Hack My Infrastructure

Genre

Ensembles will construct an electronic flow measurement system using sensors and a microprocessor and make up-tempo measurements with a laboratory flume. *Hack My Infrastructure* integrates high-tech tools with modern infrastructure challenges.

Artists

Hack My Infrastructure ensembles can include up to three members.

Instruments

Ensembles should bring the following:
- safety glasses
- a laptop computer

Ensembles should design and construct an electronic flow measurement system prior to the competition. The system will consist of the following components:
- a microprocessor
- sensors
- connections (wires, cables, etc.)
- hardware (the construction kind; used to house, frame, or secure the other components)

Arduino-family microprocessors are strongly recommended for their ease of use and sensor compatibility. Sensors may be affixed to the laboratory flume so long as they do not damage it. Connections near the water should be jacketed and adequately waterproof.

Competition organizers do not recommend that ensembles spend over $100 to construct the system.

System readings should be unambiguously displayed on a laptop computer screen in the following format:

Flow	=	_____ liters per second (L/s)
Velocity	=	_____ meters per second (m/s)
Slope	=	_____ meters per meter (m/m)

Ensembles who do not display readings in the correct format will be disqualified.

Laboratory Flume Known Values
- The laboratory flume is 16' (4.88 m) long by 3" (76 mm) wide.
- The flume surface is flat plexiglass and Manning's roughness coefficient *n* is 0.009.
- The weigh tank will be set to 30 kg (66.1 lbs).
- The distance from the top edge of the flume wall to the flume bottom is 6" (152 mm).
- The distance from the railing above the flume wall to the flume bottom is 8.25" (210 mm).

Laboratory Flume Unknown Values Ranges
- The flow depth will not exceed 6" (152 mm).
- The flow rate will not exceed 120 L/min (31.7 gal/min).
- The slope will be no less than 0.005 m/m (0.005 ft/ft) and no greater than 0.015 m/m (0.015 ft/ft).

Tracks

Ensembles will be assigned timeslots the day of the competition.

Setup and Deployment
Ensembles should prime their digital flow measurement system and boot their laptop prior to the competition time. Judges will announce the start of the competition time. Once the start has been announced, ensembles will deploy the system and affix sensors to the flume.

Figure 1 – Laboratory Flume Photographs

Testing
Judges will operate the laboratory flume (Figure 1) as shown here. Judges will record readings from the laptop computer screen but will not manipulate the digital flow measurement system or laptop computer. Teams shall not manipulate the flume, the system, or the laptop during the measurement. The measurement should be automatic.

Ensembles may request one additional measurement after the initial measurement. Ensembles may adjust the system or the laptop before the additional measurement. Judges will use the more accurate of the two measurements for scoring purposes. Judges will record the end of the competition time once ensembles have removed their sensors from the flume. Ensembles taking more than 15 minutes will be disqualified.

Scoring

The following scoring formulae will be used:

$$\Sigma = (3 \times F \times S) + T$$

$$F' = \frac{Q}{|Q_{measured} - Q|} \qquad F = \begin{cases} F' & \text{if } F' < 50 \\ 50 & \text{if } F' \geq 50 \end{cases}$$

$$S' = \frac{m}{|m_{measured} - m|} \qquad S = \begin{cases} S' & \text{if } S' < 50 \\ 50 & \text{if } S' \geq 50 \end{cases}$$

$$T = 300 - t_{seconds}$$

where:

Σ	=	Total Score
F	=	Flow Score
S	=	Slope Score
T	=	Time Score
F'	=	Raw Flow Score
Q	=	Correct Flow
$Q_{measured}$	=	Measured Flow
F'	=	Raw Slope Score
m	=	Correct Slope
$m_{measured}$	=	Measured Slope
$t_{seconds}$	=	Time Taken (# of seconds)

Judges will be rank ensembles by total score.

Notes

If financial constraints prevent you from competing, please contact conference organizers for assistance!

Direct any RFIs to conference organizers. This section will be updated to include RFI responses.