2015-2016 CONNECTICUT COMMUNITY COLLEGE QUADCOPTER CHALLENGE

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NORTHWESTERN CONNECTICUT COMMUNITY COLLEGE

OBJECTIVES

- (1) Increase the number of community college students who graduate with STEM degrees and/or transfer to STEM programs at four-year institutions.
- (2) Increase the ability of community college faculty to deliver aerospace-related content in areas of interest to NASA , and
- (3) Enhance the diversity of students pursing STEM education at Connecticut community college.

SETUP

- Five student teams of five students were selected to participate, each advised by a community college faculty member.
  - This year, five teams from four community colleges participated.
- Each team was provided one of two quadcopter kit.
- Parallax ELEV-8 v3 kit (~$500)
  - For teams who have experience assembling, soldering skills, and time.
- 3DR IRIS+ (~ $420)
  - For teams with little or no experience assembling kits.

SETUP

- The teams had to build a quadcopter, learn how to fly a quadcopter, and significantly modify their quadcopters.
- Each team had a budget of approximately $500.
- Modifications were needed to mount sensors, actuators, and electronics necessary for challenge requirements.

CHALLENGE REQUIREMENTS & EVALUATION

- **10% Videos**: Each team must create a video describing their quadcopter, with a demo. 1-2 minutes long each, to possibly post on YouTube, peer-rated at the competition

- **10% Rotor protection**: The team must design, fabricate and install rotor protection for the quadcopter. CAD-drawn (at least), required whenever flying the ELEV-8 quadcopter

- **10% Multi-pilot**: At least 3 team members must demonstrate basic flying skills this will not be a timed task.

CHALLENGE REQUIREMENTS & EVALUATION

- **10% Camera mount**: Each quadcopter must be equipped with a camera mount of some type. The mount must be CAD-drawn, must be fabricated using 3-D printing and/or laser cutting, must be switchable between outview & down view within 60 seconds, and may not use Velcro or tape.

- **10% Close-up imaging:** The quadcopter must be able to take images (while in flight) of targets on horizontal and vertical surface

CHALLENGE REQUIREMENTS & EVALUATION

- **40% Exploration:** The quadcopter should aid in exploration of an area, by providing general characterization and mapping of an “exploration region”: take photos and/or video, log environmental conditions using sensors, ultimately generate 3-D map(s) (i.e. include elevation variation) with real units

- **10% Unique (flight hardware) feature**: The team should design and implement a unique feature to the quadcopter. This feature does not have to be useful for accomplishing challenge goals (exploration), but it must be non-trivial.

STEP 1: RECRUITMENT

- Faculty from consortium members were recruited for faculty advisors.
  - Faculty advisors received a compensation of $2000 for their time.
- Teams of four or five students were recruited from Connecticut community colleges.
  - Each team contributes to diversity goals – at least 40% women and at least 20% under represented.
  - Each student participant will achieve “significant engagement” level over the course of one year – 80 hours with $1000 stipend.

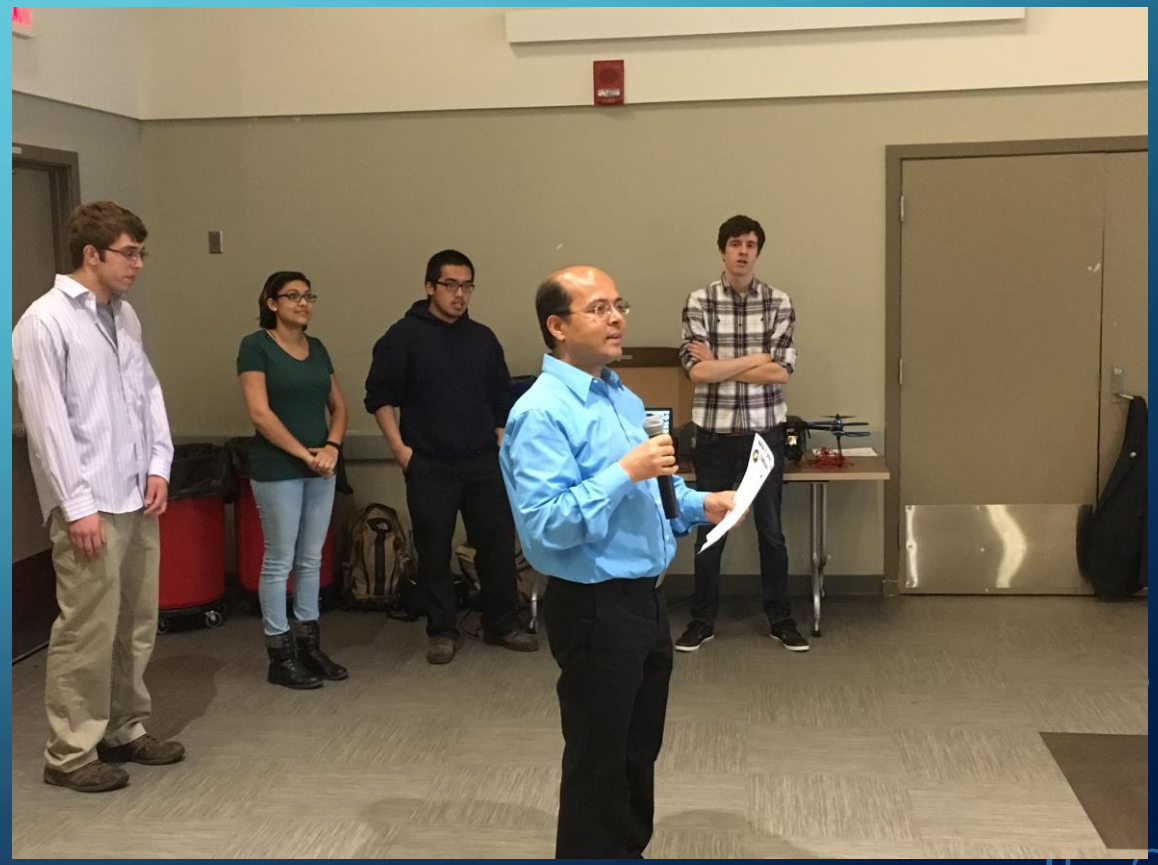
HOUSATONIC FLYERS

HOUSATONIC CC
BRIDGEPORT, CT

- Faculty advisor: Stella Litwinowicz
- Student members:
  - Blake Bennet
  - Brandon D'Agostino
  - Nicole Dineson
  - Nicholas Saint
  - Christopher Torok

NV FLYING HIGH
NAUGATUCK VALLEY CC
WATERBURY, CT

- Faculty advisor: Narendra (Ren) Sharma
- Student members:
  - John Beane
  - Joseph Dolan
  - Maari Lang
  - Khoa Nguyen
  - Bibi Rahamatullah



THE QUAD SQUAD: TEAM A

NORTHWESTERN CT CC

WINSTED, CT

- Faculty advisor: Doug Hoffman
- Student members:
  - Kristen Mallery
  - Jesse Marek
  - Michael Pavlik
  - Jeffery Wright

THE QUAD SQUAD: TEAM B
NORTHWESTERN CT CC
WINSTED, CT

- Faculty advisor: Doug Hoffman
- Student members:
  - Daniel Fetzner
  - Lillian Orelup
  - Pedro Pinales
  - William “Perry” Weingart

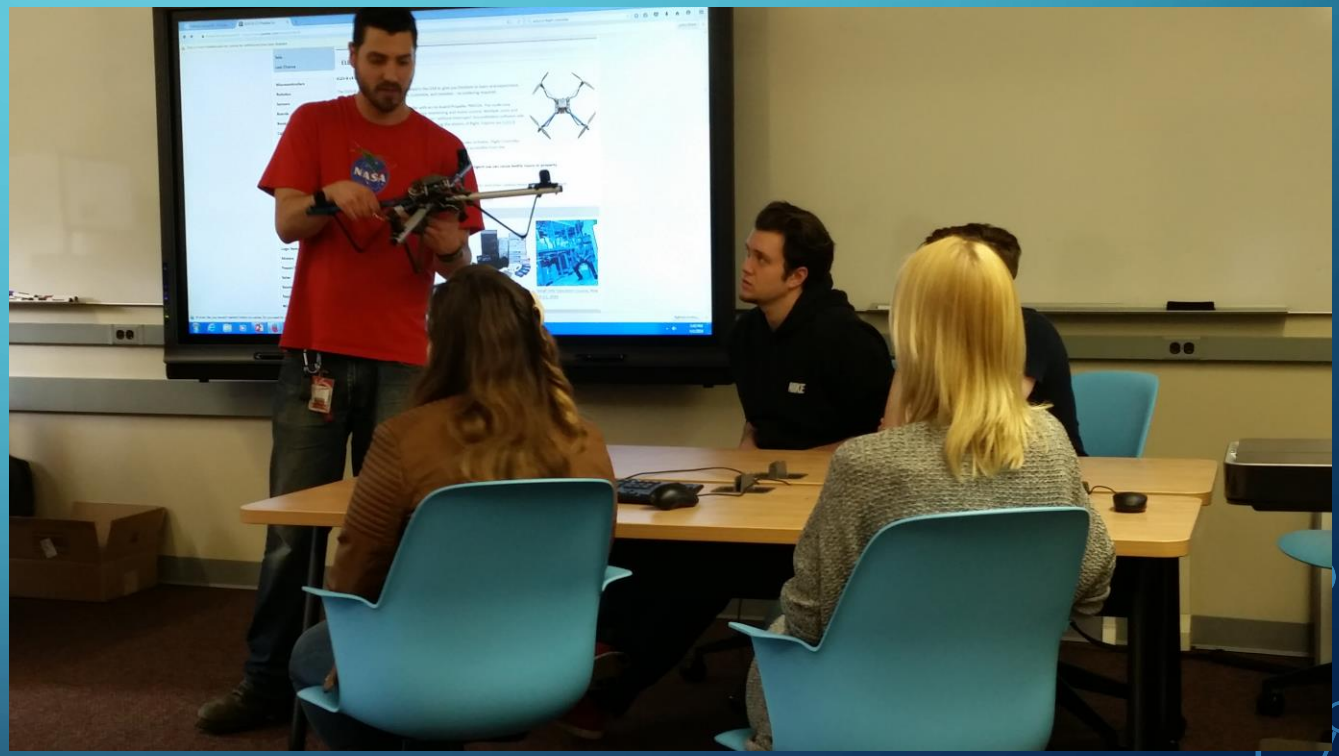
QUINEBAUG QUADCOPTER

QUINEBAUG VALLEY CC
DANIELSON, CT

- Faculty advisor: Jakob Spjut
- Student members:
  - Eric Abell
  - Amy Skrzypczak
  - John Gray
  - Melanie McFadden
  - Rhys Mills

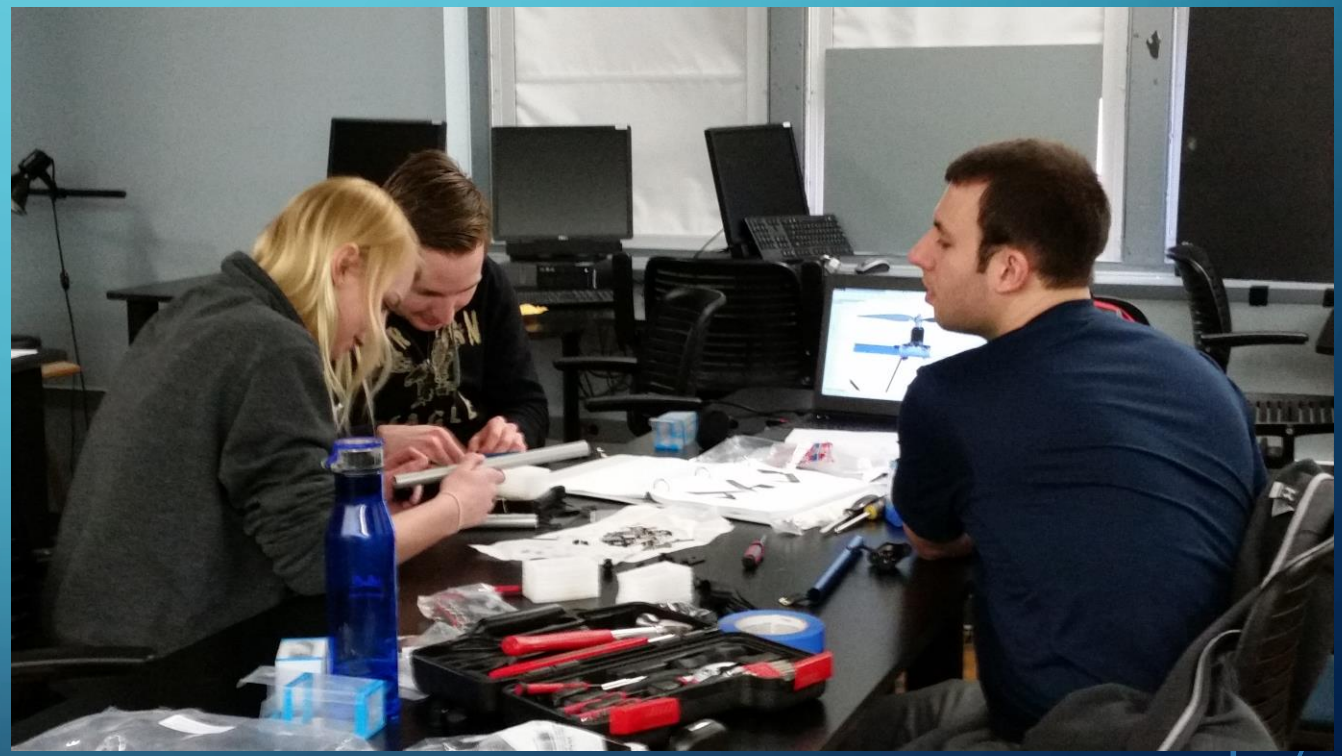
STEP 2: TRAINING

- Necessary skills for the competition.
  - Soldering
  - Programming microcontrollers
  - CAD software
  - 3D printing/ laser cutting
- University of Hartford graduate student Enrico Obst was available for training and questions through out the challenge.



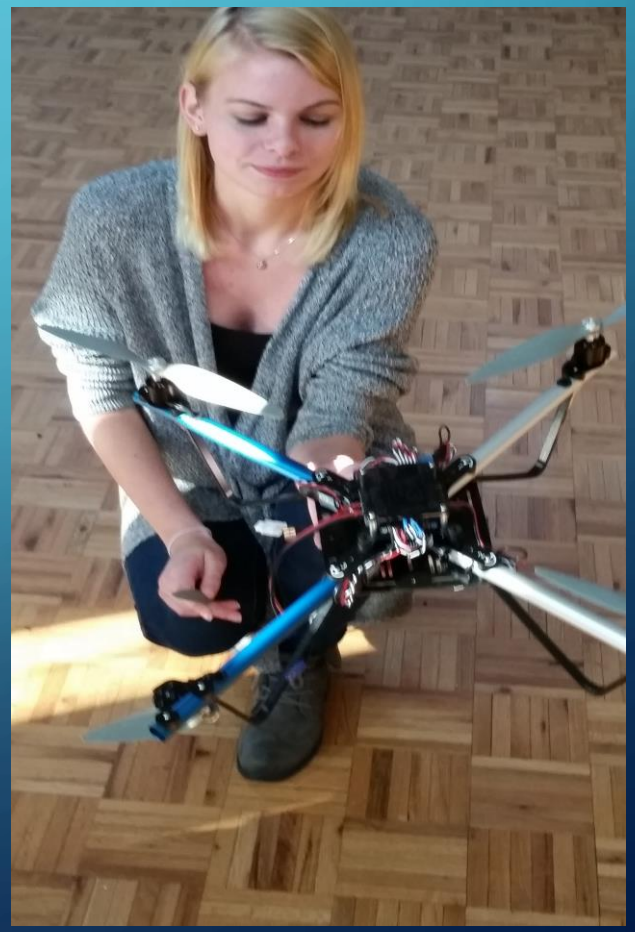
STEP 3: BUILDING THE QUADCOPTER

- Each team could choose their quadcopter kit.
- ELEV-8 kit
  - Build time of 5-10 hours.
- 3DR IRIS+ kit
  - Build time of minutes.
- Teams worked together to assemble the quadcopters and troubleshoot any problems.



STEP 4: LEARNING TO FLY THE QUADCOPTER

- After assembling the quadcopter, teams had to design rotor guards.
  - Guards had to be CAD-drawn and 3D printed/ laser cut.
- After guards were installed, teams then learned how to fly the quadcopter.
- The Challenge required at least three team members to demonstrate basic flying skills.
- TIP: keep extra rotor blades and brushless motors on hand for crashes…



STEP 5: MODIFYING THE QUADCOPTER

- At this stage, teams had to
  - Design their camera mounts, and
  - Decide upon modifications for their quadcopter.
- Modifications to the quadcopter were influenced by which challenge requirements a team wanted to complete.
  - Close-up imaging or Arduino-logged sensor pack
- Numerous inexpensive market sensors and actuators that can be controlled by an Arduino microcontroller.

STEP 6: PARTICIPATE IN CHALLENGE EVENT

- The Challenge event was held at the University of Hartford on May 13th.
- The Challenge consisted of three parts.
  - Presentation of the quadcopter to the judges.
  - Multi-Pilot demonstration
  - Exploration and data collection.

PRESENTATION OF QUADCOPTERS

- Teams presented their quadcopter to the judges, explaining the modifications and features.
- Each team created a video describing their quadcopter.
- The video also included a flying demonstration.

MULTI-PILOT DEMONSTRATION

- Three members of each team demonstrated basic flying skills to the judges.
- This was not a timed task.

EXPLORATION AND DATA COLLECTION

- Each team selected one member to fly the quadcopter through the challenge course.
- The course consisted of
  - A several of cardboard boxes
  - A bucket of sand and bucket of water
  - A couple of magnets

AFTER THE CHALLENGE

- Teams wrote up a post-competition report.
- Teams created a poster for the CT Space Grant Consortium Grants Expo.
- Some teams continued to work on their quadcopter during the summer.

MANY THANKS TO…

- Connecticut NASA Space Grant for sponsoring the event.
- Enrico Obst for providing training and talking about other Space Grant opportunities.
- Kenny Nienhusser for providing photos for the presentation.
- The faculty advisors, the students and the judges.