# Controls, Robotics, and Automation With Respect for Human Interaction

**Dr. Joshua Vaughan**

Rougeou 225

joshua.vaughan@louisiana.edu

@Doc_Vaughan

http://www.ucs.louisiana.edu/~jev9637/

# C.R.A.W.LAB

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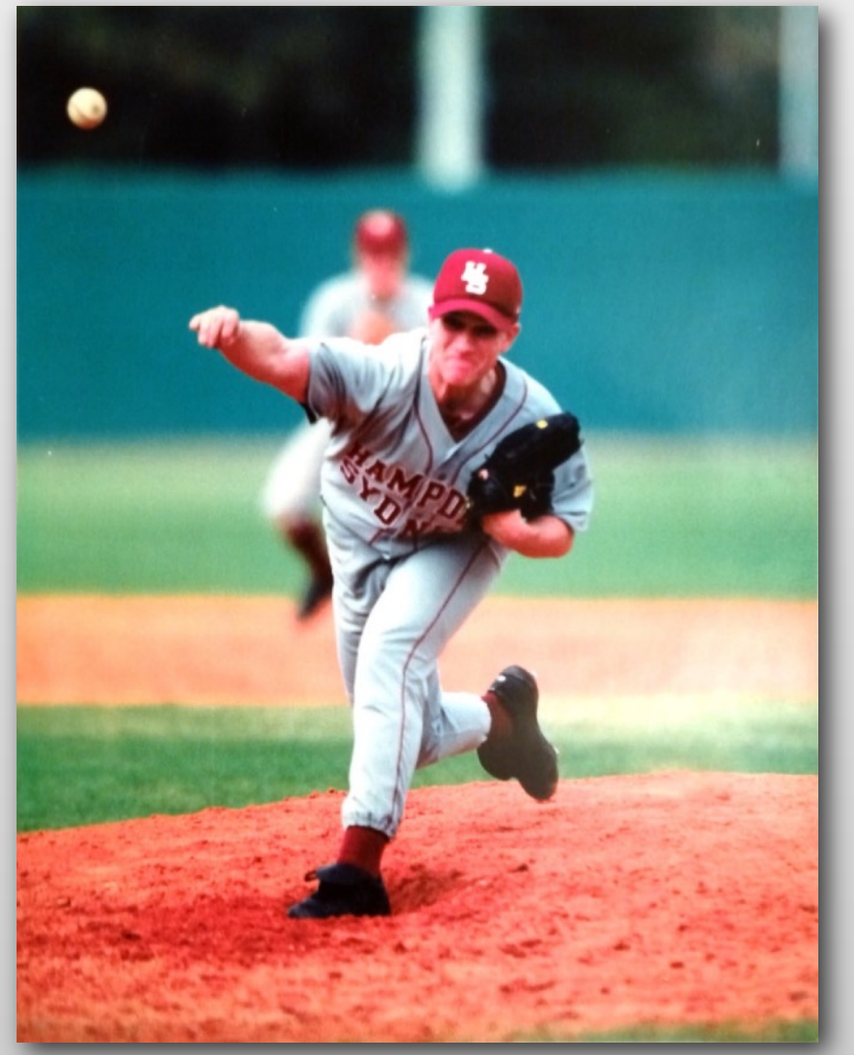
# First, Some Info on Me

- Grew up in Southern Virginia
- Bachelor's from Hampden-Sydney College in May 2002
  - Double Major: Physics and Applied Math
  - 4-year starting pitcher



# Grad. School

- Graduate School at Georgia Tech
  - Advisor: Dr. William Singhose
  - M.S. in May 2004
    - ✦ Thesis: *Active and Semi-Active Control to Counter Vehicle Payload Variation*
  - Ph.D. in August 2008
    - ✦ Thesis: *Dynamics and Control of Mobile Cranes*


# Postdoc

- Tokyo Institute of Technology with Dr. Shigeo Hirose

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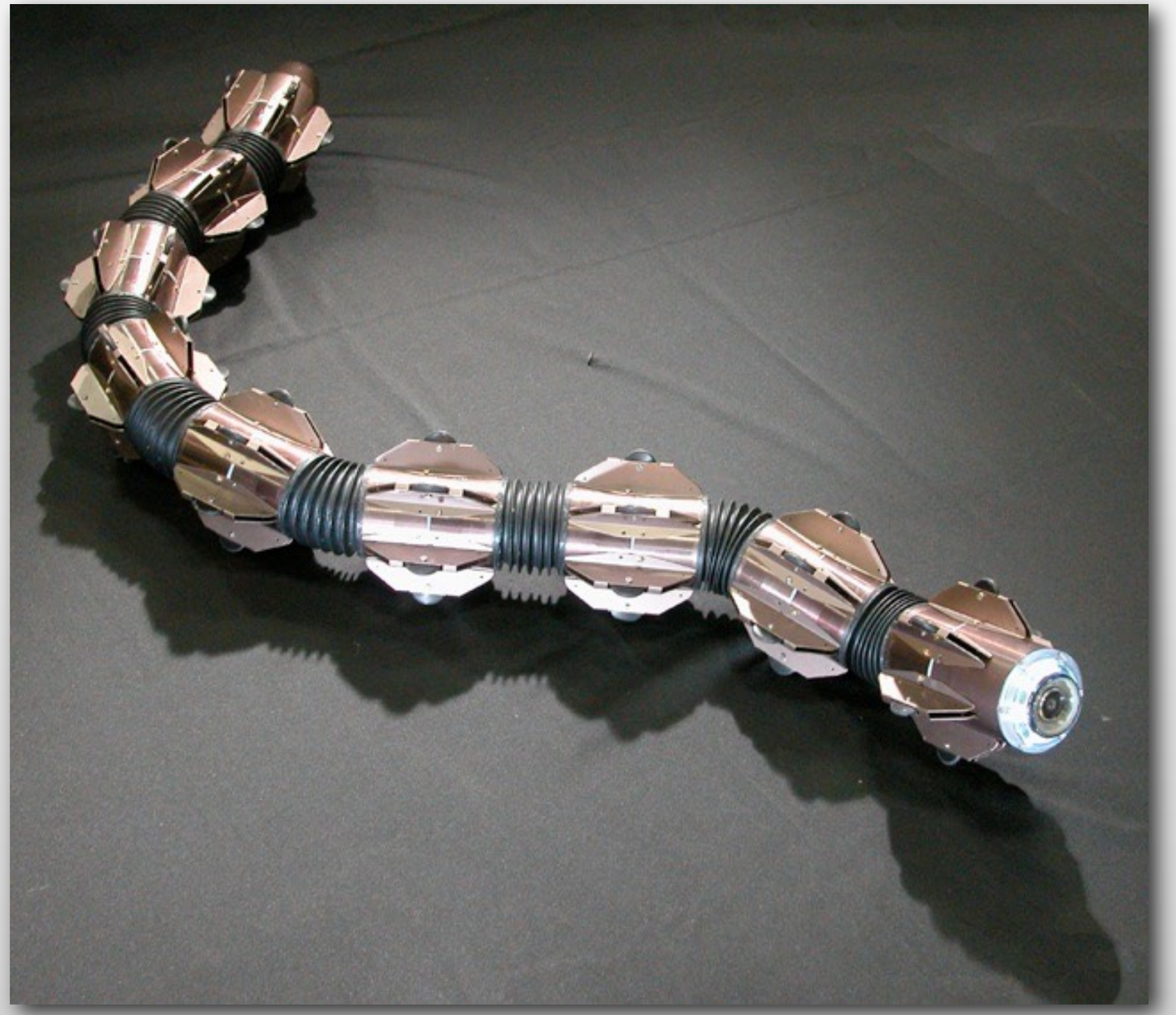
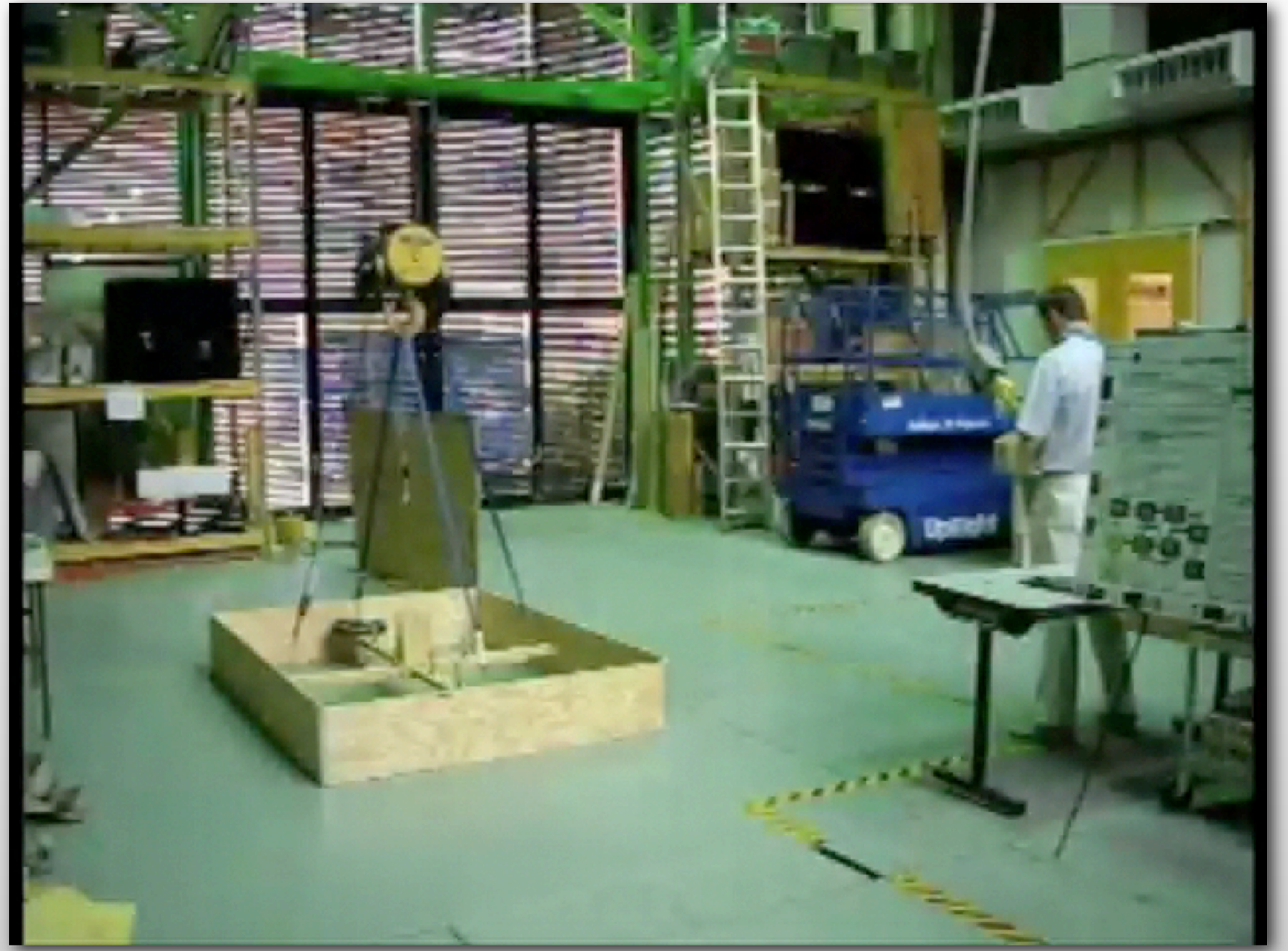


# 10-ton Bridge Crane

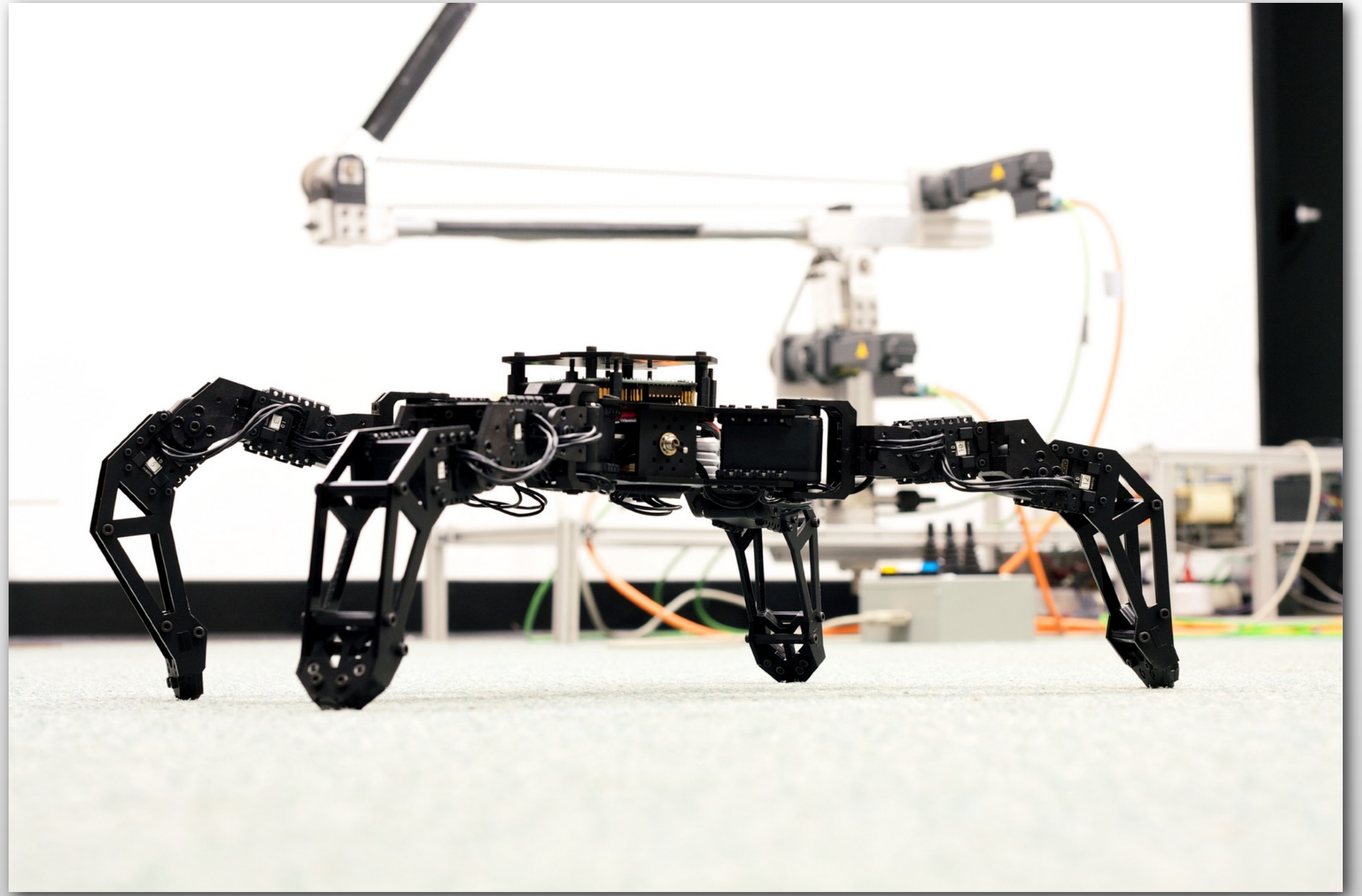


# High-voltage Power Lines

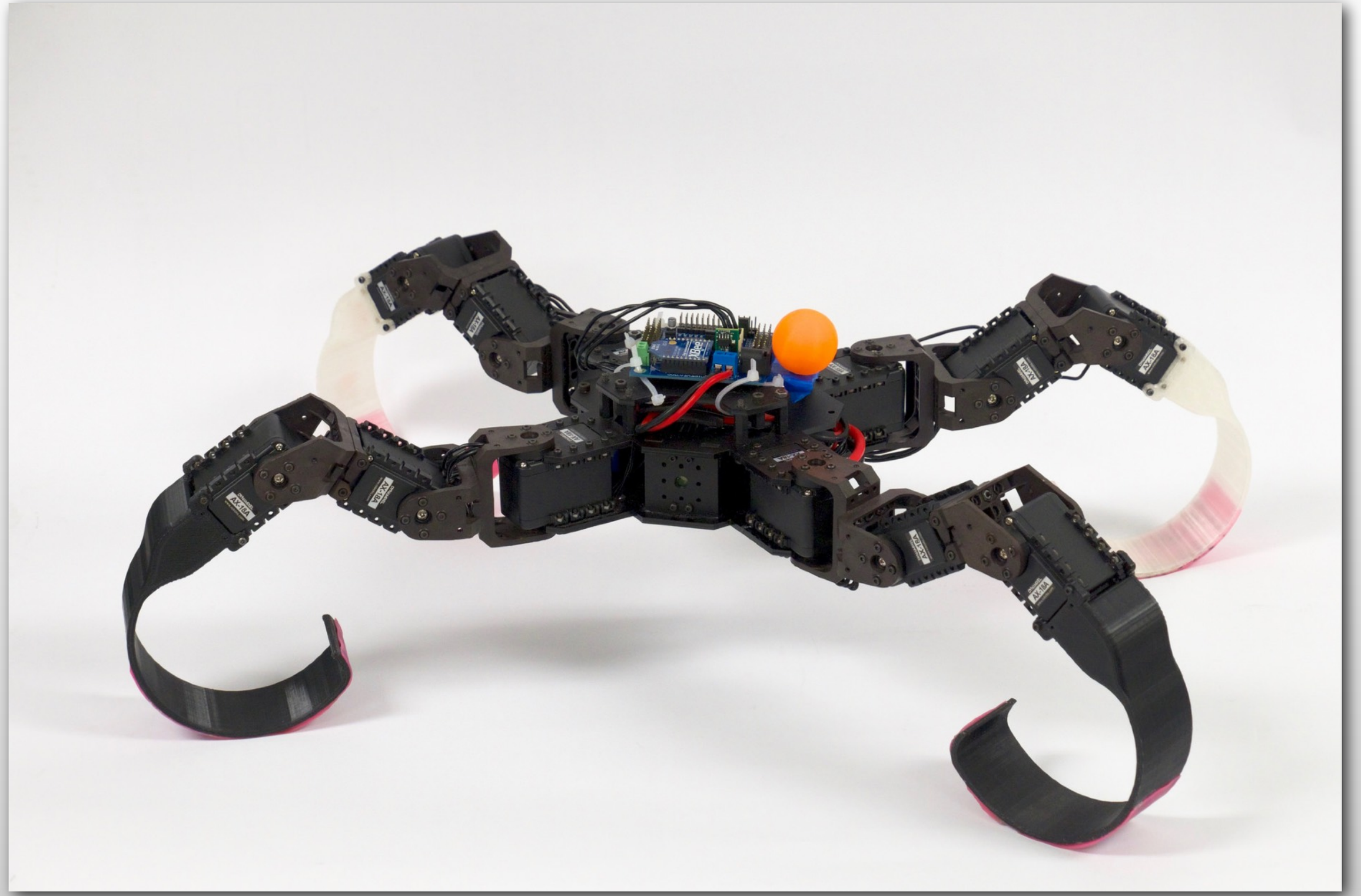
- How would you inspect these?

# Current State-of-the-Art

# Walking Robots



# Walking Robots



# 2016 Maritime RobotX Challenge

# CanSat/ARLISS

- **A R**ocket **L**aunch for **I**nternational **S**tudent **S**atellites
- Held in fall in Black Rock, NV
- Two classes of competition
- Many more Japanese than American teams

# The Black Rock Desert

# The Launch

# CanSat Class

- Size and weight of 12oz. beverage can
- Launched to ≈12,000 ft.
- Options:
  - *Mission* – Do something cool with the payload
  - *Comeback* – Autonomously navigate to target location

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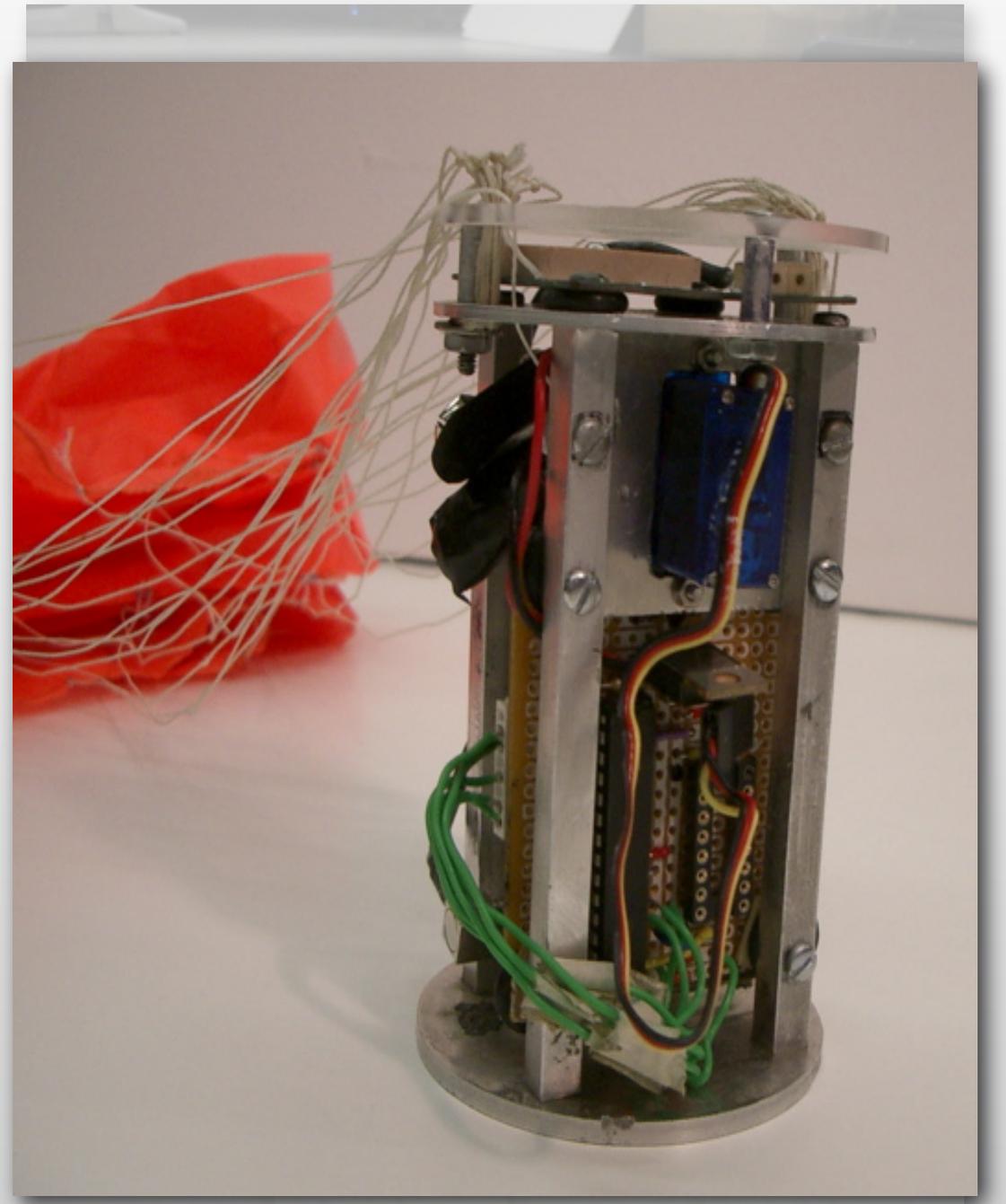

# Open Class Comeback

- Must fit in 146mm diameter, 240mm deep cylinder and be less than 1050g
- Autonomously navigate to target
- Launched to ≈12,000 ft.

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# Open Class Examples

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# For High School Teams

- CanSAT-sized Mission Class entry
- Same microcontroller as MCHE201 kit
- Possible/likely inclusions:
  - Accelerometers
  - Barometric Pressure/Altitude
  - GPS
  - Camera

# 2015 Launches

- Launch 1 – https://vimeo.com/docvaughan/arliss2015launch1

- Launch 2 – https://vimeo.com/docvaughan/arliss2015launch2

# Testing on the desert

- Pre-launch – `https://vimeo.com/docvaughan/2015prelaunchtesting`

- Post-launch – `https://vimeo.com/docvaughan/postlaunchtest2015`

# flickr Albums from Past Teams

- 2014 – https://flic.kr/s/aHsk2LRZYC
- 2015 – https://flic.kr/s/aHsk6Xt1hc
- 2016 – https://flic.kr/s/aHskC3FrAj
- 2017 – https://flic.kr/s/aHskQREGFS
- 2018 – https://flic.kr/s/aHsmorEUtX

# MCHE 201: Intro. to Eng. Design Robotics Contest

## Spring 2019


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# In Fall 2013…

A MCHE470 special topics class on robotics kick-started…

# The Master Plan Contest

# In Spring 2015…


Image from: http://planlafayette.com/assets/Version_CPCAC_Final.pdf

# In Fall 2015…

MCHE201 Teams helped James Bond defeat Blofeld and SPECTRE, saving the world…

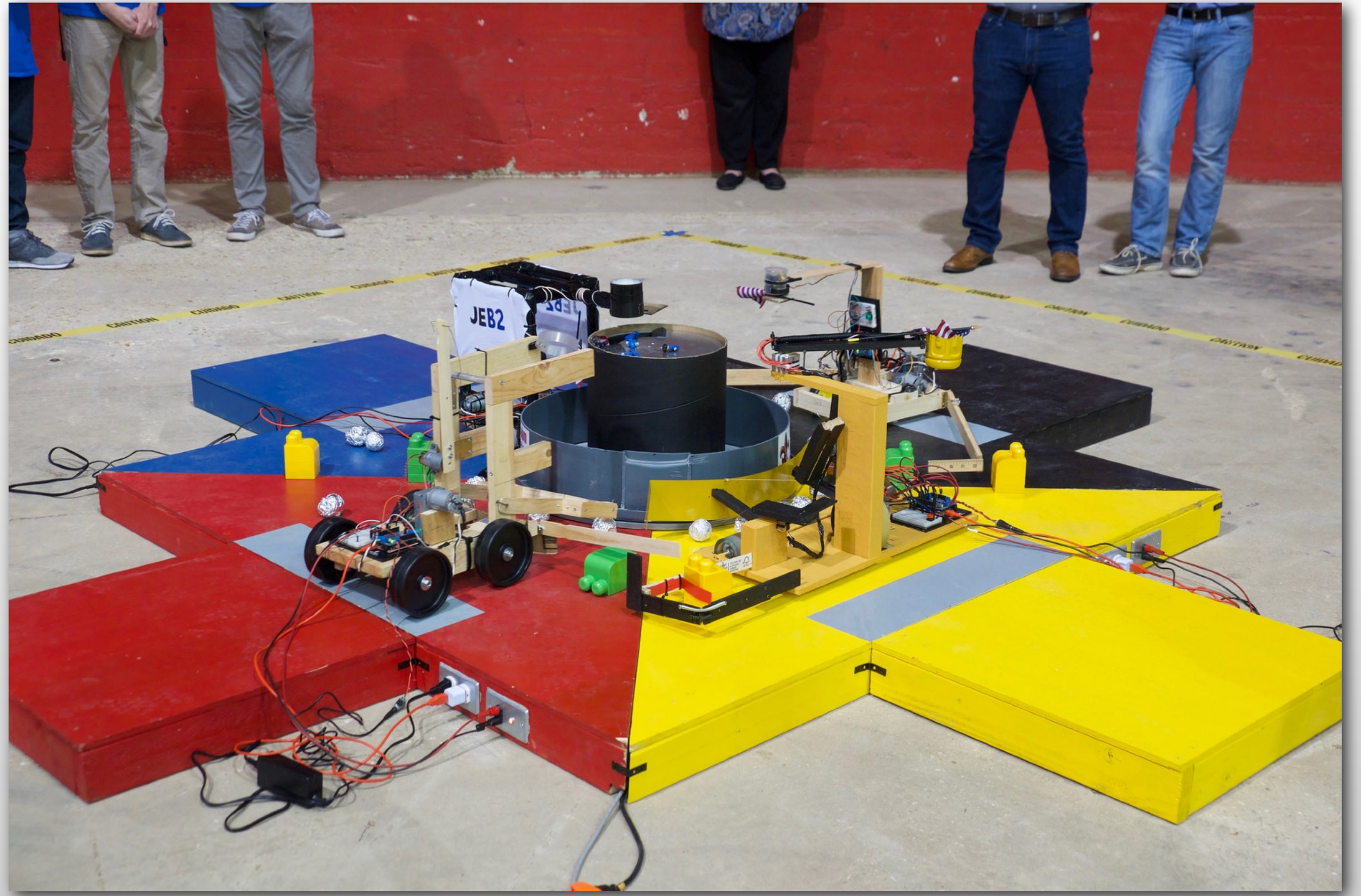
# In Spring 2016…

… with the world safe, people are again free to enjoy arts and entertainment.

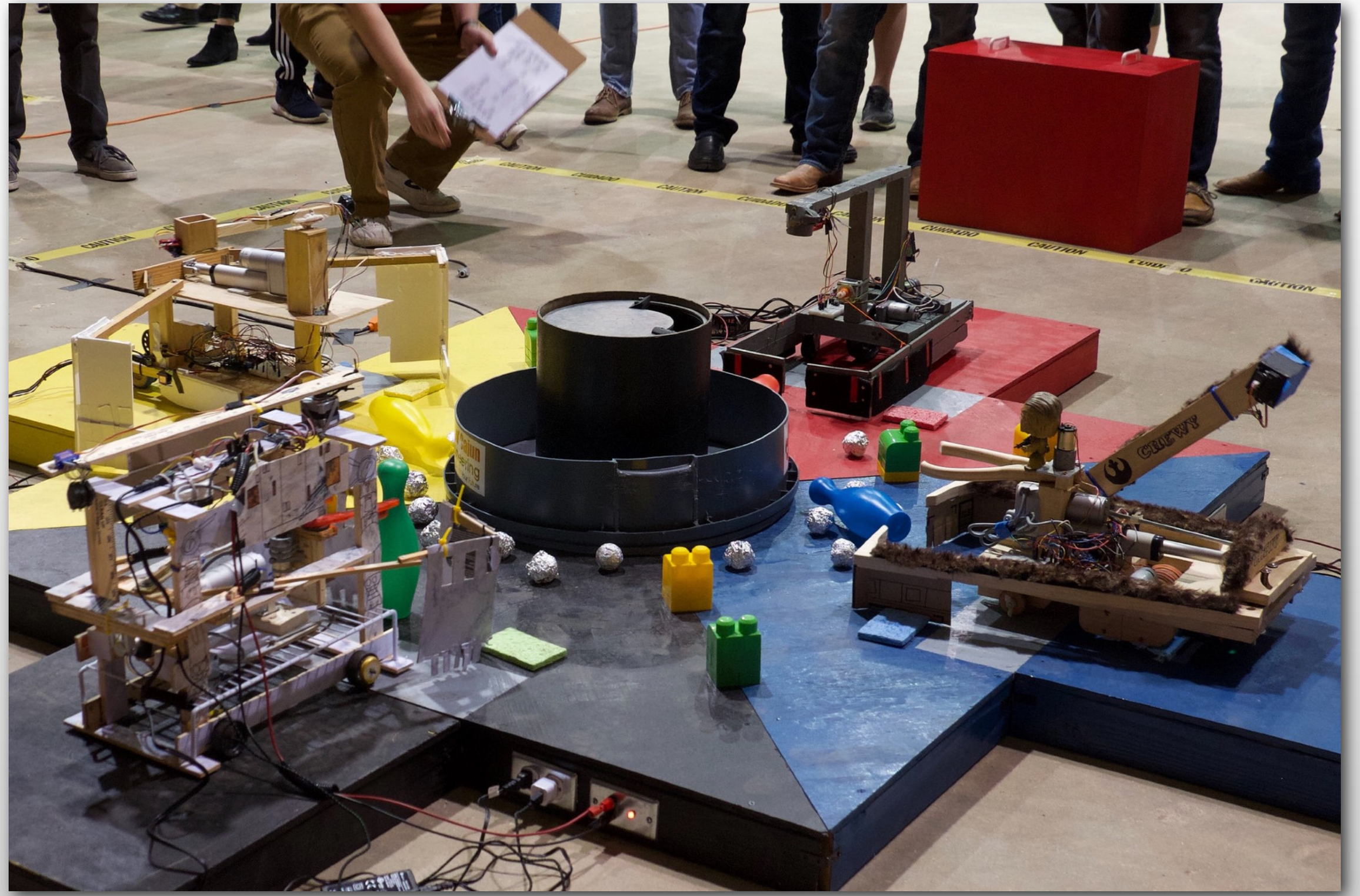
# Festival International de Louisiane

# In Fall 2016… RobotX

# In Spring 2017… Mission to Mars

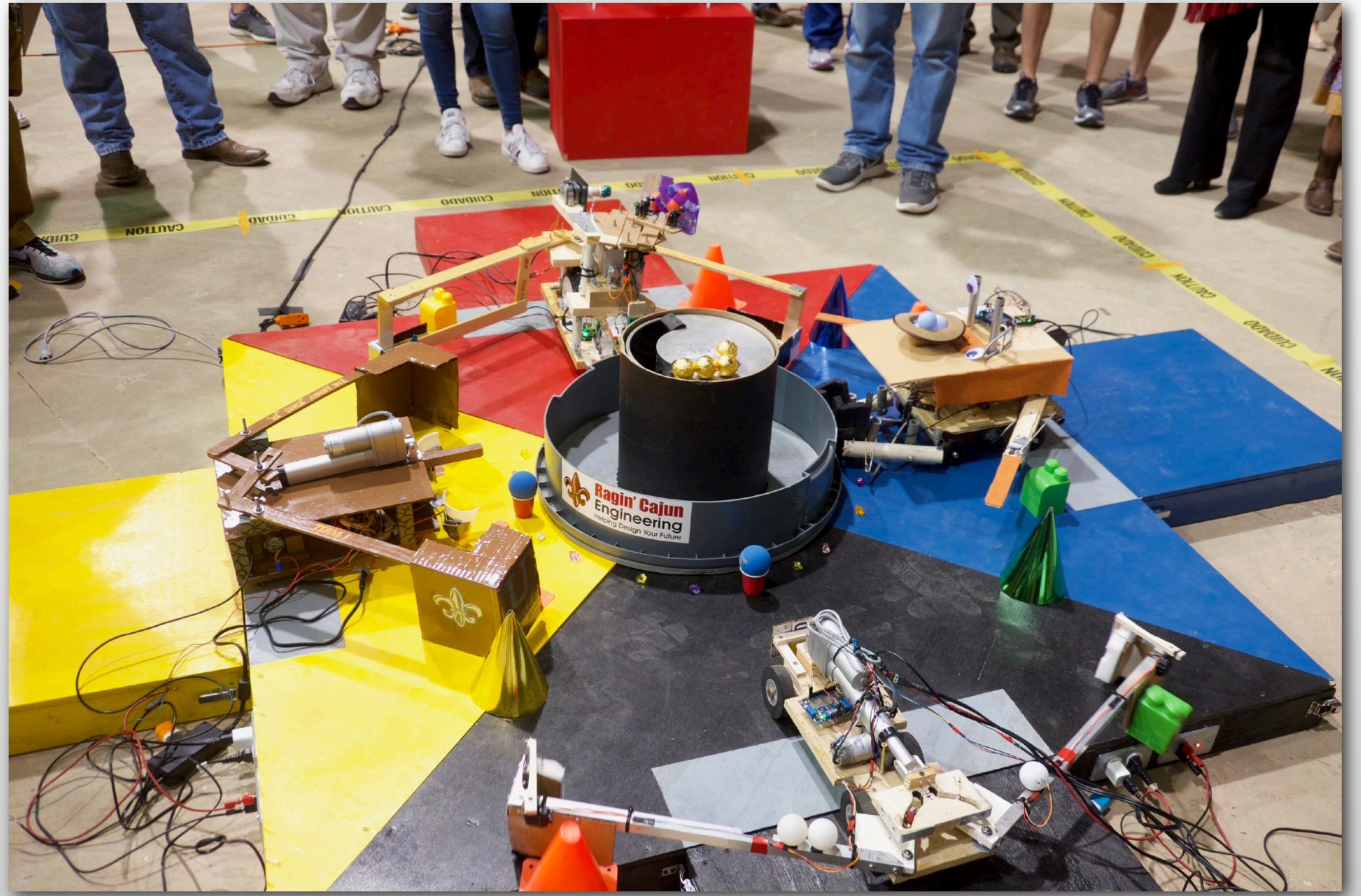


# In Fall 2017….STAR WARS



# In Spring 2018… Black Panther

# In Fall 2018… Indiana Jones



# In Spring 2019…

???

# More Details

- Must operate autonomously
- Can use:
  - 1 pyboard microcontroller
  - Components from 3 kits
  - Gravity
  - MCHE201 kit
- Will need to sense a “start” signal from the track
- Teams can buy <$100 of additional
  - Sensors
  - Building materials
- Must fit onto 2ft-by-2ft starting area and <12″x24″x18″

# Size Requirements

- Your device must be “boxed” prior to each run

- After “boxing” you can only move your device into its final position. You may *not* make *any* other adjustments.

- If adjustments are made, you must re-box your machine (even just reaching inside may warrant this)

# Even More Details

- Machines cannot:
  - Use energy other than that from gravity or the components in the kit
  - Wantonly damage other machines
  - Damage the competition track
  - Damage any competition pieces
  - Operate for more than 30sec.

**Any one of these will result in a DQ**

- Teams cannot:
  - Enter the competition track during a match
  - Interfere with your machine during a match
  - Use foul language during a match

# Final Competition

- *Tentatively* Thursday, April 25 at Blackham Coliseum
  - Design Review - 5:00pm
  - Robotics Contest - 6:15pm
- Family, friends, UL faculty/staff, high school robotics teams, and industry sponsors attend
- Official National Robotics Week Event

# Design Review

- "Science Fair-style" presentation to:
  - Faculty/staff
  - Graduate students
  - Local robotics clubs
  - Industry guests


- Judged on:
  - Aesthetics
  - Ingenuity
  - Presentation

# Robotics Contest