

### **Final project report due noon 4/26:**

The objective of the final project is to estimate the uncertainty in the helicopter design and build/test the best design. We will evaluate the best design using two criteria.

(1) to maximize the probability that in the competition all the measurement times will be above the second best time measured for any helicopter in the first or second stages of the project. These times are 6.56 sec for Team 1, 6.15 sec for Team 2, and 7.05 sec for Team 3. The competition during class time on 4/21 will consist of dropping the helicopters of each team at least 10 drops and then until one of them clocks a shorter time than the target time up to 20 drops. The members of the team of achieving 20 successful drops will get 5% bonus for the project grade.

(2) to minimize the standard deviation of measurement times for 10 drops in the competition. This helicopter design can be different from the one used above. The member of the team of achieving smallest standard deviation will get 5% bonus for the project grade.

Each team can bring as many helicopters as they wish (to protect against deteriorating performance as the helicopter drops multiple times).

The final project report should include the following sections:

1. A history of the evolutions of the designs in Phase 1 and Phase 2 should be included in an appendix.
2. The first section should include an uncertainty analysis of the helicopter fall times, including separately the aleatory and epistemic uncertainties. This section should also include:
  - a. Comparison between the calculated aleatory uncertainty and the observed one from the standard error of the response surface and variation in duplicated designs (if any) or very similar designs.
  - b. If agreement is not good, then discussion of possible reasons is expected.
  - c. Since a response surface for the standard deviation is also needed, the uncertainty in estimates of the standard deviation should also be quantified.
3. Description of the Monte Carlo procedure used to estimate the probability of failure (or standard deviation) of the design and validation of this probability of failure (or standard deviation) with experiments.
4. Description of the response surface of the probability of failure (or standard deviation) or of the reliability index (design response surface) and estimates of its accuracy.
5. Description and photograph of the optimum design prepared for the competition and discussion of any tests used to validate it.
6. Description of the competition and its results.

The report should be complete enough so that it would allow the instructor to easily check your results. In addition, it would be appreciated if you (i) could give raw data in appendices; and (ii) do not use more digits than you expect to be able to duplicate if you ran identical experiment again.