Smallsat Technology Partnerships

2022 Technology Exposition

June 8, 2022

Hosted by

NASA Small Spacecraft Technology (SST) program

NASA Small Spacecraft Systems Virtual Institute (S3VI)

NASA SST Overview

NASA SST's CAPSTONE mission 12U form factor Small Spacecraft

Credit: NASA/Rocket Lab/Advanced Space/Tyvak Nano-Satellite Systems

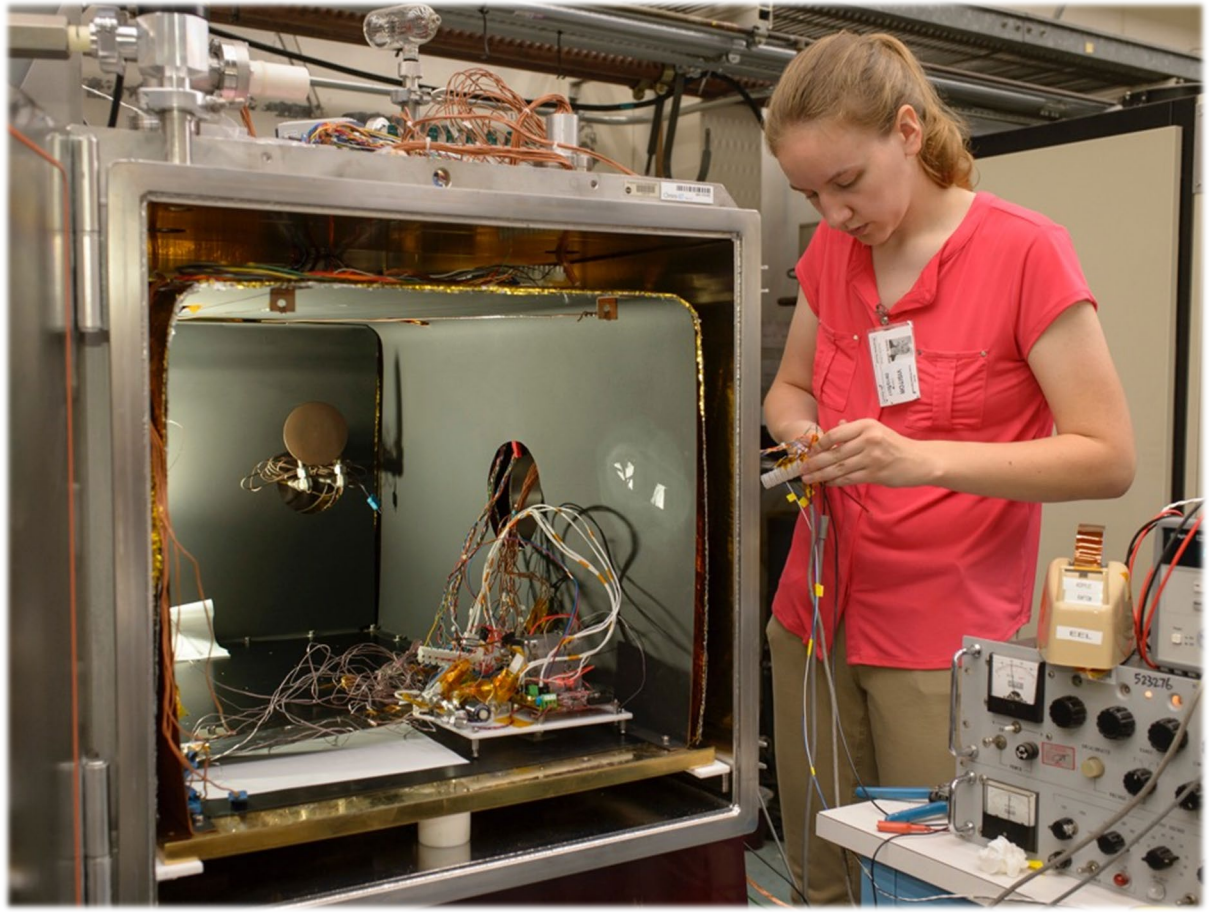
NASA's Small Spacecraft Technology (SST) program expands the U.S. ability to execute unique missions through rapid development and demonstration of capabilities for small spacecraft applicable to exploration, science and the commercial space sector

Performed through targeted development and frequent in-space testing that enables:

- Execution of missions at much lower cost than previously possible
- A substantially reduced time required for spacecraft development
- New mission architectures through the use of small spacecraft
- The expansion of small spacecraft to new destinations and challenging new environments
- The augmentation of existing assets and future missions with supporting small spacecraft

Why SST-University Partnerships?

- Advance novel technologies for Smallsats useful to NASA and industry
- Leverage unique talents and fresh perspectives from the university community
- Share NASA experience and expertise with relevant university projects
- Engage NASA personnel in rapid, agile and cost-conscious small spacecraft approaches that characterize university teams
- Foster a new generation of innovators for NASA and the nation



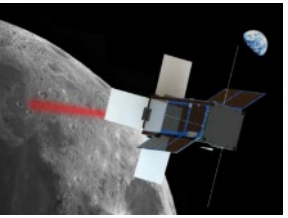
University of Illinois team member performing TVAC testing at Ames Research Center for the "Small Spacecraft Integrated Power System with Active Thermal Control “ STP. Image Credit: NASA

SST's Smallsat Technology Partnerships

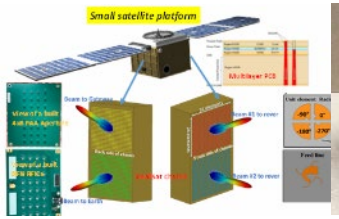
The SST program sponsors regular Smallsat Technology Partnerships (STPs):

- 2-year PI-led cooperative agreements between a U.S. university team and a NASA center to develop specific technologies for small spacecraft
- $200k / year + 0.5 FTE for NASA/JPL partner + $25k procurement for NASA/JPL in 2nd year
- Competitive solicitations – specific technology topics vary
- Starting Technology Readiness Level (TRL) typically 3-5

Image credits - STP 2020 Cohort:

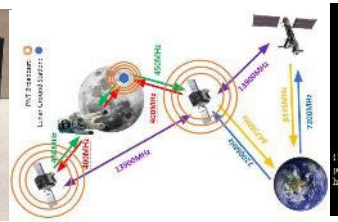


Arizona State University

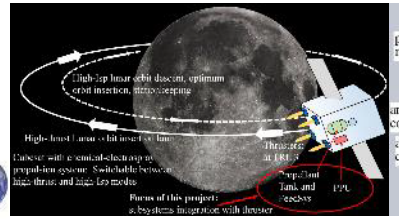


San Diego State University

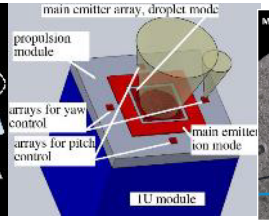
California State University, Los Angeles



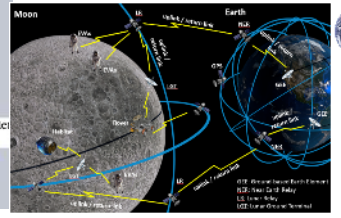
University of Colorado, Boulder



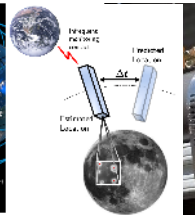
University of Illinois, Urbana-Champaign



University of California, Irvine



University of California, Los Angeles



University of Texas, Austin

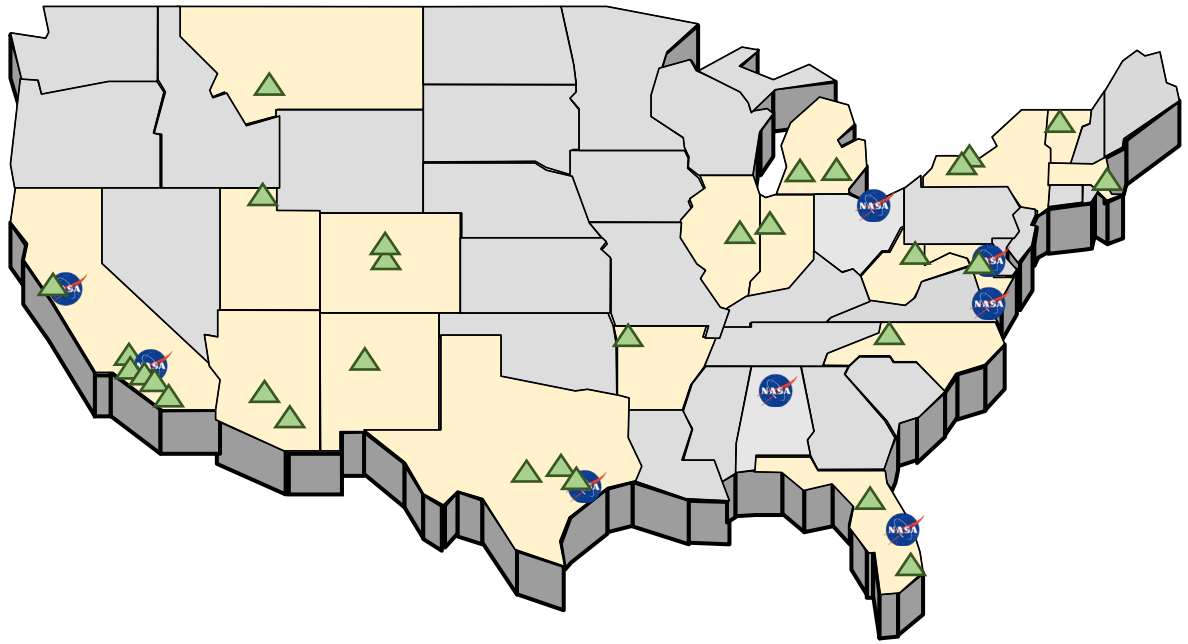
Utah State University

Smallsat Technology Partnerships Results

- Technologies Infused to NASA / OGA missions
- Several Flight Demos Awarded
- Numerous New Technology Reports / Patents
- 30+ Conference presentations
- 50+ Papers published
- 100+ Students involved
- Many Technology Readiness Levels (TRL) raised

30 Universities in 18 States

8 NASA Centers (including JPL)



Over $26,468,000 awarded to date

2013:	$6,500,000	17 awards
2015:	$3,590,150	8 awards
2016:	$4,676,693	8 awards
2018:	$5,802,500	8 awards
2020:	$5,900,000	9 awards

The 2022 Tech Expo

Co-hosted by NASA's Small Spacecraft Technology (SST) program and the Small Spacecraft Systems Virtual Institute (S3VI)

Highlights advanced Smallsat technologies emerging from the most recent STP university-NASA partnerships cohort

Technologies highlighted:

- Lunar Communications and Navigation Networks
- Thermal Management
- Smallsat Propulsion for Lunar Missions

Principal Investigators will answer questions and can tell how to infuse their technology for your future mission or product

Agenda (1/3)

NASA Smallsat Perspectives:

Space Technology Mission Directorate (STMD)

Christopher E. Baker

Program Executive, Small Spacecraft Technology Program and Flight Opportunities Program

Science Mission Directorate (SMD) SmallSat Technology

Florence W. Tan

Deputy Chief Technologist, Science Mission Directorate,

Chair, Small Spacecraft Coordination Group

Exploration Systems Development Mission Directorate (ESDMD)

Andres Martinez

Small Spacecraft Program Executive, Mars Campaign Development (MCD) division Exploration Systems Development Mission Directorate

Space Operations Mission Directorate (SOMD)

Serkan Bastug

Space Operations Mission Directorate, Launch Services Office

Agenda (2/3)

Technology Talks: Lunar Communications and Navigation Networks, Thermal

Dr. Chee Wei Wong University of California, Los Angeles	A high-precision continuous-time PNT compact module for the LunaNet small spacecraft
Dr. Brandon Jones University of Texas, Austin	Crater-Based Navigation and Timing
Dr. Satish Sharma San Diego State University	5G Arrays for Lunar Relay Operations (FIGARO)
Dr. Scott Palo University of Colorado, Boulder	A Small Satellite Lunar Communications and Navigation System
Dr. Jim Kuo California State University, Los Angeles	An Additively Manufactured Deployable Radiator with Oscillating Heat Pipes (AMDROHP) to Enable High Power Lunar CubeSats

Break and Group Photo!

Technology Talks: Smallsat Propulsion for Lunar Missions

Dr. Joshua Rovey University of Illinois, Urbana-Champaign	Lunar Missions Enabled by Chemical-Electrospray Propulsion
Dr. Manuel Gamero-Castaño University of California, Irvine	Variable Specific Impulse Electrospray Thrusters for SmallSat Propulsion
Dr. Stephen Whitmore Utah State University	3-D Printed Hybrid Propulsion Solutions for SmallSat Lunar Landing and Sample Return
Dr. Paulo Lozano Massachusetts Institute of Technology	High Specific-impulse Electrospray Explorer for Deep-space (HiSPEED)

Agenda (3/3)

NASA Partnerships Perspective

Leverage NASA Patented Technology for your Project

Jay Singh

Portfolio Manager, Technology Transfer Office

NASA Partnership Mechanisms

Martha Del Alto

Agreements Manager, Strategic Agreements Office

Closing Remarks and Social (including Smallsat and STP-themed quiz!)

Acknowledgements

The Tech Expo organizing committee:

- Sasha Weston
- Julianna Fishman
- Craig Burkhard
- Bruce Yost
- Ricky Guest
- Macro Boldt
- And the many others that have helped along the way…

The NASA speakers and Principal Investigators