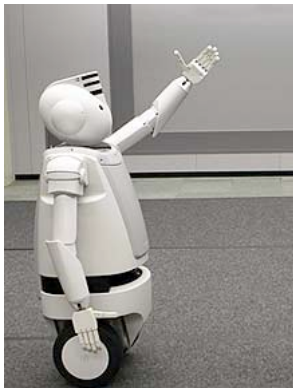
Why Robots and Robotics?

Building a pipeline into America's technical and scientific workforce

- **RIGOR**
  - **Measuring student achievement on a national and global scale by competing in national and international tournaments…. referred to as "Superbowl of Smarts"**
  - **Strong motivator for mathematics and science learning, leading to careers in science, technology and engineering with ultimate impact on national security, the economy, and leadership in development of future technologies (work force development).**

- **RELEVANCE**
  - **Increases the technological literacy of students and adults by making abstract concepts concrete (standards).**
  - **Catalyst for integrating knowledge from all disciplines, including mathematics, science, social studies, English language arts, art, etc.**

- **RELATIONSHIPS**
  - **Develops team work, communication skills, critical thinking skills, problem/project/ contextual based learning.**
  - **Sports like games and challenges with culminating tournament ….. sports for the brain….keeps students engaged after school and on weekends (keeping them drug free)**



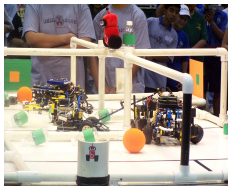
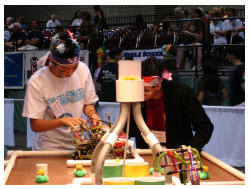
- **In summary….Robotics….Rigor ….. Relevance ….. Relationships**

Summary of scholastic robotics programs offered in Hawaii

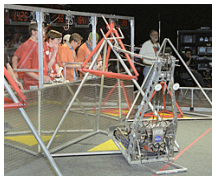
- **Elementary school programs**
  - FIRST Lego League
  - Junior FIRST Lego League
  - Robofest

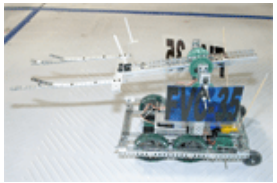


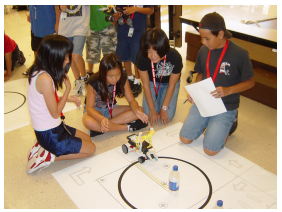
- **Middle school programs**
  - FIRST Lego League
  - Botball
  - Underwater ROV (HURC, BIRR)
  - VEX
  - Robofest

- **High school programs**
  - FIRST Robotics Competition
  - Botball
  - Underwater ROV (HURC, BIRR)
  - VEX
  - Micro Robot

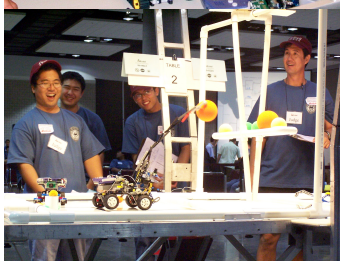


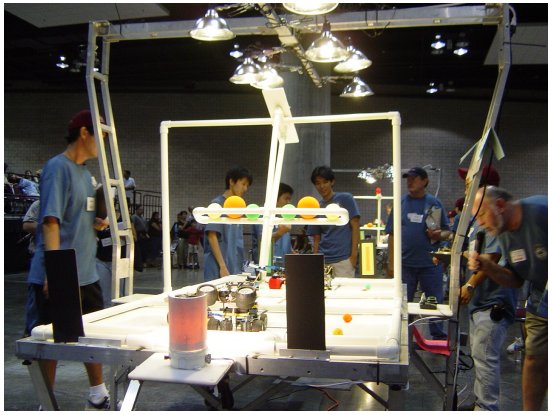


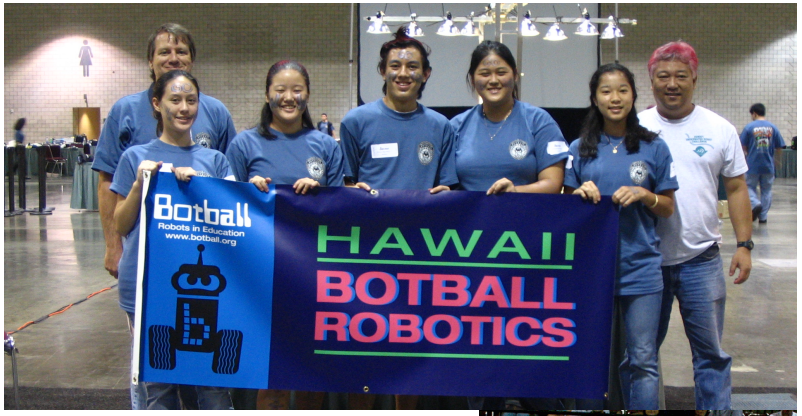


- **Robotics camps**
  - *Future Flight Hawaii* (Maui)
  - Hawaii Island Robotics Academy (Hilo)
  - Camp Eureka (Hilo)

Future Flight Hawaii
Using space to catalyze student interest in science, technology, and the future.
Space-themed educational programs







Middle and high school

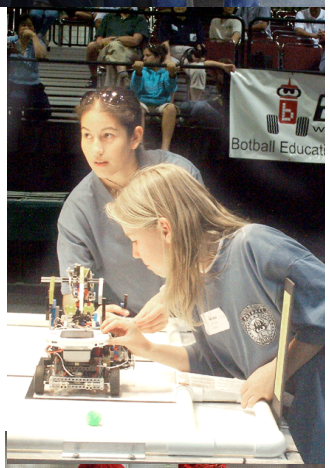
Growth:

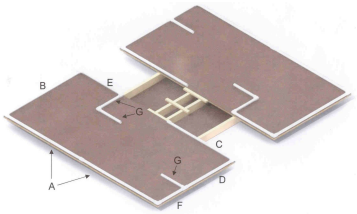
- *in 5 years, 38 Hawaii teams (2008); 2nd largest regional in the US
- *hosted national Botball tournament in Honolulu, 2007, 65 teams
- *Act 111: 2008 (partial tournament sponsorship; 18 partial scholarships)
  2009 (20 scholarships)

Cost: $2500 (kit, training, tournament)

- *robots operate autonomously (no human control)
- *skill sets: programming, sensor applications

Partners: College of Engineering, Hawaiian Electric Company, Hawaii Convention Center, Hawaii Space Grant Consortium, Projection Presentation Technology, BAE, Referentia, KEDB



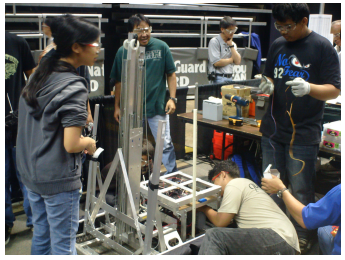
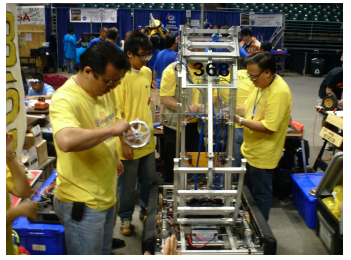
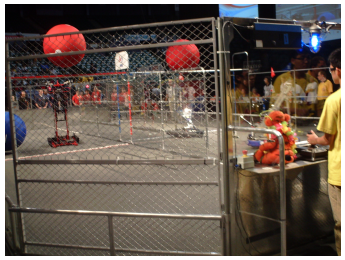


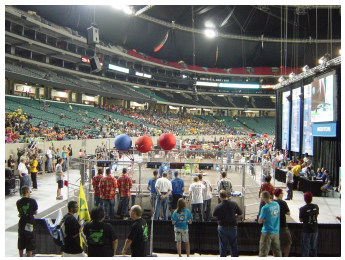
Botball

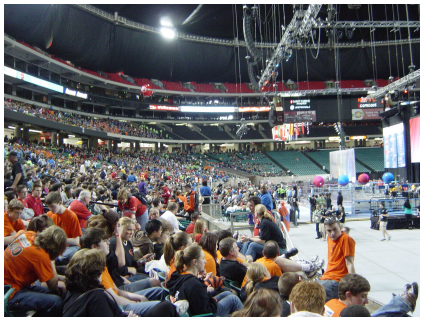
For Inspiration and Recognition of Science and Technology (FIRST)

- high school
- Growth:
  - *2007 (4 Hawaii teams); 2008 (24 Hawaii teams)
  - *2008 Hawaii hosted 1st FIRST regional with 37 teams
  - *2008: 6 teams qualified for national tournament
  - *Act 111: 2009 (7 scholarships)
- Cost: $6000 (kit, tournament)
- robots operate autonomously and with wireless remote control
- skill sets: mechanical, electrical, use of tools, software
- Partners: NASA, University of Hawaii, DBEDT/State of Hawaii, BAE Systems



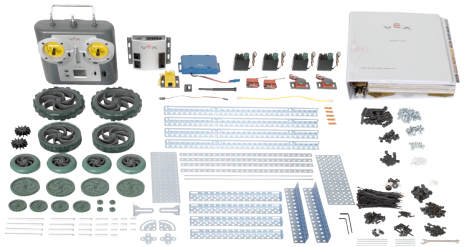




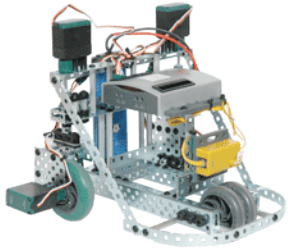





International VEX Robotics Competition

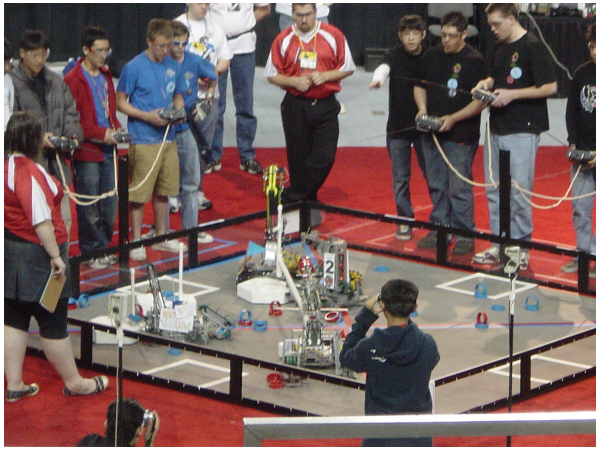
Middle and high school





Growth:

- ***inaugural year (2008): goal—50-60 Hawaii teams**
- ***hosting 1st Pan Pacific VEX Championships, December 2008, Honolulu with an anticipated 100-120 teams from Hawaii, Asia, mainland US**
- ***Act 111: 2008 (50 team registrations; 40 kits; 3 VEX fields; summer training)**

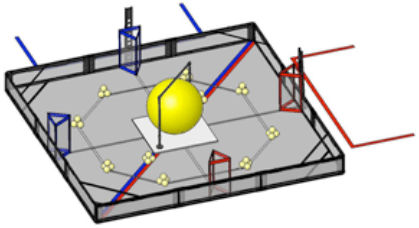


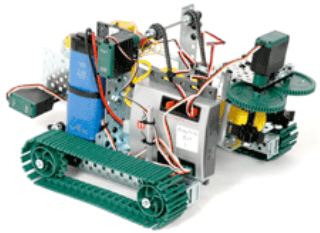
Cost: $1000 (kit, tournament)

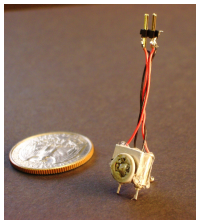
***robots operate autonomously and with wireless control**

***technical skill sets: programming, mechanical**

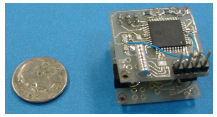
Partners: College of Engineering, Innovation FIRST, Hawaii Convention Center, DBEDT/State of Hawaii, HECO, MECO, HELCO





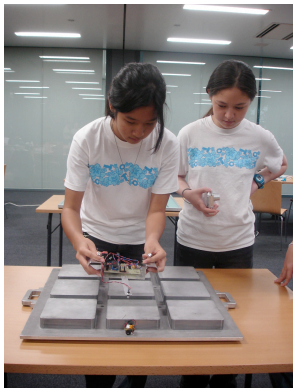


International Micro Robot Maze Contest, Nagoya, Japan, November 9, 2008



High school

Growth: 2007: 1st year: Waiakea High School, 1st team in the US to participate
2008: combined Waiakea High/Hilo High School team will participate
Act 111: none (2008)
goals: train other schools in part through a web based tutorial
host a Hawaii based micro robot contest
develop an elementary and middle school micro robot program



Cost: $200 (parts)

Categories: 1 cubic inch, 1 cubic centimeter, 2 inch bipedal (wired or autonomous)

Partners: East Hawaii Robotics Alliance; College of Engineering (mentor)

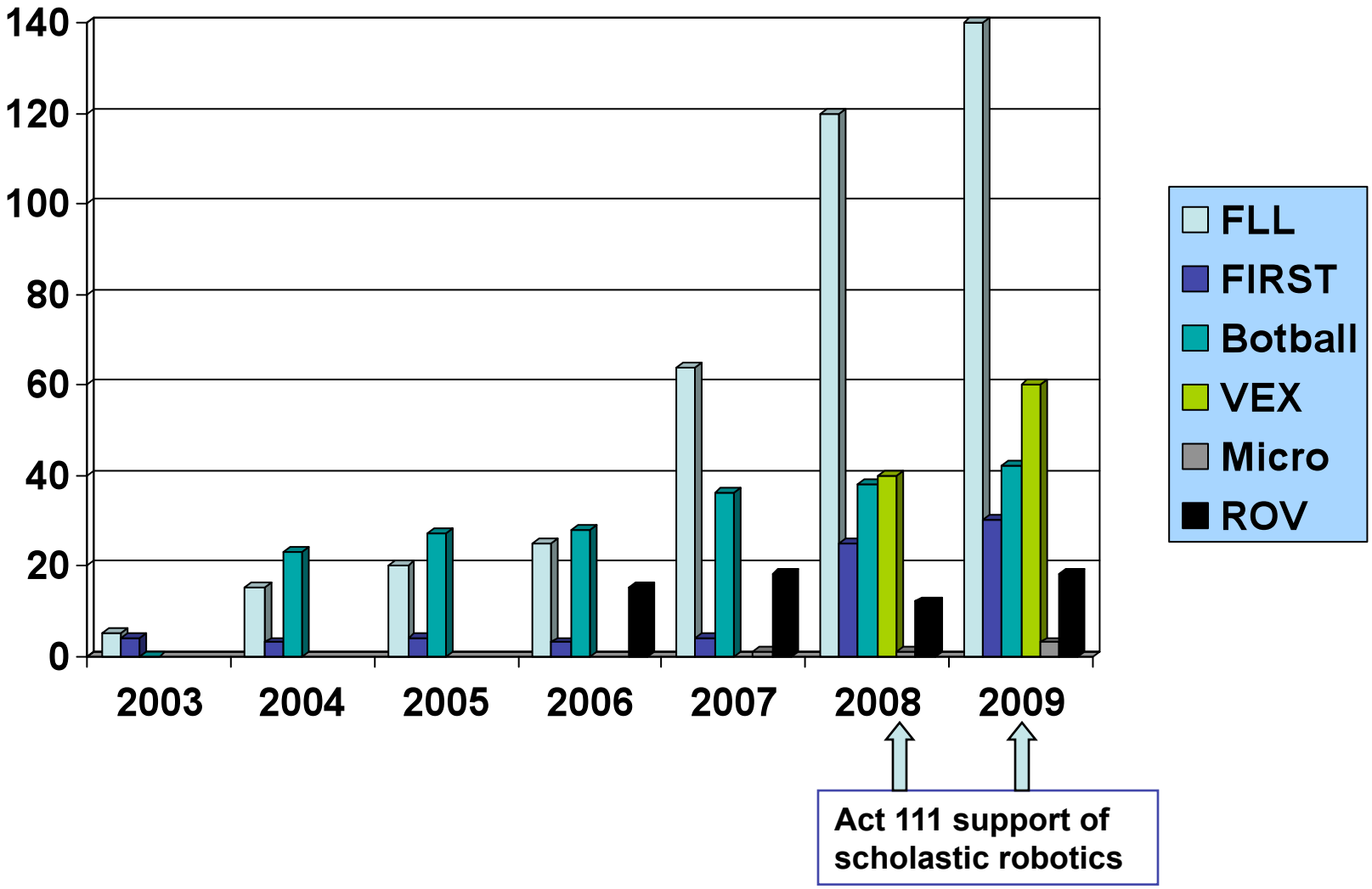
***skill sets: design/fabrication of circuit boards, soldering, sensors, programming**

***outcome: invitation to participate in Super Science Fair, Ritsumeikan University, October 2008**

94 public schools participated in scholastic robotics competitions in 2007-2008 school year

- **FIRST Lego League: 39 public schools (2007)**
  - Aikahi Elementary, Aina Haina Elementary, Aliamanu Intermediate, Assets, August Ahrens Elementary, Calvary Chapel, Connections PCS, DeSilva Elementary, Hahaione Elementary, Hanahouli, Hickam Elementary, Highlands Intermediate, Iao Intermediate, Iolani, Jefferson Elementary, Kaelepulu Elementary, Kaleiopuu Elementary, Kahuku Elementary, Kalakaua Middle, Kalihi Waena Elementary, Kamakahelei Middle, Kaneohe Elementary, Kawananakoa Middle, Kula High and Intermediate, Maemae Elementary, Makalapa Elementary, Mid Pacific Institute, Moanalua Elementary, Moanalua Middle, Momilani Elementary, Nawahiokalaniopuu, Niu Valley Middle, Noelani Elementary, Pearl City Elementary, Pearl Harbor Elementary, Pearl Habor Kai Elementary, Pearlridge Elementary, Punahou, Sacred Hearts Academy, Seabury Hall, Thompson Academy, Waianae Intermediate, Waialua Intermediate, Mililani Middle, Waialua Elementary, Waipahu Intermediate, Washington Middle, Webling Elementary
- **Botball: 29 public schools (2008)**
  - Baldwin High, Earl's Garage, Farrington High, Hanalani Schools, Hawaii Preparatory Academy, Highlands Intermediate, Hilo High School, Hilo Intermediate School, Honokaa High, Iao School, Innovations PCS, Iolani, Kahuku High and Intermediate, Kamakahelei Middle, Kapaa Middle, Kealakehe High, Kekaulike High, King Intermediate, Lanai High, Maui Waena Intermediate/Maui High, Moanalua High, Moanalua Middle, Olomana, Roosevelt High, Stevenson Intermediate, Wahiawa Middle, Waiakea High, Waiakea Intermediate, Waimea Canyon Middle, Waimea Middle, Waipahu Intermediate, Washington Middle
- **Underwater ROV: 9 public schools (2007)**
  - Assets, Connections PCS, Hilo High, Hilo Intermediate, Kailua High, Kealakehe Intermediate, Mililani High, Moanalua High, Sacred Hearts, St. Josephs, Waimea High, Waters of Life PCS
- **FIRST Robotics: 16 public schools (2008)**
  - Baldwin High, Campbell High, Farrington High, Hawaii Baptist Academy, Hilo High, Honokaa High, Iolani, Island School, Kamehameha School, Kapolei High, Kohala High, Maryknoll High, Maui High, McKinley High, Moanalua High, Nanakuli High, Punahou, St. Louis High, Parker School, Radford High, Sacred Hearts Academy, Waimea High, Waiakea High, Waialua High, Waipahu High
- **VEX Robotics: new tournament, fall 2008**
- **Micro Robot: 1 public school (2007/2008)**
  - Waiakea High

Goal: provide each school that would like to engage students in STEM through robotics with the opportunity and support—125+ public schools by 2009



Why robotics….the evidence is compelling: Botball

93% of students surveyed stated that Botball was one of the best or better things they've ever done at school.

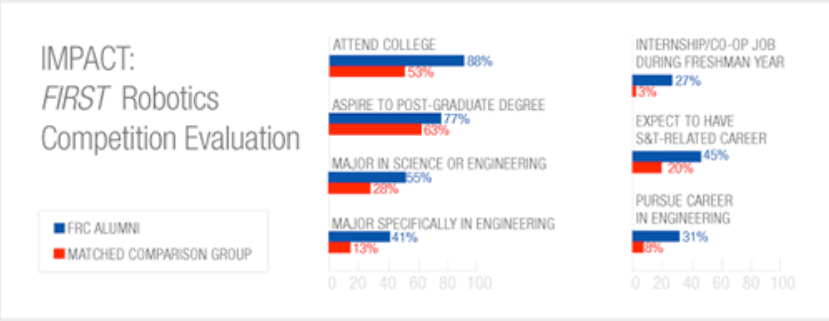
89% of students participating in Botball feel more confident with technology after participating in Botball

93% of students feel that of all their academic/club experiences, Botball is one of the best or better things they've done

Why robotics….the evidence is compelling: FIRST

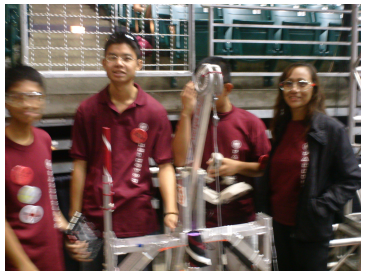
When compared with the comparison group, FIRST students are:

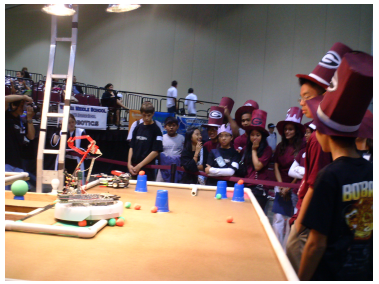
•More than 3 times as likely to major specifically in engineering.
*** More than twice as likely to expect to pursue a career in science and technology.**
*** 10 times as likely to have had an apprenticeship, internship, or co-op job in their freshman year.**
*** Significantly more likely to expect to achieve a post graduate degree.**
*** Nearly 4 times as likely to expect to pursue a career specifically in engineering.**



The evidence is compelling….inspiring a technical work force

- Attended 8 week NASA INSPIRE internship, summer, 2008
  - Kelson Lau, Waiakea High School, Ames Research Center
    - Botball, FIRST Robotics, underwater ROV, micro robot
    - Governor's Innovation Award
    - ISEF: Novel Servo-Controlled Bipedal Micro-Robot
- Attended 10 week NASA Robotics Academy internships in summer, 2008
  - Julian Yuen, Farrington High School, Goddard Space Flight Center
    - Botball, FIRST
    - Attending MIT fall 2008, Electrical Engineering
  - Jordan Olive, Waiakea High School, Ames Research Center Attending 8 week NASA INSPIRE internship, summer, 2008
    - Botball, FIRST, underwater ROV, micro robot
    - Career aspiration: Aerospace Engineer




Wideband applications to support robotics sustainability and expansion….goal: equity

- **Dissemination of information and communication**
  - **Live and archived events**
  - **Video streaming and pod casting of tournaments and results**

ROC
ROBOTICS ORGANIZING COMMITTEE

FIRST ROBOTICS VEX ROBOTICS
FIRST LEGO LEAGUE BOTBALL
MICRO ROBOTS UNDERWATER ROV

- **Teacher, student and mentor professional development**
  - **Web based modules**

    Robotics with the XBC Controller : August 8 - September 7
    http://robotics.nasa.gov/courses/summer06/

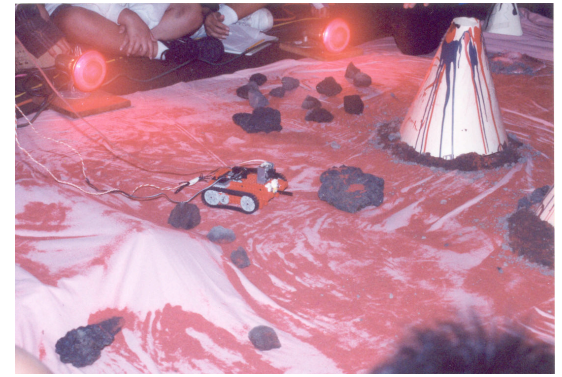
    VEX Robotics in Engineering Online Course : June 21 - July 29
    http://robotics.nasa.gov/courses/summer05

  - **Video conferencing and cable television delivery**

Wideband applications to support robotics sustainability and expansion….equity

- **National and international collaboration**
  - **Internet and video and web cam conferencing**
    - **Workshops, virtual mentoring**
    - **Gracious professionalism—collaboration of ideas**

- **Facilitating project based learning and virtual tournaments**
  - **Tele operated robotics, analog to real world applications**
  - **Criteria based competitions (results streamed into common site for scoring)**
  - **Example: Virtually Marsville (Japan/Hawaii collaboration): 10 schools**



Robots in Hilo controlled via internet by students in California