

# RET 2012 - Follow-up

## Crafting an Engineering Program for High School Students

How RET has enriched the content

Marie Aloia

Bayonne High School

December 13, 2012



Mentors:

Zhonghui Huang and Dr. James Scicolone

## Teaching Engineering

### Locally Designed Program

- Three aspects
  - Engineering concepts and theory with math
  - Hands on applications of the theory, with measurement and/or evaluation
  - Writing – documenting the process and results
- Two levels
  - Year 1: Fundamentals, several topics, small projects
  - Year 2: Long term and competitive projects

## Intro to Engineering - topics

### First Quarter

- Engineering Design Method
- Systems Engineering
- Engineering Societies
- Patent Law
- Project Management
- Entrepreneurship

### Second Quarter

- Mechanical Engineering
  - machines
- Structural/Civil Engineering
- Heat Transfer
- Chemical Engineering
- Engineering Games/Toys

### Third Quarter

- Electrical Engineering
  - DC circuits and motors

### Fourth Quarter

- Special topics
  - Solar energy
  - Hydrogen cars
  - TEAMS/TSA
- Acoustical Engineering
  - Build instruments
- Final Project/Presentation
  - Analyze “How it’s Made” for
  - Systems/patents/management
  - Entrepreneurship

## Engineering - Long term projects

Students typically have more than one project

Team Projects include:

- FIRST Tech Challenge
- Panasonic CDC
- TEAMS and TSA
- Young Science Achievers Program, YSAP

Solo projects include:

- Projects continued from summer internships
- Student proposals
- Also YSAP

## RET - Summer 2012

Two projects:

1. Create a database of coated powder properties to validate a mathematical model that can predict bulk properties based on the host and guest particle characteristics
2. Create a blends database showing the effect of coatings on each of the components, the API and major excipients, on the bulk properties of the blend

## What RET brings to my classroom this year

Fluid Mechanics: use Fluid Power Lab and add-ons

- Hydraulics – project 1
  - Hydraulic Arm build lab – (Teacher Geek)
  - Evaluate and test arm for mechanical advantage
- Pneumatics – project 2
  - Demos with table top compressor and vacuums
  - New kit for the FTC team – demo in January
- Solids fluidization – project 3
  - Build solids fluidization box with interchangeable plates. Test with various materials.

## Hydraulics - Project 1

Hydraulic Arm model from kit

- 3 directional pistons
- 1 claw control piston

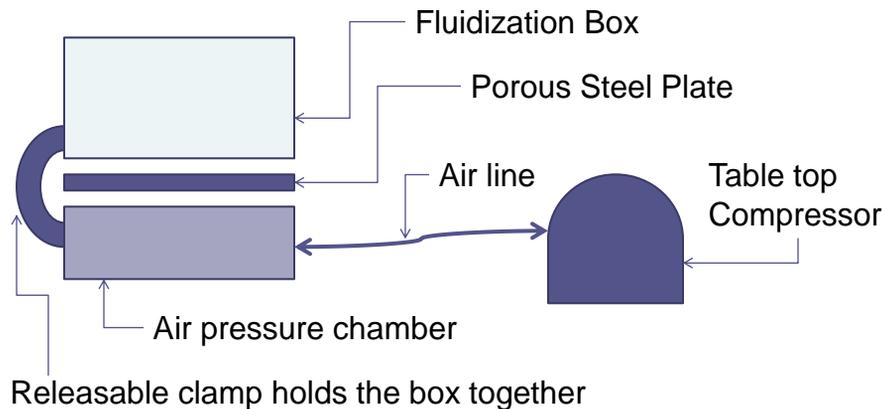
Learning experience includes

- Design
  - the kit has several variations
- Hand skills, planning, construction
- Measurement
- Use of Engineering notebook



## Solids Fluidization -Project 3

Construction Plan





## Lessons for Solids Fluidization

NJCCC 8.2

- Students will observe and understand how the device works
- Student will vary the plate types and measure how the difference in air flow affects fluidization
- Students will vary the air flow rate
- Students will fluidize various materials
- Students will optimize the fluidization parameters for each substance.
- Generalize the parameters needed to fluidize



## Assessment of Student Work

1. Engineering notebook
  - General format, eg. page numbers, dates
  - Orderly data tables, all entries identified
  - Comments and reflections on observations
2. Written assignments
  - Reports, solo and team based
3. Oral presentations and/or demonstrations



## Thanks Again to:

### Pre-College Programs

- Dr. Howard Kimmel
- Levelle Burr-Alexander
- Dr. Linda Hirsch
- Dr. Narh Kwabena

### York Center Lab

- Dr. Rajesh Dave, Dr. James Scicolone,  
and Dr. Ecevit Bilgili
  - Maxx Capece and Amanda Guertin (2012–REU)
  - And especially to Zhonghui Huang for all her help
- Financial support by NSF: (Award: EEC 908889)