the consistent problem-solving capability for the DoD that helps bridge the civil-military divide and improves outcomes for service members.

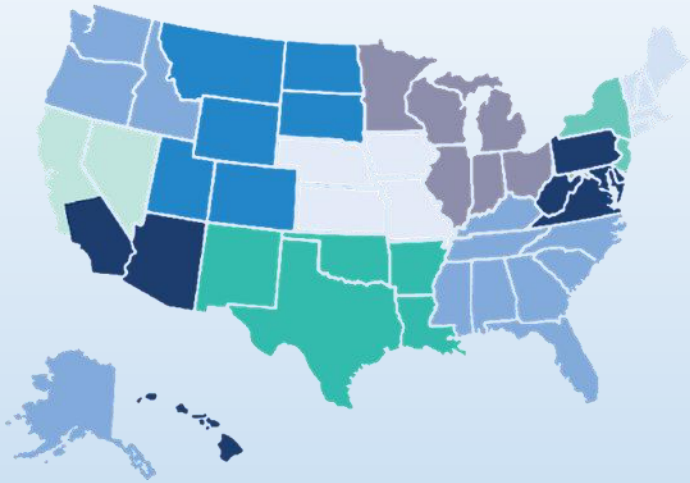
NSIN

Who

- DoD program office reporting to the Under Secretary of Defense for Research & Engineering
- Program of Record FY20
- NSIN pays for all programming

What

- Partners with universities and the venture community to bring innovative tools and solutions to warfighters



Where

- HQ in Arlington, VA
- 33 regional positions across 20 states
- 21 embedded personnel at universities

NSIN

NSIN by the Numbers

NSIN Funding FY 2019-2021:

$95

million dollars

NSIN has helped

909

DoD organizations solve

963

problems by generating

1,366

unique solutions.

Engaged

6,925

new people in the National Security Innovation Base.

Supported

370

new companies to enter the National Security Innovation Base and spun out **33 of DoD-funded technologies.**

Companies in NSIN programs have **raised**

$640

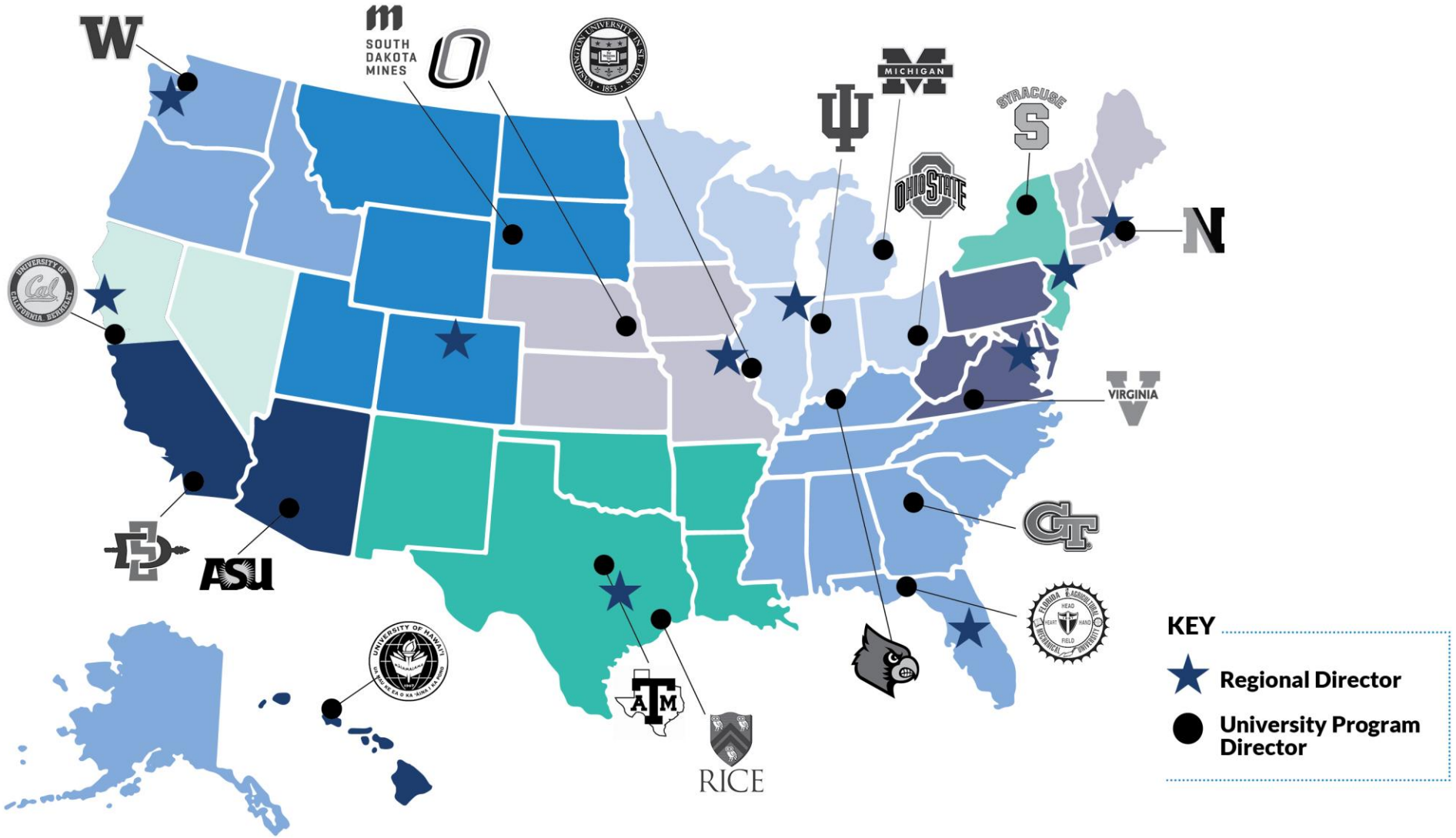
million in private funding and

$295

million in DoD funding.

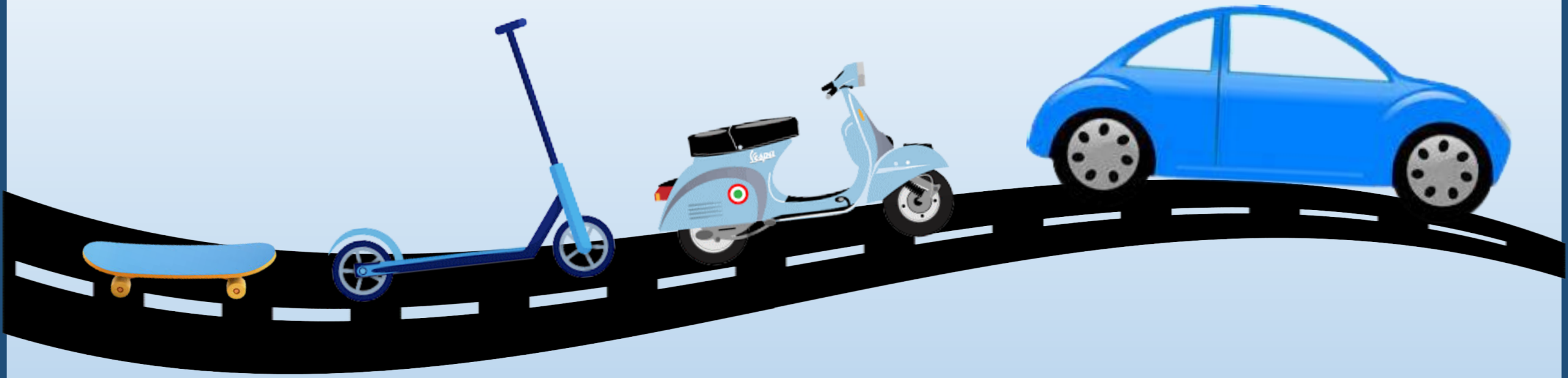
NSIN

NSIN University Partners



NSIN

Solution Evolution



Basic expectation;
Initial solution

Capstone, X-Force
Fellowship, SBIR

Capstone, X-Force
Fellowship, SBIR

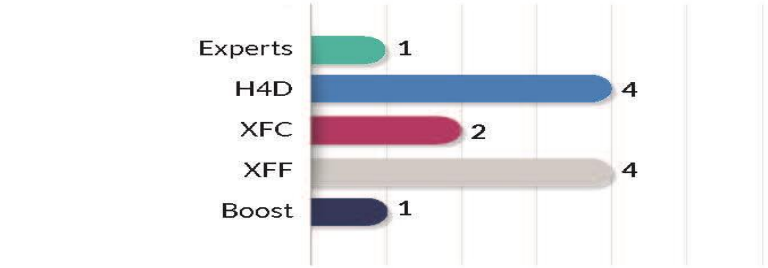
Final solution and
production – LLC,
Phase 3

2021 – Completed Projects

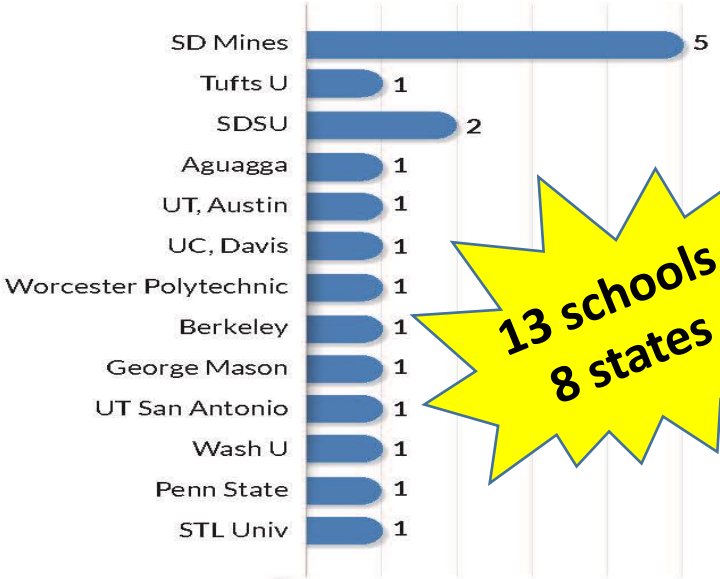
NATIONAL SECURITY INNOVATION NETWORK

ELLSWORTH AFB USE OF NSIN PROGRAMS TO SOLVE PROBLEMS

NSIN PROGRAMS



UNIVERSITY COLLABORATION



13 schools
8 states

NSIN PROGRAM	UNIT	PARTNER	PROBLEM
H4D	28 CES	South Dakota Mines	Concrete Spalling
H4D	28 MXG	South Dakota Mines	Training Analysis
X-Force Capstone	28 CES	San Diego State University	Counter Drone
X-Force Capstone	28 SFS	San Diego State University	Wind Proof Trash Cans
H4D	28 SFS	University of Texas, Austin	RoadCon
H4D	28 FSS	University of California, Davis	Resource Connections w/Spouses
Boost (SBIR)	28 CES	Aguagga (Tacoma)	PFAS Onsite Destruction
X-Force Fellowship	28 MXG	Berkeley	Data Analysis & Dashboards
		George Mason University	Data Analysis & Dashboards
		University of Texas, San Antonio	Data Analysis & Dashboards
X-Force Fellowship	28 MXS	South Dakota Mines	3D Printing of B-1 Parts
		Washington University St. Louis	3D Printing of B-1 Parts
		Washington University St. Louis	3D Printing of B-1 Parts
X-Force Fellowship	28 MSG	South Dakota Mines	Energy Resilience Trade-off Matrices
		South Dakota Mines	Energy Resilience Trade-off Matrices
		Penn State	Energy Resilience Trade-off Matrices
X-Force Fellowship	28 CS	South Dakota Mines	Network Wire Tracing
		St. Louis University	Network Wire Tracing
		Washington University St. Louis	Network Wire Tracing
Experts	28 MSG	Worcester Polytechnic Institute	Energy Resilience
		Tufts University	Energy Resilience

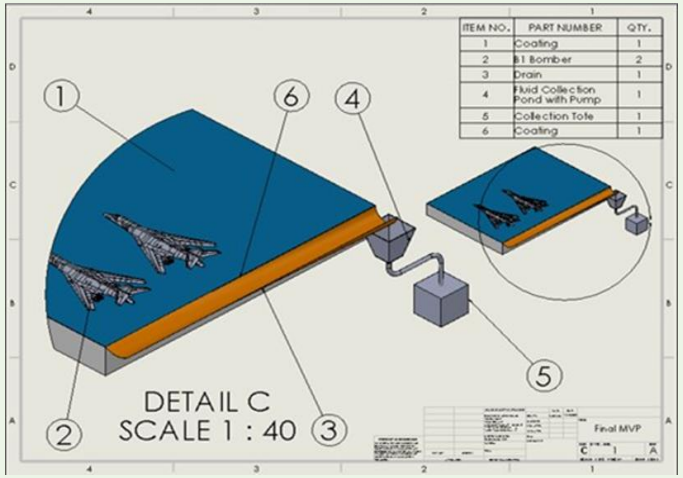
H4D

Taming the Dragons Breath

Completed Dec 2020

Problem: Heat and chemicals degree concrete at twice the normal rate

Solution: Recommended chemical concrete coating and a fluid collection method



Phase 1 SBIR

Member of team formed LLC; Phase 1 SBIR

H4D

Filling in the Blanks: MXG Training

Completed Dec 2020

Problem: There is no easy means of gathering all maintainer training on one dashboard to make decisions on requirements

Solution: Started working with Excel tools to synthesize data

Completed by 2021 X-Force Fellowship

With the guidance of:
Scott Shaffar
Barry Dorr
Michael Hard
Michael Lester
Dr. Thad Welch
Dr. John Wood

SAN DIEGO STATE UNIVERSITY

GUARDIAN OF THE NORTH

NATIONAL SECURITY INNOVATION NETWORK

Project Overview

Ellsworth Air Force Base in South Dakota outsourced a project for Drone Force One to design and manufacture. The product will detect and identify multi-rotor UAVs that enter a specified area. To achieve this we employed our knowledge and research to develop a unit which will detect and identify a nearby UAV and alert a computer interface of its presence.

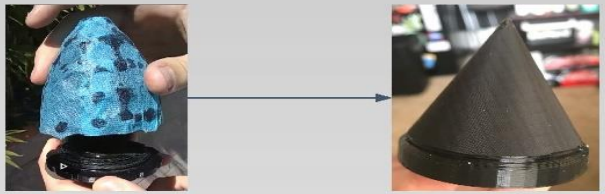
Completed May 21
Prototype in use by SFS for training

Manufacturing Approach

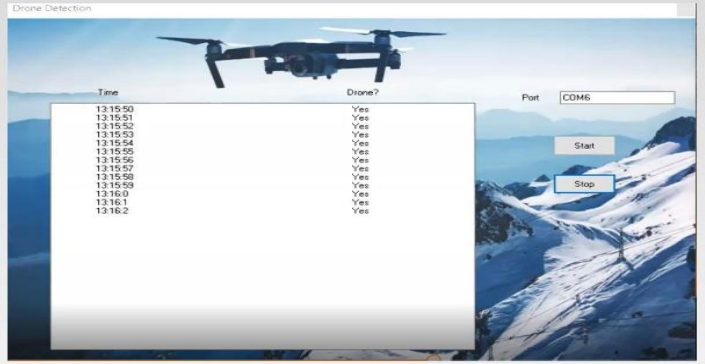
- Sheet Metal Construction
- Water-Jet & Welding
- Powder Coat Finish

Prototype Development

- Microphone Fairing
- Drone Detection Software



Detection GUI



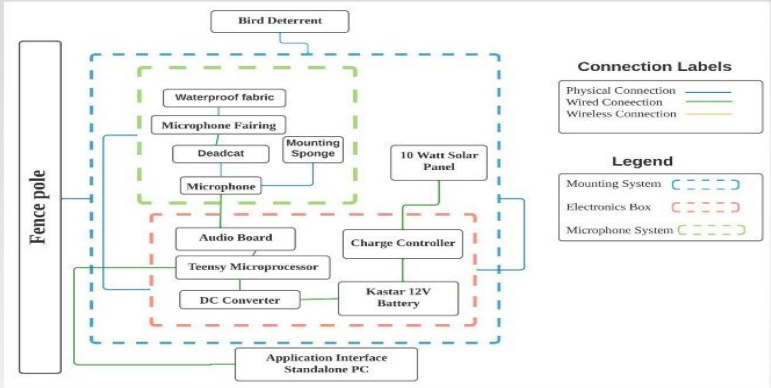
Project Requirements/Specs

- Withstand South Dakota Weather
- Tamper Resistance
- Identify Presence of a Multi-Rotor Drone

Main Components

- 10 Watt Solar Panel
- Teensy 3.6 with Audio Shield
- IP67 Electronics Box
- 3D Printed Microphone Fairing

System Level Diagram



Drone Force One Team Members

Spring 2021

Automatic Trash Lock (GUST)

By All Weather Trash Team

Sponsored By USAF and NSIN

San Diego State University

Department of Mechanical Engineering

Project Overview

Problem Statement:
High wind conditions at Ellsworth AFB have led to tipped residential trash cans causing an unsightly mess of spilled trash, costly cleanup, and risk to aircraft

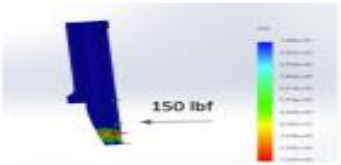
Need:
The trash can lid must stay closed whenever tipped over, must auto-lock when users interact to dispose of trash, and lastly must open when inverted by the local refuse company's trash collection truck.

Engineering Analysis

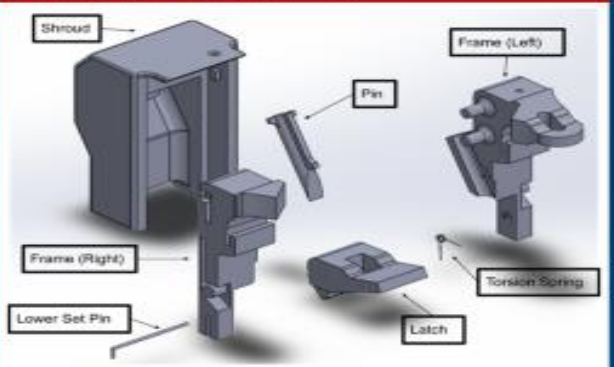
Factor of Safety Analysis on all Parts with ASA & Ultem 1010 Resin

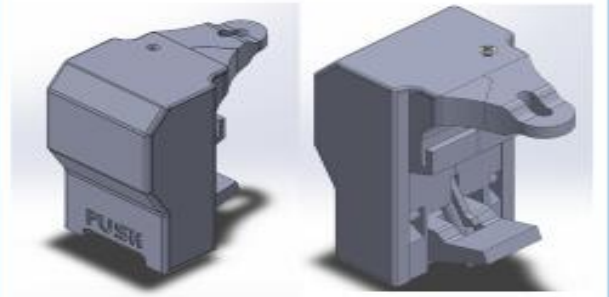
FOS @ C	Shroud	Pin	Outer Tab	Latch
ASA	18	1.01	6.2	1.1
Ultem 1010	44	1.2	14	2.4

- Stress analysis was performed using Solidworks simulation to determine if the pin could achieve a reliable factor of safety at a max force of 150 lbf.



CAD Models – Exploded View





Final Product

- GUST is made using ASA for its UV resistance and high tensile strength.
- The gravity-driven internal components keep the trash can closed when knocked over and open the trash can when inverted by the trash truck.

Prototype Iterations

Testing Methods

- Manual Tip Test

- Refuse truck pickup test

- Load stress on latch and pin

- Freezing weather condition affects

Team Members

Hector Cea
(Team Lead)
Analyst/Research Lead

Jacob Hoppe
CAD Specialist/ Design Lead

Collin Vizina
Manufacturing Lead/Prototyping

David Arushanyan
Research/Supply Manager

Completed May 21. Team & SDSU have patent pending. EAFB beginning production

EXPERTS BETA

"ENERGY"

Tufts UNIVERSITY

WPI

JMU JAMES MADISON UNIVERSITY

Discussion of Energy Solutions with Academia: Generation, Transmission, Storage, Efficiency, and Resilience

Completed Jun 21

Follow-on Summer Fellowship created research portfolio and decision matrices

Where Are We Going Now?

H4D
Completed Jun 21

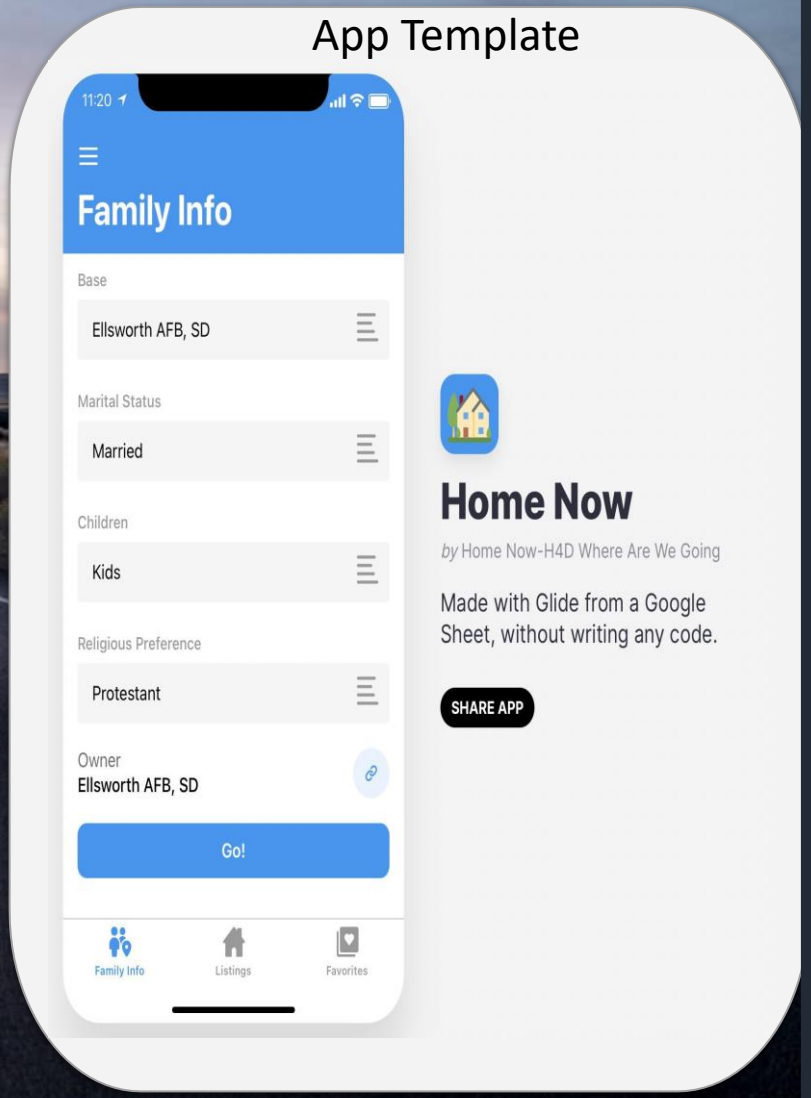
***Initial Findings*:**

- Interviewed 200+ individuals
- A 30 min commute from base was the max considered by all.
- Schools were top priority followed by crime/safety, all based on the house location.
- There is a need for an App to manage data and needs

Next Steps:

- Student LLC continuing work and partnered with Dyess
- New App name is PCS PAL

App Template

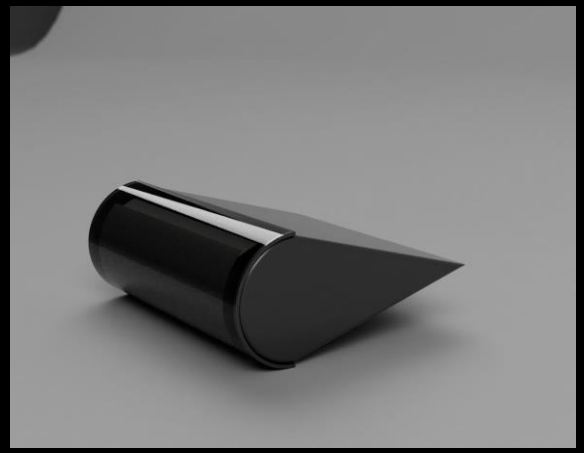


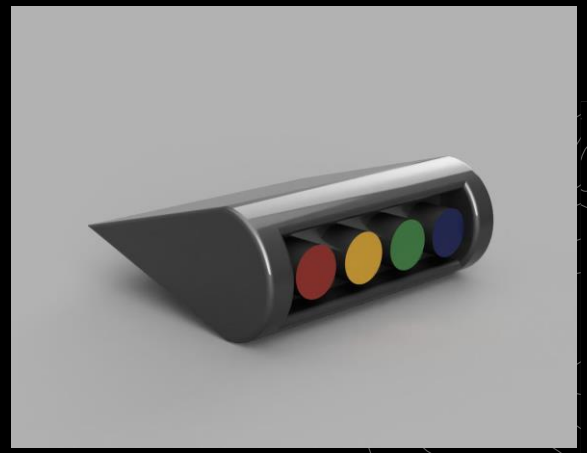
ROADCON

H4D

THE UNIVERSITY OF TEXAS AT AUSTIN

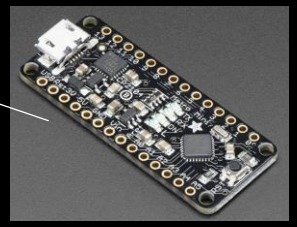
V1

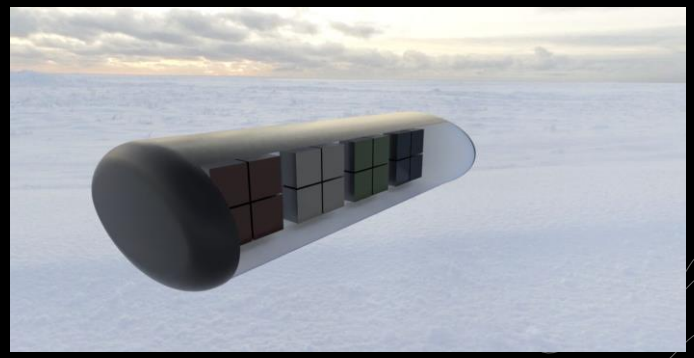




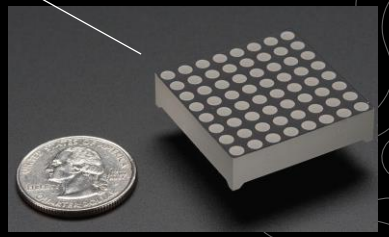
V2

Arduino





LED Panel



Completed May 21

Planning a follow-on project to continue the work

X-FORCE 2021 SUMMER FELLOWSHIPS

GEORGE MASON UNIVERSITY

Berkeley UNIVERSITY OF CALIFORNIA

THE UNIVERSITY OF TEXAS UTSA AT SAN ANTONIO

MXG Data Analysis and Dashboards for Training

Follow on to Dec 20 H4D project. Final solution created and in use!

October 18, 2021

Berkeley X-Force Fellows Team Up with Military Sponsors to Solve Real-World Problems

Facebook Google+ Twitter LinkedIn

The X-Force Fellowship gives undergraduate and graduate students the opportunity to tackle real-world national security issues in DoD agencies. (Photo courtesy of NSIN)

SOUTH DAKOTA MINES

PennState

Energy Decision Matrices

Follow-on to Experts Beta project. Provided wealth of research and tool for decision-making.

STORAGE

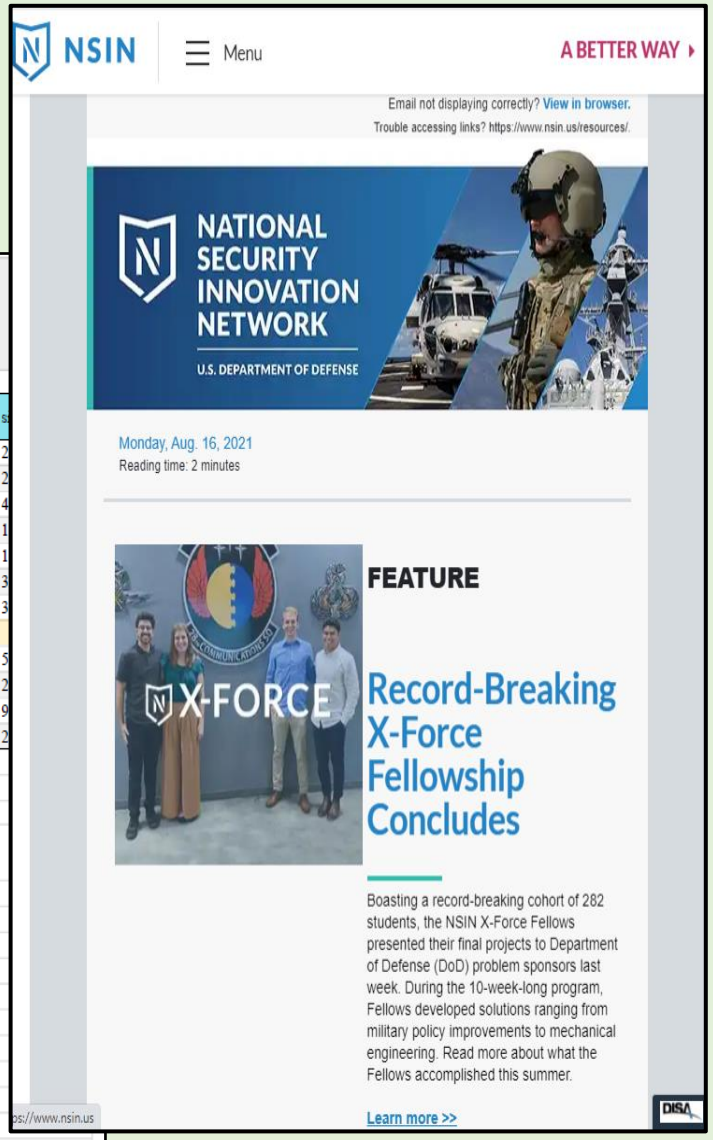
Data	Fixed O/M Cost [USD/kW-yr]	Capitol Cost [USD/kWh]	Round-Trip Efficiency	Cycle Life #	Cycle Life yrs**	Carbon Footprint [kgCO2eq·MWh-1]	Technical Feasibility	Energy Density Wh/L	s
Lithium ion LFP	9.31	$415	86%	2000	5.77	11	10	350	2
Lithium ion NCM	9.57	$425	86%	1200	6.08	11	10	460	2
Sodium Sulfur	10	$900	87%	5,000		176	6	250	4
Redox Flow	11.97	$426	70%	5,201		53	2	75	1
Lead Acid	12.72	$378	85%	599	2.13	149	10	85	1
Sodium Ion		N/A	92%	37000		140.33	2	312.5	3
Molten-Salt Thermal	N/A		93%	NA	NA	27	5	290	3
Geothermal**							8		
Hydrogen Fuel Cells	28.51	$312	35%	10403	20	47	9	1750	5
Flywheels	5.6	$200	90%	10000	20	438	10	50	2
Pumped Hydro	30.4	$262	80%	13870	40	273	1	1.1	9
Compressed Air	16.12	$119	52%	10403	30	27	8	4	2

* All numbers based on storage systems rated to output in the range of 10MW for 10 hours (100MWh)

** Geothermal Data was difficult to find in usable forms

Scaled (out of 10) (worst to best)	Cost /kWh	Round-Trip Efficiency	Energy Density Wh/L	Cycle Life	Carbon Footprint [kgCO2eq·MWh-1]	Technical Feasibility	TOTAL
Weight	1	1	1	1	1	1	
Lithium ion LFP	5.85	8.6	7	1.4	9.7	10	42.6
Lithium ion NCM	5.75	8.6	10	0.9	9.7	10	45.0
Sodium Sulfur	1.00	8.7	5.4	3.6	6.0	6	30.7
Redox Flow	5.74	7	1.6	3.7	8.8	2	28.9
Lead Acid	6.22	8.5	1.8	0.4	6.6	10	33.6
Sodium Ion*		9.2	6.8	10.0	6.8	2	34.8
Non-Batteries							
Molten-Salt Thermal		9.3	6.3		9.4	5	30.0
Hydrogen Fuel Cells**	6.88	3.5	10	7.5	8.9	9	45.8
Flywheels	8.00	9	1.1	7.2	0.0	10	35.3
Pumped Hydro	7.38	8	0	10.0	3.8	1	30.1
Compressed Air	8.81	5.2	0.1	7.5	9.4	8	39.0

Data Filter All

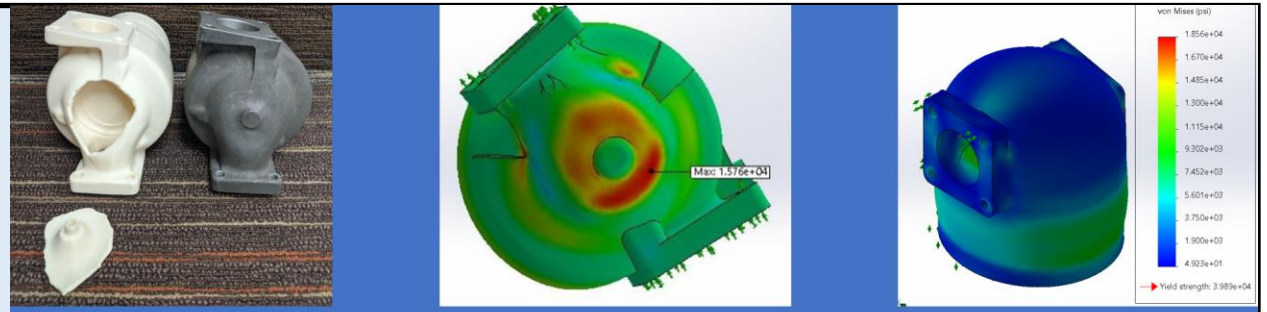


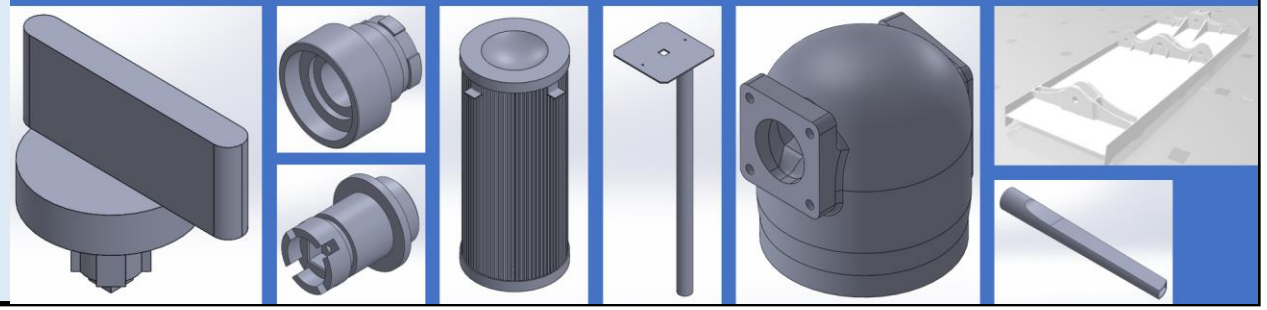
Fix My Broken Bones

Reverse engineered designs; proved increased durability.

Researched best software options for modeling.

Multiple solutions in use.



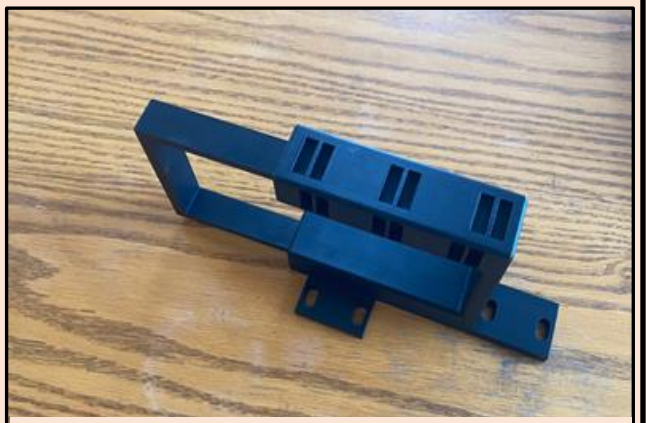


It Hurts When IP

Developed Cable Management plan and 3-D printed bundling device.

Solution in place.

Rack Cable Bundler



Adjustable Cable Bundler

SOUTH DAKOTA MINES

Fall ’21 Innovating for National Security & Capstone Projects

Things that Go Bump Under the Snow

Develop means to alert snow equipment operators of obstructions under the snow to reduce damage to plow blades and vehicles.

Child Care Finder

Create a user-friendly platform that creates a one-stop place for parents seeking any kind of child care.

Better Waze to Clear Snow

Improve efficiencies of snow removal and real time status communications.

Deicing Fluid Remix

Analyze and recommend mitigation options for deicer fluids used on aircraft

Slip Sliding Away

Develop a method of catching fluids before they fall from the aircraft wings to the hangar floor causing slipping hazards.

Oh My Aching Back

Create a device that is safe around the aircraft to lift heavy boxes raised overhead during maintenance.

SAN DIEGO STATE UNIVERSITY

Lord of the Fliers	Develop data analytics and collation methods for airfield status data.
If It's In Stock, We Got It!	Assess retail inventory process; develop efficiencies to create time savings and better control cost of sales and variances.
Learning Curve	Create means of collecting diverse unit training data from multiple platforms and allowing easy assessment of currency/gaps.
Show Me the Money	Data management and decision-making tool for tracking and approving unfunded requirements

NSIN's newest pilot program. Recruits start-ups from low income states to solve DoD problems.
Businesses move through a 3-month incubator program.
Ellsworth's problem set for the cohort is Resilient Energy. Starts in Nov.

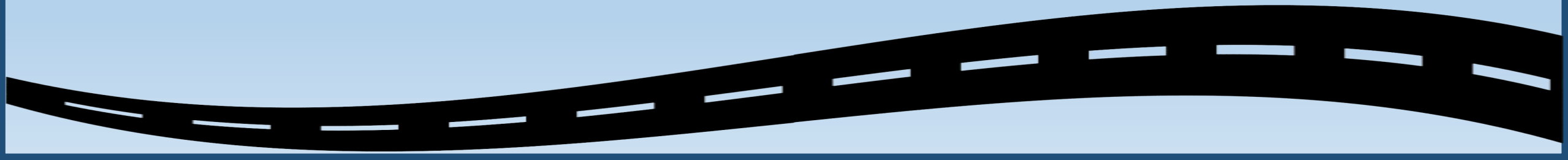
NATIONAL SECURITY INNOVATION NETWORK
U.S. DEPARTMENT OF DEFENSE

<u>NSIN Design Thinking Bootcamp:</u> Free class taught by University of California-Berkley. Virtual 4 weeks in 3 hour blocks M-W-TH. Up to 40 students. Planning on hosting in Jan 22.

Berkeley
UNIVERSITY OF CALIFORNIA

Benefits to the Installation & Community

- Installation Perspective
  - Fresh approaches to solve short and long term problems
  - Re-energized base personnel; shadow program to promote innovation
  - Provides foundation for SBIR/STTR or commercialization opportunities
  - Positive interaction between military members and student teams; synergy of ideas
  - Exposure to military life and potential for recruitment
- Community perspective
  - Strengthened ties to installation, academic institutions, and entrepreneurs
  - Unique experience for students
  - Potential to create start-ups and build defense economy



Questions??

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