SSEP

Student Spaceflight Experiments Program

General Program Briefing

revised September 18, 2018

National Center for Earth and Space Science Education
and the Arthur C. Clarke Institute for Space Education

Inspire...then Educate

Summary: What is the Student Spaceflight Experiments Program

Breaking new ground in commercial space, SSEP is the first pre-college STEM education program that is both – a U.S. national initiative and implemented as an on-orbit commercial space venture. SSEP immerses hundreds of students across a community in an authentic research proposal competition as part of the real Space Program.

In each community-

- one student team designed experiment is selected to fly to ISS to be conducted by the astronauts

- a Local Team of educators delivers a microgravity curriculum to typically 300+ students (Grade 5-12)

- over 9 weeks, teams of 3-5 students each design a microgravity experiment and write a formal research proposal vying for the flight slot

- a formal proposal review culminates with a National Review Board selecting the community's flight experiment

Student Researchers from Southside High School, San Antonio, TX.

The Student Spaceflight Experiments Program (SSEP) is a program of the National Center for Earth and Space Science Education in the U.S., and the Arthur C. Clarke Institute for Space Education internationally. It is enabled through a strategic partnership with DreamUp, PBC and NanoRacks, LLC working with NASA under a Space Act Agreement as part of the utilization of the International Space Station as a National Laboratory.

Inspire ... Then Educate

National Center for Earth and Space Science Education

Arthur C. Clarke Institute for Space Education

dreamUp

NANORACKS

New Worlds Together

SSEP Student Spaceflight Experiments Program

Deep Investment in Partnership

National Partners – USA

Smithsonian National Air and Space Museum
Center for the Advancement of Science in Space (CASIS), and
Subaru of America, Inc.

National Partners - Canada

Magellan Aerospace

Local Partners

Over 1000 Local Partners to date, including: school districts, private schools, 28 NASA Space Grant colleges and universities, businesses, foundations, private philanthropists, and local research institutions providing science advisors

SSEP Student Spaceflight Experiments Program

Created to Address U.S. Strategic Need, SSEP is:

Students from Stockton University, Galloway, NJ set up a preliminary experiment with flax seeds in a FME.

- a high caliber STEM education program for grades 5-16 tuned to Next Generation Science Standards (NGSS);
- designed to be a national model for inspiring and engaging the next generation of scientists and engineers, and to address science literacy.

The Basics

- SSEP was launched in June 2010 by NCESSE in partnership with NanoRacks, LLC. It is now just 8 years old.
- A U.S. national Science, Technology, Engineering, and Mathematics (STEM) education initiative that gives typically 300+ students across a community the ability to design and propose real microgravity experiments to fly in low Earth orbit, first aboard the Space Shuttle and now aboard the ISS.

Student Researchers from Dillard Elementary School, Elk Grove, CA analyzing the first in a series of trials testing the hatch rate and growth of fairy shrimp.

- SSEP immerses and engages students and their teachers in real science—on the high frontier—so that students, as early as 5th grade, are given the chance to be researchers—and experience science firsthand.

Since inception in June 2010, there have been 15 SSEP flight opportunities:
SSEP on STS-134 and STS-135 — the final flights of Space Shuttles Endeavour and Atlantis; and SSEP Missions 1 through 13 to the ISS. SSEP Mission 13, was announced in early Spring and kicked-off in 38 communities on September 4, 2018.

ISS Commander Sunita Williams activating a SSEP FME Mini-laboratory

Community Network: Data Available through the first 14 Flight Opportunities (does not include Mission 13 to the ISS)

Maps are not to scale

Track Record: Data Available through the first 14 Flight Opportunities (does not include Mission 13 to the ISS)

The Flight Team from PSJA Thomas Jefferson T-STEM Early College High School run tests to analyze how microgravity will affect the development of hybrid brine shrimp.

- 165 communities have participated from 40 states, the District of Columbia, 4 Provinces in Canada, and a community in Brazil
- 233 community programs undertaken; 38 communities have participated in at least 2 and as many as 8 flight opportunities, reflecting the sustainable nature of the program.
- 1000+ Local Partners

5th grade students from Setters Way Elementary in Fort Bend, TX work on a trial version of their project, "Growing *Solanum Tuberosum* in microgravity"

Students from Winfield Middle School, Winfield City, AL removing kudzu seeds from seed pods and scarifying them.

Track Record continued: Data Available through the first 14 Flight Opportunities (does not include Mission 13 to the ISS)

- 86,800 grade 5-16 students across 1,600+ schools fully immersed in microgravity experiment design and proposal writing;
- Over 18,700 flight experiment proposals received from student teams;
- 240 experiments flown on:

  STS-134
  STS-135
  M1: SpaceX-D1
  M2: Space X-1
  M3a: Orb-D1
  M3b/M4: Orb-1
  M5: Orb-2
  M6: Orb-3 (lost), SpaceX-5 (re-flight)
  M7: SpaceX-7 (lost), SpaceX-8 (re-flight)
  M8: SpaceX-9
  M9: SpaceX-10
  M10: SpaceX-11
  M11: SpaceX-12
  M12: SpaceX-15

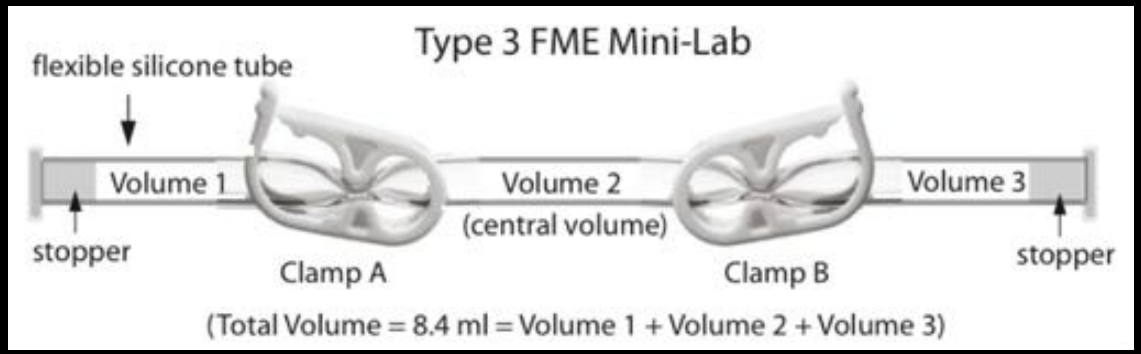
Astronaut Ricky Arnold on the ISS, holding the SSEP Mission 12 flight mini-lab from Hillsborough County, FL.

- 8 SSEP National Conferences at the Smithsonian National Air and Space Museum

Flight Hardware:
Fluid Mixing Enclosure (FME) Mini-Lab

Student flight experiment teams receive real flight certified hardware fabricated by NanoRacks. Students assemble, fill, seal, and ship the FME Mini-lab to NanoRacks in Houston in preparation for launch.

Above: loaded and assembled Type 3 FME Mini-lab
Right: graphic labeling components of a Type 3 FME Mini-lab



Fluid Mixing Enclosure (FME) Mini-Lab:
Heat Sealed Containment

Type 3 FME Mini-labs

Type 1 FME Mini-labs

Type 2 FME Mini-labs

- Each SSEP experiment must pass NASA Flight Safety Review to ensure samples pose no risk to the astronaut crew, ferry vehicles, or ISS.
- More levels of containment = less restrictions on samples.
- The current FME Mini-lab has 3 containment levels: the main silicone tube together with two polyethylene bags heat sealed around the tube.

Mission Highlight:
SSEP Mission 12 to ISS

Student Researchers from both Winnipeg, Manitoba, Canada flight experiment teams for SSEP Mission 12.

Launch Date:
June 29, 2018 at 5:42 am EDT, SpaceX-15

Return to Earth:
August 3, 2018, SpaceX-15

Payload Designation:
SSEP14 –*Mercury*
Named for NASA's Project Mercury

Number of Student Flight Experiments: 34
One for each of the 31 M12 communities and a second for 3 of the 31 communities

Mission 12 to the ISS: Scope

- Number of Participating Communities: 31, with 3 communities flying 2 mini-labs
- Total Number of Students Fully Engaged in Experiment Design: 12,150 from grades 5-16
- Number of Student Team Proposals Submitted: 2,498
- Total Number of Proposals Submitted for Step 2 Review: 98
- Number of Students Engaged in Mission Patch Art and Design Competition: 24,831
- Total Number of Mission Patches Submitted: 22,320
- Total Number of Mission Patches Selected to Fly: 55

NASA image of SpaceX-15 night launch

Mission 12 to the ISS: Communities and Experiment Summary

Returning

	Community	State	Proposal Title	School District
1	Sao Paulo	BRAZIL	Addition of "green plastic" to enhance catalytic properties in Space	Dante Alighieri School; Kennedy Space Center International Academy
2	Nanaimo, British Columbia	CAN	In planarian (*Dugesia tigrina*)	School District #68 Nanaimo; Nanaimo District Secondary School
3	Winnipeg, Manitoba	CAN	1. Growth of *Lacinato* in Microgravity 2. Can Yarrow germinate in microgravity?	Winnipeg School Division
4	Winfield City	AL	The Effects of Microgravity on the Germination of Kudzu Seeds	Winfield City School System; Winfield Middle School; Winfield City High School
5	Corcoran	CA	Broccoli Study	John Muir Middle School; Corcoran Unified School District
6	Moreno Valley	CA	Effects of Microgravity on soybean Germination	Moreno Valley Unified School District
7	Riverside	CA	The Brine Shrimp	Mark Twain Elementary School;Riverside Unified School District
8	Sanger	CA	The effect microgravity has on the developmental stages of brine shrimp	Sanger Unified School District; Fairmont Elementary School
9	San Jose	CA	The Effect of Microgravity on Spider Plant Seed Germination	Discovery Charter School
10	Bridgeport	CT	Effect of Microgravity on Nanoparticle-Cellular Interaction	University of Bridgeport
11	Stamford	CT	Effects of Crossbreeding *Sordaria Fimicola* in Microgravity	Stamford High School; Stamford Public School District
12	Hillsborough County	FL	The Effect of Microgravity on Wheat Germination	Hillsborough County Public Schools
13	Port St. Lucie	FL	The Effect of Microgravity on the Growth of Golden Lake Arkansa	Renaissance Charter School at Tradition
14	Jackson County	GA	Fairy Shrimp in Space	Jackson County School System
15	Honolulu	HI	How microgravity affects reproduction in *Caenorhabditis elegans*	Punahou School
16	Indianapolis	IN	Growing Carrots on the International Space Station in Microgravity	Saint Simon the Apostle Catholic School
17	University System of Maryland (USM) - College Park	MD	The Effect of Microgravity on Bacteriophage Replication and Infectivity	University of Maryland College Park; University of Maryland Baltimore County
18	Kalamazoo & Detroit - Michigan Archdiocese	MI	1. Planarian Worm Head Regrowth 2. Rust in Microgravity	St. Monica Catholic School St. Fabian Catholic School
19	East Orange	NJ	Effect of Microgravity on Root Growth of *Brassica Rapa*	East Orange School District; East Orange STEM Academy; East Orange Campus High School
20	Galloway - Stockton University	NJ	on Drug Delivery Systems	Stockton University
21	Springfield	NJ	Will Tardigrade Eggs hatch and develop in Microgravity?	Springfield Public Schools
22	Belen	NM	Death and Decomposition of Tomato Leaves in Microgravity	Belen High School; Belen Consolidated Schools
23	WNY STEM - Buffalo/Niagara	NY	The Effect of Ascorbic Acid on the Rate of Regeneration in Microgravity	Buffalo Community Schools; Buffalo Charter Schools; Buffalo Community Centers; Niagara Falls City School District; Lockport City School District; Tonawanda City School District; Olean City School District
24	Sumter	SC	The Effects of Microgravity on Seed Germination in Sodium Polyacrylate	Alice Drive Middle School; Sumter School District
25	Knox County	TN	The effect of microgravity on tooth decay	Knox County Public School System
26	Brazosport	TX	Would Lemongrass Seeds Germinate in Microgravity?	Brazosport ISD
27	Burleson	TX	The effects of microgravity on Penicillium mold growth	Burleson Independent School District
28	Ector County	TX	The efficacy of *Sporosarcina Sakaiensis* in a Microgravity Environment	Ector County Independent School District
29	Fort Bend	TX	1. Growing Solanum Tuberosum in Microgravity 2. Can L. acidophilus prevent C. albicans in the presence of microgravity?	Fort Bend Independent School District
30	Pharr	TX	Brine Shrimp?	Thomas Jefferson T-STEM Early College High School; Pharr-San Juan-Alamo Independent School District
31	Forward - Grantsburg	WI	Grain Size and Distribution Analysis of Gallium in Microgravity	Grantsburg School District

Mission 12 to the ISS: Launch Experience

M12 Student Researchers conduct poster presentations for the visitorship at the Kennedy Space Center Visitor's Complex the day before launch of their SSEP experiments

SSEP Student Researchers, their families, teachers, and other community delegates watch live from the Smithsonian National Air and Space Museum, the launch of SpaceX-15 carrying the SSEP Mission 12 experiments payload.

SSEP 2018 National Conference: Smithsonian National Air and Space Museum, June 28-29, 2018

Group photos of SSEP Student Researchers that attended and presented at the 2018 SSEP National Conference

All those that work on the frontiers of human exploration were children once that dared to dream.