



**SAN DIEGO STATE
UNIVERSITY**

**SDSU ME310 Project 2 :
Projectile motion**

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Dept. of Mechanical Engineering

Burrows, M (2011) Jumping mechanisms and performance of snow fleas (Mecoptera, Boreida). Journal of Experimental Biology 215:2362–2372.



<http://i.imgur.com/IK65Rvp.gif>

Project description

- You are developing an autonomous rover which has a projectable expendable sensor package to analyze samples on a foreign planet
- The soil samples are known to be across random barriers of cliffs or chasms which the rover cannot cross, and the sensor package sends all results back wirelessly (it isn't expected to be retrieved)
- So the SDSU space program project leader has decided to launch the sensor into place as a projectile

Project definition

- Design a system to launch the given spheres (1/4") to an unknown target as precisely as possible
 - Functionality - 1/3
 - You get functional points for accuracy (33.3%)
 - You get functional points for repeatability (33.3%)
 - You get functional points for the length of time the ball is in the air (33.3%)
 - Design - 1/3
 - You get design points for packaging (33.3%)
 - You get design points for robustness (33.3%)
 - You get design points for aesthetics (33.3%)
 - Analysis – 1/3
 - Analyze the main mechanism for all forces involved (33.3%)
 - Perform a motion synthesis to solve for the lengths of the main 'firing mechanism' (33.3%)
 - Perform a motion analysis to prove theory behind the projectile motion, and quantify movement trajectories (33.3%)
 - Report
 - Each team will submit a single report (for the whole team) in digital form
 - This report will follow a provided format and will include complete designs of every component, as well as the analysis and synthesis used
 - Presentation
 - Each team will perform a 7 minute presentation and demo

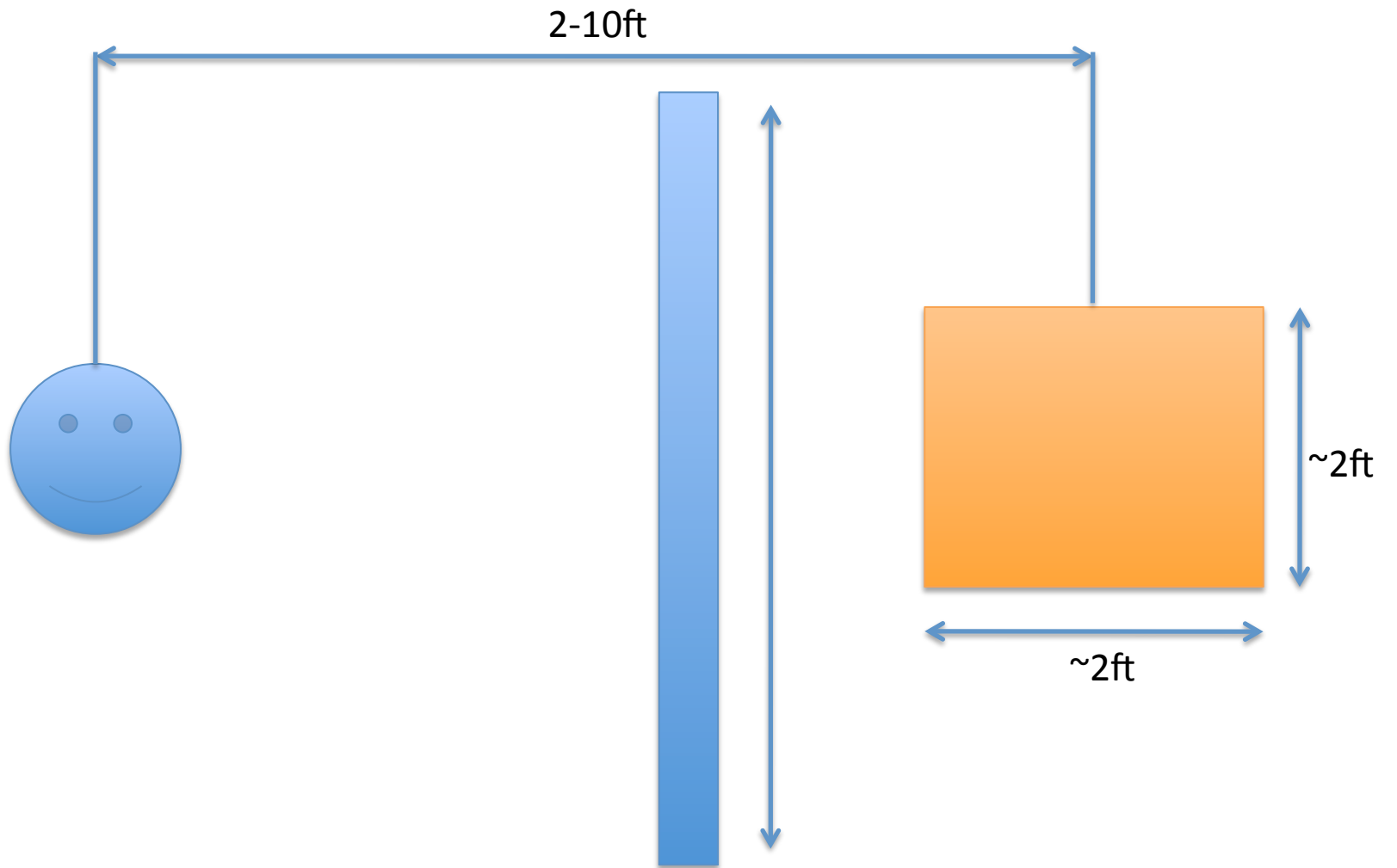
Project definition (II)

- You cannot use commercial or open source flying platforms
- Each team will have up to 5 attempts, 3 will be counted
- You will be able to provide initial settings but the system must be autonomous – ie driven and fired electromechanically,
- You MUST engage it with an electrical switch
- The switch must trigger a microcontroller after a timed delay of 5 seconds which are displayed visually as some sort of countdown with LEDs
- At least one sensor must be used
- You are required to drive some sort of power level actuator,
 - this doesn't necessarily *have* to be a DC motor
- The sphere must touch the target/landing area, but otherwise you can have other components go with it, and you must use the whole sphere (no chopping it up!)
- Once the sphere plus 'components' leaves the main base, nothing can remain in contact from the base (ie no super long-arms!)
- The base can move from the given starting point, but there will be a random barrier 1-3ft tall randomly placed before each team's trials, which will remain in place for all 5 trials (will not be moved between trials) and this must be done autonomously (no interaction with a user)
 - The *main* base may not cross the barrier
 - The device cannot cause a huge mess by blasting the target sand everywhere or damage the target box
- **Your design must not pose a danger to spectators or yourself**
- **You may add to your kit, but total additional parts count may not exceed \$50 – your report must include a parts breakdown of every purchase formatted as a BOM**

Weekly progress assignments

- You will have weekly deadlines to break down this project, details posted soon but will likely be (this is an overview of weekly assignment description)
 - Week 1: Concept
 - Week 2: Proof of concept
 - Week 3: Circuit design, analysis, and draft report due
 - Week 4: Final demonstration and report due

Project definition (III)



Balls



- Color: Semi-clear white
- Temperature Range: Not rated
- Tensile Strength: Poor
- Impact Strength: Poor

Dia.	Dia. Tolerance	Pkg. Qty.		Pkg.
1/8"	±0.002"	250	9587K11	\$3.23
1/4"	±0.002"	250	9587K13	11.24

Product Detail

Rigid HDPE Polyethylene Ball, 1/4" Diameter

[More About Plastics](#)

You ordered 1 each on 02/27/15.

Packs of 250

ADD TO ORDER

In stock

3/8"	±0.002"	100	9587K17	10.06
7/16"	±0.002"	100	9587K21	11.02
1/2"	±0.002"	100	9587K23	8.83
9/16"	±0.002"	50	9587K25	7.25