The STEM Showdown will consist of a series of online multiple-choice questions. Middle school (Grade 6-9) Participants in both Middle School (Grade 6-9) and High school (9-12) will answer questions about the science and mechanics of flight. A Showdown participant will have 50-minutes to answer as many questions as possible.

The content and skills for both middle school (Grade 6-9) and high school (Grade 9-12) covered by the Showdown this month are as follows:

**Topic I: History of flight**
- a. History of heavier-than-air man-carrying flight
  - i. Significant Events & People
    - 1. Historic Flights
    - 2. Famous Flyers, Inventors, & Engineers
    - 3. Historic Crashes
  - ii. Types of man-carrying crafts
    - 1. Balloons
    - 2. Planes
    - 3. Helicopters
    - 4. Rockets
- b. History of heavier-than-air model planes
  - i. Types of Models
  - ii. Significant Models
  - iii. Famous Engineers & Modelers
  - iv. Reasons for Modelling
  - v. Modeling Competitions, Contests, & Organizations

**Topic II: Vocabulary**
- a. Parts of man-carrying crafts
  - i. Balloons
  - ii. Planes
  - iii. Helicopters
  - iv. Rockets
- b. Forces of flight
Topic III: Basic forces of flight
   a. Lift, Drag, mass (gravity), propulsion
   b. Stability
      i. Center of mass
      ii. Center of lift
      iii. Stability margin
   c. Calculations
      i. Wing area
      ii. Tail area
      iii. Tail moment
      iv. Prop pitch vs. pitch angle vs. location on the prop (radius)
      v. Maximum turns calculation for Super Sport rubber
      vi. Rubber winds with various winder ratios (10:1, 15:1, 20:1 are common)
      vii. Approximate Energy storage (area under the rubber winding or unwinding curve)
   d. Model trimming
      i. Impacts of various adjustment
         1. Decalage
         2. Tail tilt
         3. Rudder
         4. Thrustline
         5. Wash-in
         6. Motor stick flexibility (lengthwise and torsional)
      ii. Energy management
         1. Flaring props

Topic IV: The science of rubber
   a. Hysteresis
   b. Stretch winding
   c. Torque
   d. Lube
   e. Matching of prop to rubber
      i. Understanding what adjustments to make to prop, rubber, and winds for given situations, such as:
         1. Running out of winds before landing
         2. Excessive winds at end of flight
         3. Hits ceiling

Topic V: Materials used in modeling
   a. Balsa
      i. Grain (A, B, C) and applications
      ii. Density (calculations as well as impact)
      iii. Bending strength
   b. Carbon laminates
      i. Advantages
      ii. Disadvantages
   c. Covering materials
   d. Adhesives
      i. CA's
      ii. Cellulose-based glues
      iii. Weight management
   e. Propellers
      i. Helical pitch
      ii. Wash-out
      iii. Flaring
      iv. Variable pitch
      v. Impacts of diameter, pitch, number of blades
**Recommended Materials**

- Each Showdown participant will need a computer with internet access, scratch paper, something to write with, and a stand-alone, non-programmable, non-graphing calculator (e.g., a TI-83 or NSPIRE)
- Showdown participants may use resources available to help them answer the questions asked during the Showdown. These resources could be a collection of notes on the topics listed below, copies of magazine or journal articles, a textbook, or any combination of these items.

**Scoring**

- High score wins.
- Ties will be broken using:
  a. The time it takes to complete the test; and
  b. The results to the questions indicated as tiebreakers.

**Additional Resources**

- The Science Olympiad Store ([store.soinc.org](http://store.soinc.org)) carries a variety of resources for Electric Wright Stuff and Wright Stuff that may be useful for this topic.
- Other resources can be found on the Electric Wright Stuff (middle school) and Wright Stuff (high school) Event Pages at [soinc.org](http://soinc.org).