



MISSION POSSIBLE

1. **DESCRIPTION:** Prior to the competition, the participants will design, build, test and document a "Rube Goldberg®-like Device" that completes a required Final Task using a sequence of consecutive tasks.
TEAM: 1-3 **IMPOUND:** Yes **EYE PROTECTION:** #2 **TIMES:** Set-up: 30 min, Run: 3 min max
2. **EVENT PARAMETERS:**
 - a. Students must provide the Event Supervisor with a Task Sequence List (TSL) describing the chain of events leading to the task completion.
 - b. All team members must bring and properly wear safety spectacles with side shields.
3. **CONSTRUCTION PARAMETERS:**
 - a. All parts of the device must fit within an imaginary box of 50 cm x 50 cm x 80 cm in any orientation.
 - b. Each device must pass a safety inspection before operation. Devices with potential hazards or violation of any safety procedure will not be permitted to run unless safety concerns are resolved to the satisfaction of the event supervisor. Unsafe devices will only receive participation points.
 - c. The device shall be designed and constructed to execute, consecutively, a sequence of tasks selected from the list in section 4.
 - i. The Starting Task shall be Task 4.a. and the Final Task shall be Task 4.j.
 - ii. Tasks between the Starting Task and the Final Task may be in any order.
 - iii. After the Starting Task, the device must operate autonomously.
 - iv. Each task in the device must contribute to the completion of the Final Task.
 - v. Parallel tasks sequences are not allowed and tasks that do not lead to the Final Task are not scored.
 - vi. Additional non-listed devices, tasks, and energy sources may be built into the device between the listed tasks. They must contribute to the completion of the Final Task but will not earn any points.
 - d. Electric components shall be limited to batteries, wires, motors, switches, resistors, capacitors, commercial photocells, and mechanical relays. No computers will be permitted in the device.
 - e. Liquids (except for water), uncontrolled projectiles, and hazardous materials (e.g. matches, rat traps, candles, model rocket engines, lighters, fireworks, gunpowder, flammable substances) are not permitted.
 - f. No more than 10.0 volts will be permitted to power any single electrical circuit. All batteries must be factory-sealed and labeled with their voltage by the manufacturer. No lead-acid batteries will be allowed.
 - g. Energy devices such as flashlights, batteries, and mousetraps may be set / activated prior to starting the device, but not the motors (see Penalties, 7.b.ii.).
 - h. If the device is sensitive to light, air currents, etc., the team must provide all necessary shielding, which is also constrained by the size limitations listed in 3.a.
 - i. If the device is remotely timed or controlled (non-autonomous), the team will be disqualified.
 - j. A task can receive points only if it is successful, listed, and contributes toward Final Task completion.
4. **THE TASKS:**
 - a. Starting Task- Drop a standard golf ball from above the entire device so that it is released into the device and triggers a mousetrap that will begin the chain of events. (100 pt. penalty if this is not first.)
 - b. Activate a photocell which will provide the power to operate a motor, which leads to the next action.
 - c. Use a motor to turn a shaft that continuously moves a mass for at least 10 sec before the moving mass leads to the next action. 1 point additional for each 1 sec, beyond 10 sec and up to 40 sec, that the motor continually moves the mass before the moving mass activates the next step (30 extra points are possible).
 - d. Deactivate a student-created electromagnet that releases a mass that leads to the next action.
 - e. Use the heat generated by the resistance in an electrical wire to melt a mono-filament line in two, so that it releases a mass that leads to the next action.
 - f. Activate either pneumatics or hydraulics in an enclosed system that leads to the next action.
 - g. Raise a golf ball vertically by at least 30 cm, so that the ball's new position leads to the next action.
 - h. Pop a pre-inflated balloon, whose deflation leads to the next action.
 - i. Use a motor with a propeller that generates a wind, which leads to the next action.
 - j. Final Task- Raise a flagpole with a rectangular school flag (fixed or mobile) that is at least 5 cm x 10 cm so that the lowest part of the flag is at least 30 cm higher than all original parts of the device (the flag and flagpole are allowed to go outside the dimensions listed in 3.a).

5. TASK SEQUENCE LIST:

- The TSL details only the scorable sequence of tasks to occur during device operation. Each task from section 4, intended to earn points, must be numbered and lettered on the TSL and in the device.
- This List must be submitted at impound or as announced by the tournament director.
- Example TSL:

Step	Letter/Action
1	a. Starting Task - Drop golf ball on mousetrap to activate it
2	b. Mousetrap turns on flashlight that powers photocell that operates motor
3	i. Motor spins propeller that produces wind that pushes cart with pin
4	h. Pin pops balloon which allows mass to release
5	d. Falling mass opens switch which shuts off electromagnet & drops a mass
6	g. Falling mass uses pulley to raise golf ball over 30 cm within device
7	c. Golf ball switches motor on, which pulls string to move mass more than 10 s
8	j. Final Task-Moving mass raises the flag over 30 cm above the device

6. OPERATION OF DEVICE:

- The timing of the device begins when a team member releases a standard golf ball into the device.
- There is a maximum time limit of 3 min. If the device is running after 3 min, the points earned up to then will determine the score. No completion points will be awarded. Once started, the clock is never stopped.
- Penalty points are assessed each time a team member touches the device or crosses the imaginary box enclosing the device.
- If the device stops, jams or fails, the team will be allowed to "adjust" it to continue operation and penalty points will be deducted. Any obvious stalling to gain a time advantage will result in disqualification.
- If an action inadvertently starts a task out of sequence on the TSL then all tasks skipped in the listed sequence will not earn points even if they are completed.
- If the team completes the task themselves or makes an adjustment that leads directly to task completion in the very next action, task completion will not be awarded.
- Timing stops when the device fails to continue operating, the last action completely stops, or when 3 min have elapsed (whichever comes first). The "ideal" operation time is 60 sec for Regionals, 60-90 sec at States, and 90-120 sec at Nationals (selected time, to the nearest sec, will be announced after impound).

7. SCORING:

- Points:
 - 2 points will be awarded for each full second of operation up to the "ideal" time.
 - 100 points, if all conditions of the Final Task are successfully completed within 3 minutes.
 - 75 points, if the TSL is submitted on time and uses the format specified.
 - 25 points, if the TSL is 100% accurate in documentation of device operations.
 - 50 points, if the team uses no more than 30 minutes to get their device ready to run.
 - 25 points for the first time each lettered task is successfully completed.
 - Up to 30 points for the additional action as described in Task 4.c.
- Penalties:
 - 1 point will be deducted for each second that the device operates beyond the "ideal" time until the device stops, completes the Final Task, or reaches the three-minute time limit (whichever occurs first).
 - 15 points each time the device is touched, adjusted, or restarted.
 - 50 points, one time, for any substance that leaves the boundary of the device (except the flag & pole).
 - 100 points for each motor that is already running at the start.
 - 100 points if the Starting Task is not the first thing that happens in the device.
- Violations: Teams with construction violations, parallel design, or "dead end" paths will be in the 2nd tier.
- Ties will be broken by the following sequence: 1. Fewest penalty points, 2. Closest to "ideal time", 3. Greatest Final Task measurement (as measured to lowest edge).

RECOMMENDED RESOURCE: Mission Possible DVD see store at www.soinc.org