Introduction to Aerospace Project
Performance of MSU Unmanned Aerial Vehicle (UAV)

Background
MSU 404/405 students are building a UAV and will fly it before the end of the semester. This UAV is designed for maximum lifting capability and for maximum range. The 404/405 students have done some analysis regarding its performance, but not to the extent that we have learned in the Introduction to Aerospace class.

Project Statement of Work
As a team, you are to estimate the performance characteristics of the MSU UAV. This will include, but not be limited to:

- Maximum gross weight
- Takeoff roll
  - Normal
  - Over 50’ obstacle
- Landing ground roll
  - Normal
  - Over 50’ obstacle
- Range
- Endurance
- Rate of Climb
- Ceiling
- Max speed
- Cruise speed (@85% power)
- Stall speed
- $V_{NE}$ (this is V Never Exceed, the speed at which structural damage can occur)

Notes:
These are minimum performance and specifications, but you can add additional criteria. This is an OPEN ENDED project, it is not the typical GIVEN-FIND format of a closed ended homework or test problem (You may find this uncomfortable, but it is representative of a aerospace flight vehicle preliminary design application.) Where hard data are not available for the UAV, you will have to make assumptions. Where assumptions are made, you need to justify the rationale with engineering logic. We will have group presentations on the last day of class.
General Characteristics of MSU UAV  
(consistent with data from Taylor, John W.R. *Jane's All The World's Aircraft* London: Jane's Yearbooks)

### General characteristics

- **Crew:** None, Unmanned Aerial Vehicle (UAV)
- **Length:** 1.3 m
- **Wing:**
  - Wingspan (b): 2.134 m
  - Chord Length (C): .305 m
  - Surface Area of Wings (S): .515 m²
  - Clark Y Airfoil [http://www.ae.illinois.edu/m-selig/ads/afplots/clarky.gif](http://www.ae.illinois.edu/m-selig/ads/afplots/clarky.gif)
- **Horizontal Stabilizer:** Assume flat plates for control surfaces
  - Span (b): .66 m
  - Chord Length (C): .146 m (average of max and min length)
  - Surface Area of Wings (S): .096 m²
- **Vertical Stabilizer:** Assume flat plate
  - Span (b): .229 m
  - Chord Length (C): .126 m (average of max and min length)
  - Surface Area of Wings (S): .029 m²
- **Height:** 0.27m
- **Empty weight:** 6.6 kg
- **Maximum Takeoff Weight:** 14.5 kg
- **Powerplant:** 1X OS Diesel Max FX 1.9 hp @ 16,000 rpm

### Project Format
Groups will prepare a 10-12 min presentation of their analysis to be presented in class Thursday, May 29. There is no formal report due. However, groups will turn in hard copies of their presentations, along with supporting appendices (These appendices should be sufficient to understand the assumptions and analyses used to obtain the performance calculations of the project.)