



STELLARXPLORERS

The National High School Space Challenge



STELLARXPLORERS History

StellarXplorers I Proof of Concept (2015)

In August 2014, the Secretary of the Air Force's Acquisition Office charged with science, technology, engineering, and mathematics (STEM) outreach asked the Air Force Association (AFA) to consider developing a STEM outreach program similar to AFA'S CyberPatriot cyber education program but with a space theme. The AFA Aerospace Education Council formed a Space Task Force to develop a pilot program. The result was a one-day proof of concept held on April 15, 2015, at the Space Foundation Discovery Lab in Colorado Springs, Colorado. The Air Force STEM Outreach Program sponsored the StellarXplorers I competition and Analytical Graphics, Inc (AGI) provided their Systems Toolkit (STK) software and training on the software.

Five Colorado high schools participated in the competition held in the Space Foundation's Discovery Lab. The teams had three hours to determine the best orbit to uplink data from a remote location and then download the data to a ground station over a seven-day period.

After the competition, teams traveled to the Broadmoor Hotel for a tour of the Space Symposium Exhibit Hall. The Awards Ceremony was held at the AGI booth where Rangeview High School was named the inaugural StellarXplorers National Champion. Enthusiastic responses from the competitors, industry professionals, and senior military leaders made the proof of concept a success, and the Space Task Force immediately began plans for expansion.



The Rangeview High School Space Raiders of Aurora, CO, winners of the first StellarXplorers competition. (left-to-right) Bill Yucuis, AFA Space TF Chair; Gage Niles; Sie Hen Son; Herman Solis; Dave Nuttall; Maj Gen Denker, AF Space Command; and Jerry White, AFA Vice Chair for Education.

StellarXplorers II Pilot National Deployment (2015-2016)

StellarXplorers II planned to expand to a national program and when Kaiserlautern American School in Germany asked to participate, it became international. In addition to the Air Force STEM Outreach Program, StellarXplorers II was also sponsored by OrbitalATK and Kratos Defense. AGI again provided the STK software and training support, while the Space Foundation provided facilities for the completion, access to their Space Symposium, and at-cost tickets for the Symposium banquet.

Twenty-seven teams registered to compete in three online qualification rounds that encompassed three aspects of the space design problem. In addition to having an orbit determination round (similar to StellarXplorers I), teams had a second round to determine the best satellite components for the mission, and a third round to determine the best launch vehicle. An Academic component was added in StellarXplorers II. Teams were provided access to an on line textbook, *Exploration of Space* provided by the Coyote Enterprises, Inc. (CEI), , and during Qualifying Rounds 2 and 3, teams took a 20-question on-line Quiz

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that counted as 20% of their score. The cumulative scores from the three Qualifying Rounds were used to determine the top ten teams that qualified for an all-expense trip to Colorado Springs for the Finals. On Wednesday, April 13, the ten teams arrived at the Space Foundation's Discovery Lab and had eight hours to arrive at the best solution to a space design problem which included all three aspects experienced during the Qualifying Rounds, all within cost and weight constraints. In addition, 20% of the team's final score came from a 15-minute debriefing. On Thursday morning, teams gave their debriefings to a three-person panel and then traveled to the Broadmoor Hotel to visit the Space Symposium Exhibit Hall.

Later that afternoon, an Awards Ceremony was held at a nearby Marriott hotel where the *Sirius Potatoes* team from Palos Verdes Peninsula High School of Rolling Hills Estates, CA, was named the StellarXplorers II National Champion, with another team from Palos Verdes Peninsula placing second, and a team from Rangeview High School, CO, coming in third. The awards were presented by Major General Roger Teague, Director of Space Programs, and Mr. Dick Bundy, AFA Vice Chairman for Aerospace Education. General John Hyten, Commander of Air Force Space Command, and Major General Stephen Denker, Deputy Director, NRO, also were in attendance. Afterwards, teams traveled back to the Broadmoor to attend the Space Symposium Hall of Fame Awards dinner.



StellarXplorers II Champions, Team *Sirius Potatoes* from Palos Verdes Peninsula High School, Rolling Hills Estates, CA. (left to right): Richard A. Bundy, AFA Vice Chair for Education; Team Captain Regina Kim; Eugene Lin; Saahil Parikh; Yodai Takeuchi; Sher Shah; Team Director Mrs. Elizabeth Grenier; and Major General Roger W. Teague, USAF, Director, Space Programs, Office of the Assistant Secretary for Acquisition.

Competitors from StellarXplorers II, ten National Finalist teams represented high schools and other organizations from California, Colorado, Utah, Alabama, and Kaiserslautern (Germany). The diversity of the finalists was especially rewarding to see. Nearly 30% of the finalists were females and the finalists represented all the races: 44% were Caucasian, 24% were Asian/Pacific Islander, 11% Hispanic, and 9% African-American (4% more than one race and 7% declined to designate). Since only one-third of finalists were graduating seniors, we expected to see many of these same students in next year's StellarXplorers III Finals and were not disappointed.

StellarXplorers III Full National Deployment (2016-2017)

StellarXplorers III showed another growth spurt with 131 teams registering, representing 30 states and two overseas locations, Germany and Okinawa. Teams still had three online rounds featuring the three aspects of the space design problem as in StellarXplorers II. The third round, however, consisted of two groups. The top 30 teams after the first two rounds were competing in the Semifinal Round for a place in the National Finals. The second group competed in the Prestige Round. The scenario for both groups involved launch vehicle selection. Like StellarXplorers II, teams had 20-question on-line quizzes but this year it was based on the *Understanding Space* textbook (the textbook used at the Air Force Academy for their Introduction to Space course) donated by Coyote Enterprises, Inc. DoD STEM, Blue Origin, Lockheed Martin, and SpaceX

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joined the sponsor list, and Embry-Riddle Aeronautical University became an additional educational partner. As in StellarXplorers II, the competitors again were a diverse group, with 24% female and only 49% White/non-Hispanic.

From 4-9 April 2017, ten high school teams, including two teams from Germany, gathered in Colorado to participate in the StellarXplorers III Finals. Thursday, April 6 was a day to visit space-related facilities, beginning with a bus trip to the Air Force Academy in Colorado Springs for a tour of their Astronautics Laboratory, where Academy Cadets briefed their FalconSAT spacecraft project. The StellarXplorers students joined the Cadet Wing (4000 cadets) for lunch at the Cadet Dining Facility (Mitchell Hall) where the students were introduced and welcomed. The students were then off to visit the 33rd Space Symposium hosted by the Space Foundation held at the Broadmoor Hotel in Colorado Springs, CO. Students had time to visit the Exhibit Hall and interact with space industry leaders. The visit to the Space Symposium was consistently rated by competitors as one of the highlights of the StellarXplorers National Finals. Following the tours, the students convened in one of the meeting rooms of the Broadmoor Resort for a Pizza Party provided by United Launch Alliance (ULA), the program's first Platinum sponsor. Each student was greeted and welcomed by Salvatore "Tory" Bruno, President and Chief Executive Officer of ULA and General Jay Raymond, Commander of Air Force Space Command. At this event that Mr. Bruno and General Raymond announced that ULA and the Air Force would jointly provide scholarships to each member of the first, second and third place teams in the Finals Challenge.

Early on Friday, April 8, the teams loaded busses for the ride from their hotel in south Denver to the Space Foundation Discovery Center in Colorado Springs, for the StellarXplorers National Finals Challenge. Once again, teams had eight hours to solve a scenario involving all phases encountered during the earlier rounds. Saturday morning, April, the teams presented their out-briefings, worth 20% of their overall score, and were judged by a three-person panel consisting of Kevin Gooder of SAF/AQM, plus Bill Yucuis and Tyler Worley, both of the StellarXplorers staff. Following the briefings, the students toured the Denver Museum of Nature and Science on Saturday afternoon. That included a viewing of an IMAX movie about space engineering. After the tour of the museum, the students returned to the hotel to get ready for the awards reception and banquet.

At the StellarXplorers Awards Banquet, the *Sky Dragons* of San Pedro High School, CA, were named the top team earning the Schriever Trophy, and each student was awarded a \$3000 education grant. The *Scintillators* of Kaiserslautern, Germany, were named the second place team (\$2000 grant), while the *Rocketeer Steers* of Graham High School, TX, placed third (\$1000 grant).



StellarXplorers III National Champions – San Pedro High School *Sky Dragons*. Xavier Jackson and Sareta Gladson (co-Captains); Mr. Doug Martinez, Team Director, Yoseph Jackson. Anthony Munguia, Xhicheng Yu. The team excelled in competition and greeted the out-briefing judges in five different languages.

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Kevin Gooder presented the grants, congratulated all the competitors, and thanked the StellarXplorers staff for their efforts to expand the program and excite the students about space. The following morning, it was time for teams to return to their schools and get ready for StellarXplorers IV.

StellarXplorers IV (2017-2018)

StellarXplorers IV continues to show sustained growth. This year, there are 180 registered teams, up 37% from StellarXplorers III. Teams hail from 31 states, including Hawaii and Alaska, and three overseas locations; Korea, Guam, and Germany. Of the 180 teams, 52 are public schools (non-JROTC), 95 are AFJROTC, 12 are NJROTC, 11 Civil Air Patrol, and two teams 2 are MCJROTC. There are also five magnet schools, a single private school, and two teams sponsored by the Boys and Girls Club. Half the teams are from or support Title I schools and female participation has risen to 30%. The competitors remain a more diverse group than the U.S. as a whole, with less than 60% White Non-Hispanic, 14% Hispanic, 13% Asian/Pacific Islander, 3% Black, and 9% two or more races.

For StellarXplorers IV, a Quarter Final Round was added between the Qualifying Round and Semifinal Round. For the National Finals, an individual closed book quiz will be given to all students. The National Finals will again be held in Colorado Springs, CO, from April 16-21, 2018.

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