



LEVEL:	Middle and High School
NUMBER OF TEAMS:	Regional Design Day – up to 3 teams per school MESA Day – 1 team per school
TEAM MEMBERS:	3 to 5 students
SCORING:	Performance – 75 points Engineering Design Poster – 25 points

OBJECTIVE

Teams will engineer two similarly designed, primarily paper fan boats that can travel a 6-foot water course as quickly and consistently as possible. Both boats must use the same Arizona MESA-designated fan, which the team will transfer from Boat 1 to Boat 2 between official runs. Teams will also create an Engineering Design Poster documenting how they explored, designed, tested, and iterated their solution.

RESOURCE VIDEOS

- [Why Ships Float](#)
- [Sailing Faster Than the Wind](#)

MATERIALS

Required fan: Teams must use the fan distributed/provided by Arizona MESA. The product link is provided only as a reference: [designated fan reference](#)

- The water-contacting hull of each boat must be paper.
- Tape and other limited water-resistant materials may be used to connect, reinforce, or secure components, but may not cover, wrap, coat, laminate, or waterproof the hull.
- Wax, paint, glue coatings, plastic coverings, laminates, or other treatments intended to create a waterproof barrier are prohibited.
- Arizona MESA will provide the official box gutter and water at the event.

BOAT REQUIREMENTS

1. Teams must bring two similarly designed boats for competition.
2. Both boats must be clearly labeled with the full school name and identified as Boat 1 or Boat 2.
3. The same Arizona MESA-designated fan must power both boats. Teams must engineer a method that allows the fan to be detached from Boat 1 and attached to Boat 2 between runs.
4. Each boat, with the designated fan installed, may weigh no more than 1 kg (1000 g).
5. The water-contacting hull must remain primarily a paper engineering solution and may not be waterproofed.
6. Both boats must be presented at specification check. Boat-specific requirements will be checked on both boats; the fan will be inspected with the competition entry.

OFFICIAL COURSE

The official course is a box gutter approximately 8 feet long, 5.5 inches wide, and 3.75 inches deep. The scored course is 6 feet, marked by a starting line and finish line.



Official gutter course visual. The 6-foot scored course is divided into 1-foot sections for continuous side-contact penalties.

SPECIFICATION CHECK

- Both boats and the designated fan must be presented for inspection.
- An ordinary specification failure results in zero performance points unless the issue can be corrected before the competition begins; the Engineering Design Poster remains eligible for scoring.
- A safety issue must be corrected before a boat may operate.
- Serious or intentional rule violations may result in full disqualification at the discretion of Arizona MESA/event judges.

OFFICIAL RUN PROCEDURE

1. Boat 1 is prepared with the designated fan attached.
2. When directed by the judge, the team turns on the fan. The official time begins when the boat is placed in the water.
3. The boat travels the 6-foot scored course under its own fan power.
4. Time stops when the entire boat crosses the finish line.
5. After Run 1, the team transfers the same designated fan to Boat 2 and prepares for Run 2 as directed by the judge.
6. Boat 2 completes the same official procedure.

SIDE-CONTACT PENALTIES

Discrete contact: Each discrete contact with the side of the gutter adds 10 seconds to that run's time.

Continuous scraping: If a boat remains in continuous contact with or scrapes along the side of the gutter, a 10-second penalty is assessed for each 1-foot section of the scored course in which that continuous contact occurs. Continuous scraping is scored by distance rather than as repeated individual touches.

Adjusted Time = Official Run Time + Side-Contact Penalties

DNF — DID NOT FLOAT

A boat receives a DNF if it sinks, becomes unable to make forward progress, or otherwise fails to cross the finish line under its own fan power. A boat that is still making forward progress may continue its run at the judge's discretion; there is no fixed maximum run time.

PERFORMANCE SCORING — 75 POINTS

The single fastest adjusted time recorded across all successful official runs establishes the 75-point benchmark for both Run 1 and Run 2.

Successful Run Score = (Fastest Adjusted Time Across All Official Runs ÷ Team Run Adjusted Time) × 75

- Calculate a performance score for each successful run, rounded to the nearest tenth.
- If both boats finish successfully, average the two run scores.
- If one boat receives a DNF, that run receives one-third ($\frac{1}{3}$) of the performance score earned by the team's successful run. Average the successful-run score and the DNF score.
- If both boats receive a DNF, the team's Performance Score is 0.
- The Engineering Design Poster remains eligible for up to 25 points regardless of a DNF.

TIE BREAKER

If teams have identical final Performance Scores, the team with fewer total side-contact penalties across the two official runs will place higher. If still tied, the lower combined adjusted time of successful runs will break the tie.

TL;DR

- Build two similarly designed, primarily paper boats.
- Use one Arizona MESA-designated fan for both boats and engineer a way to transfer it between boats.
- Each boat + fan may weigh no more than 1 kg (1000 g).
- Do not waterproof the paper hull.
- Complete two official runs on the 6-foot scored course.
- Side contact adds time; continuous scraping is penalized by each 1-foot course section affected.
- DNF means Did Not Float. One DNF earns $\frac{1}{3}$ of the team's successful-run score; two DNFs earn 0 performance points.
- Performance = 75 points; Engineering Design Poster = 25 points.

READ THE FULL SPECIFICATIONS. The TL;DR is a quick reference and does not replace the complete rules.

ENGINEERING DESIGN POSTER — 25 POINTS

Poster size: 36 inches high × 48 inches wide, landscape. Posters must be submitted digitally as a PDF by 5:00 p.m. at least two weeks before MESA Day; Arizona MESA will announce the specific deadline.

Poster Template: Teams are encouraged to use the [Arizona MESA Engineering Design Poster Template](#). Use of the template is recommended, but not required.

Include the project/prototype name, school, team-member names, school logo, MESA logo, and the engineering story described below.

EDP Area	Pts	Fan Boats Poster Evidence
Explore	5	Define the challenge and constraints; investigate buoyancy, stability, propulsion, materials, and/or other relevant concepts; document useful research or early observations.
Design	5	Explain the team's boat concept, fan-transfer approach, material choices, and important design decisions. Include useful diagrams, dimensions, or images.
Test	6	Present meaningful testing and data from prototypes or trials. Show what was measured and what the evidence revealed about speed, stability, side contact, fan placement, or other performance factors.
Iterate	6	Show how testing informed changes to the design. Explain refinements, tradeoffs, lessons learned, and how the two competition boats reflect the team's evidence.
Communicate	3	Make the engineering story clear and easy to follow; use visuals/data effectively and include all required identifying information.



FINAL SCORE

Performance Score (75) + Engineering Design Poster (25) = 100 points

JUDGE QUICK REFERENCE

Item	Result / Score
Boat 1 + designated fan $\leq$ 1000 g	Pass / Correct
Boat 2 + designated fan $\leq$ 1000 g	Pass / Correct
Paper water-contacting hull; no waterproof barrier	Pass / Correct
Same Arizona MESA-designated fan used for both boats	Pass / Correct
Boat 1 adjusted time	_____ sec
Boat 1 run score	_____ / 75
Boat 2 adjusted time	_____ sec
Boat 2 run score	_____ / 75
Final Performance Score (average of two run scores)	_____ / 75
Engineering Design Poster	_____ / 25
FINAL SCORE	_____ / 100