Deliverables

Phase I: (March 2 - May 2, 2023)

Students will build A3Sats (low cost satellite emulator that runs on solar panels and batteries, transmits UHF radio telemetry, has a 3D printed frame, and can be extended by additional sensors and modules.)

Phase II:

For those who complete Phase I, Phase II is an extension the project, and may take another semester or longer. The CubeSat Sims can be launched on a high altitude balloon or drone as the real-life realization to the principles the students are learning in Phase I. Multiple groups/schools taking different data and analyzing/comparing, and diversifying the sensors aboard lead to collaborative "missions." e.g. data, LINK

Our teams and collaborating partners will be challenged to create an app or webpage whereby each team's data can be shared via an interactive global map.

Phase III:

Phase III is part of the all-encompassing goal to be implemented later. With the fundamentals and real-life launch/data experience completed, the third phase is to build and fly operational CubeSats. https://vaspace.org/33/ (These CubeSats would be orbital with either the Air Force, private entities/companies such as BLUE ORIGIN, or NASA's CubeSat Launch - https://www.nasa.gov/directorates/heo/home/CubeSats_initiative

Teams are encouraged to share their accomplishments by posting videos to YouTube that describes the process, products, and learning by each team. **The project will adjust to the students need/desire based on their learning and progress. Phase I can be achieved in one semester.**

Schedule for Excellence

Each school works with their assigned mentor to create their own collaborative schedule. (asynchronous, synchronous, and in person) Each team will share weekly status reports covering research, technical questions, challenges, and project management updates. Teams have the option of written reports, video reports, or checking in live weekly via zoom.

Timeline

- January: A3Sats Distributed in Peru, Introduce Mentor to Teams, Establish Communication and Norms
- February: Host 8 Virtual Workshops to Build Background Knowledge and Skills
- March 2 - May 2: Assemble A3Sats, Acquire, Analyze, Apply, Learning Community Customization and Communication with other Teams
- May- June: PHASE II for those continuing - Design Launch (Balloon, Drone)

Learning Approach

Student Driven / Teacher Facilitated / Aerospace Industry Inspired and Informed

Students will do the work via experiential, hands-on, and applied learning.

Facilitating Teachers facilitate a relationship between their students and subject matter experts. Teachers are not expected to be subject matter

experts. Teachers will communicate in order to build a digital community and share, catalog, and record successes and ideas.

Mentors inspire and inform by simply listening to students and offering advice. Mentors will be provided with resources for "Best Practices" and encouraged to communicate with other mentors to give our teams a global network of support. Mentors do not teach, create content and curriculum, or handle classroom management.

Collaboration Between Teams
The combined network of our mentors and teams will ensure that all parties are supported. Teams are highly encouraged to share solutions and help other teams.

Bilingual
Spanish / English

Our intent is to provide this global learning adventure simultaneously in Spanish and English. We will work through challenges and opportunities together, respecting the potential of multiple perspectives for the global mission of empowering all learners, GLOBALLY.

Design Team

- Project Lead: **Paola Wong** (Officer of the Peruvian Air Force, **STEAM World Peru** Project Developer)
- A3SAT Product Design: **John Moore** (Executive Director for Earth Observations and Earth Observations)
- Lead for Facilitating Teachers: Adrian Ojeda Flores (**Liceo Naval C. de N. Francisco Carrasco**)
- Project Coordinator: **Dr. Gregg Cannady (**One Voice 4 Change)
- Project Management Advisor: **Eric Wilson** - (Colorado School of Mines, PhD Student, Space Resources Program)
- Advisory: **Rusty Low** (The Globe Program)

- Advisory: **Peder Nelson** (Sr. Instructor at Oregon State University; Science lead for Land Cover in NASA's GLOBE Observer, OregonView State Coordinato)
- Aerospace Mentor Advisor: **Dr. Emily Matula** (Extravehicular Activity (EVA, spacewalks) Flight Controller, NASA Johnson Space Center)
- Advisory: Kevin L. Simmons - (NSS Space Ambassador)
- Advisory: Felicity Muench (**Executive Director**, One Voice 4 Change)

RFP - Coming Soon

Events & Invitations

- Oct. 29-30 - SmallSat Education Conference **LINK**
- Nov. 29 - NASA's Gravity Recovery and Climate Experiment (GRACE) **LINK**
- February Background Knowledge Sessions TBA

Teams

School/University	Facilitating Teacher/Professor	Mentors

Resources & Links

CUBESATS and SMALLSATS: A New Revolution in Spacecraft:
https://www.jpl.nasa.gov/topics/cubesats

A MUST SEE VIDEO - A³SAT Explained: **https://youtu.be/duRXNO4H65o**

How to Build Your Own Satellite: CubeSats: **https://youtu.be/ustX3vnm2AY**

NASA's CubeSat Launch initiative (CSLI):
https://www.nasa.gov/content/about-cubesat-launch-initiative

The GLOBE Program in Kenya: **https://fb.watch/hvh_4hsZXz/**

CubeSats in Peru: Details

NASA - CubeSats: **https://www.nasa.gov/mission_pages/cubesats/index.html**

CubeSats & SmallSats NASA Jet Propulsion Laboratory:
https://youtu.be/9KyzCPV8R74

SmallSat Education Conference playlist - October 2022:

SOLDERING BASICS: **LINK**

About ELaNa: **https://www.nasa.gov/mission_pages/smallsats/elana/index.html**
Educational Launch of Nanosatellites (ELaNa) is an exciting initiative created by NASA to attract and retain students in the science, technology, engineering and mathematics disciplines.

CubeSat Design Handbook - Capital Technology University:
https://github.com/sandyfreelance/cactus-open
(graciously shared by Dr. Sandy Antunes.

There are so many ways to find out more about CubeSats. Check out Pony Express from LM.
https://news.lockheedmartin.com/2020-01-16-Lockheed-Martin-Launches-First-Smart-Satellite-Enabling-Space-Mesh-Networking

https://www.nasa.gov/mission_pages/cubesats/index.html

https://www.nasa.gov/sites/default/files/atoms/files/nasa_csli_cubesat_101_508.pdf

Mission Examples: Payloads

L'Ralph: https://www.boulder.swri.edu/pkb/ssr/ssr-ralph.pdf
Lucy Instrument Suite: http://lucy.swri.edu/mission/Spacecraft.html
Lucy Instrument Details: https://iopscience.iop.org/article/10.3847/PSJ/abf83f
OSIRIS-REx Instrument Suite: https://www.asteroidmission.org/objectives/instruments/
O'TES: https://christensen.asu.edu/gallery/otes-process/

CubeSat Products:

Dragonfly CubeSat Cameras: https://dragonflyaerospace.com/products/
CubeSat Catalog:
https://www.satcatalog.com/components/?subsystem=Payload+Subsystem&component-type=Camera%2FImager

CubeSats in Peru: Details

CubeSat Vendor Catalog: https://gomspace.com/shop/subsystems/default.aspx
Other vendors you can look up: Tyvak, NanoAvionics, Adcole, Pumpkin Space

The Horizons of CubeSat Technology: **https://youtu.be/_v3rSxYY1hE**
"Learn a Lot - The Hard Way" with Sarah Rogers, Phoenix CubeSat Design:
https://youtu.be/CnlBBM_umOM

NASA CubeSat 101:
https://www.nasa.gov/sites/default/files/atoms/files/nasa_csli_cubesat_101_508.pdf

Activity from NASA: **https://aura.gsfc.nasa.gov/outreach/engineerAsatellite.html**

TED Talk: what can we use the satellite for? What problems can we solve?
https://www.youtube.com/watch?v=UHkEbemburs

Space Steps: https://spacesteps.com/home
Building web apps to help educate students around the world on space topics. Stay tuned for apps built for S2B2O.

Online Dashboard for Sharing Data (example):

https://admin.tago.io/public/dashboard/61f1df51ee9306001873dd24/c039ed19-66f4-4912-ad71-afbdac43baf8

Phoenix CubeSat
https://phxcubesat.asu.edu/resources/documents
Shared by Sarah Rogers, Systems Engineer, MIT Lincoln Laboratory

Virtual CubeSat Build: FREE APP - https://spacesteps.com/ssa

Glossary of Aerospace Terms **en español: LINK** Here is the accompanying explanation from Alexandra Lora (ABE, Agencia Boliviana Espacial: **LINK** (This paper presents a proposal to standardize the aerospace terminology in Spanish and then create a tool (Spanish Aerospace Terminology Standardization SATS) available to use for all public.) The creation of the translation tool would be a valuable quest for our teams to complete.

AIAA FREE HS Student Membership: LINK

BLUECUBE Aerospace

Understanding the Space Environment: An example video is **HERE**.

https://sos-orbital-mechanics.com/
A Tool for Learning Orbital Mechanics and Space Mission Design

SOS Manual – SOS – Satellite Orbit Simulator (sos-orbital-mechanics.com) (This manual can be used as a guide to space mission design principles)