# SE3250 Project Two (Winter AY2012)

# Rail Gun Call for Fire Simulation

**Objectives:**

**Create a simple discrete event model and simulation to represent a call for fire**

**Explore the model implications and insights from the output**

**Communicate the results**

You are comparing several different architectures for providing fire support to an expeditionary force. The architectures involve the use of proposed rail guns. The time to prepare, charge, and fire each gun (cycle time) is a random variable.

Targets appear and generate a fire request on average every three minutes. The time to prepare, charge, and fire each gun has a mean of 1.5 minutes. Assume initially that no target needs to have a second round fired at it.

Consider the time frame for analysis to be 8 hours (480 minutes).

Complete this project in groups. It is **due at our seventh class meeting.**

**Requirements:**

1. Construct an Extend discrete event model for a single rail gun system, using the exponential distribution for all arrival and server times. Use a notebook for monitoring parameter and output values. Use a database to read the target and gun parameters into the model, and to record the output metrics for each run.

2. Estimate the average time until a target is fired upon. Provide a 90% confidence interval for your answer.

3. Estimate what fraction of the average time in (2) is due to queuing delays.

4. Is there a warm-up (transient) state for your model? What metric are you using to identify the transient state? If the transient state exists, identify approximately when it ends.

5. On average, how many fire requests at any given time in steady state are waiting for a gun to become available? Provide and interpret a 90% approximate confidence interval for your answer.

6. Identify at least one other interesting feature of your model’s **output**.

7. Based on your judgment, do you have enough guns on hand?

8. When supported forces are in close contact with the enemy, the mean time between fire requests can drop to 45 seconds. How does that change your answers to (2) to (6)?

9. Based on your judgment, suggest and implement one refinement to this model. How does your refinement affect your answers to (2) through (6)? Note, a refinement is not a simple parameter change.

10. Would it be better to have one gun with a mean cycle time of 1.5 minutes or four guns with cycle times of 6 minutes? Why or why not? Support your assertion with a **statistical hypothesis test**.

11. This model may be sensitive to the choice of fire request and server distributions. Set the time between targets to follow a normal distribution with mean 3.0 and standard deviation of 0.25. Set the gun cycle times to follow a normal distribution with mean 1.5 and standard deviation of 0.5. How do your answers for (2) to (6) and (9) change? Explain why using common sense arguments.

12.

a) Summarize your results in a well-written and well-illustrated report.

b) Include a **four** slide summary brief, and be prepared to present it in class. Remember, the target audience is at the senior level, do not focus the brief on modeling details.