GO FLY
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Rules

The goal of the GoFly Prize is to foster the development of safe, quiet, ultra-compact, near-VTOL personal flying devices capable of flying twenty miles while carrying a single person.

The challenge consists of three progressive payout opportunities spanning two years beginning in 2017:

Phase I:

- Up to ten $20,000 prizes awarded based on a written report.

Phase II:

- Up to four $50,000 prizes awarded based on revised Phase I material (or for new teams new Phase I material) and demonstrated performance of progress to date.

Fly-off:

1. One $1,000,000 Grand Prize awarded for the best compliant overall fly-off score.
2. One $250,000 prize for the quietest compliant entry.
3. One $250,000 prize for the smallest compliant entry.
4. One $100,000 prize for disruptive advancement of the state of the art.

Fly-off scores for the Grand Prize will be based on highly challenging criteria in the following areas:

- Performance, including speed & endurance
- The ability to achieve near vertical takeoff and landing
- Quietness
- Compactness
- The experience of open-air flight

What the device looks like or how it works to accomplish the task, and accomplish it safely, is up to you.

1. Schedule and Deliverables

Dates and other information here are subject to change at the discretion of GoFly. GoFly will post changes on the challenge site and ensure that all registered teams are informed of any change. All judging decisions are final.

All materials must be in English and be submitted electronically by the appropriate deadline through the competition website. No exceptions.

1.1. April 18, 2018: Phase I submission deadline

Teams will submit a written report summarizing the project (submission form preview available here). To be eligible to enter a submission for Phase I of the GoFly Prize, competitors must complete all registration and legal forms and pay the submission fee.

Submissions will be scored in the following categories:

50 points	Technical content and feasibility
15 points	Novel innovation and market considerations
15 points	Safety considerations
10 points	Project execution feasibility
10 points	Organization, clarity, and succinctness

1.2. June 14, 2018: Phase I awards issued

Based on the Phase I submission scores, and at the discretion of the judges, Phase I winners will be announced and prize money issued. The winners will be announced publicly. However, their work will remain private (except for the publicly-releasable graphic).

1.3. December 8, 2018: Phase II registration deadline

Regardless of Phase I participation, all teams must register for Phase II by the Phase II registration deadline. To be eligible to participate in Phase II of the GoFly Prize, teams must complete all registration and legal forms, procure required insurance, and be accepted by GoFly into the competition. A complete list of documents are available at the competition website.

1.4. February 6, 2019: Phase II submission deadline

Teams will submit up-to-date Phase I material (all parts) with the addition of a status report. In addition to the Phase I scoring categories, an additional 50 points will be awarded based on project status and progress to date.

The Phase II status report will act as sufficient documentary proof that a prototype, demonstrator, or the device itself has flown and successfully performed at a minimum the following maneuvers (tethered testing is acceptable):

- Vertical or near-vertical takeoff followed by steady flight out of ground effect
- Aborted landing
- Vertical or near-vertical landing

1.5. March 28, 2019: Phase II awards and fly-off invitation issued

Based on the progress to date as exemplified in the Phase II submission, and at the discretion of the judges, Phase II winners will be announced and prize money issued. The winners will be announced publicly. However, their work will remain private (except for the publicly-releasable graphic).

Fly-off participation is by invitation only. Invitations to participate in the fly-off competition will be extended to teams meeting all Phase II submission requirements.

1.6. September 2019: Flight readiness review

A flight readiness review will be supported by a flight readiness report, which will include flight logs showing at least 10% of safe prior flight minimums and a final safety report.

1.7. October 2019: Final Fly-off

Teams must arrive at the fly-off prepared with device, operator, crew, supplies, and support equipment necessary to complete all fly-off tech inspection and flight demonstration tasks.

Materials that must be presented to organizers include:

- Logs of safe prior flight minimums
- Affidavit that entry is the same as has been represented to organizers and authorities and that has completed the documented and logged testing
- Optional: drawings or other aids to assist judges in verifying sightlines compliance
- Means of measuring fuel reserves (for devices whereby fuel weight measurement method is inapplicable)
- Final Operator's Manual (including but not limited to required inspections and functional checks to ensure safe and working condition)
- Data submitted may be marked to protect Intellectual Property as detailed in the Master Team Agreement.

2. Fly-Off Tasks and Measurements

The fly-off will consist of two phases: tech inspection and flight demonstration. Various scored and unscored attributes will be measured or validated in each phase. The scored parameters are ***size***, ***noise***, and ***speed***.

2.1. Tech Inspection
Teams must report to tech inspection at the fly-off with their device in flight-ready condition at fully fueled weight.

2.1.1. Conformance
Teams must certify that their entry is one-in-the-same as the device that has been represented to GoFly and other authorities and that has completed the documented and logged testing.

Teams who will fly the flight demonstration unmanned with a dummy instead of a human operator must show that the dummy is not structurally or mechanically integral to the device (beyond the level that a human operator would be) by removing the dummy and exhibiting the operator interface using a human operator.

2.1.2. Size measurement (SIZE)
The scoring parameter for ***size*** is the maximum single dimension in any direction between two planes, measured in feet.

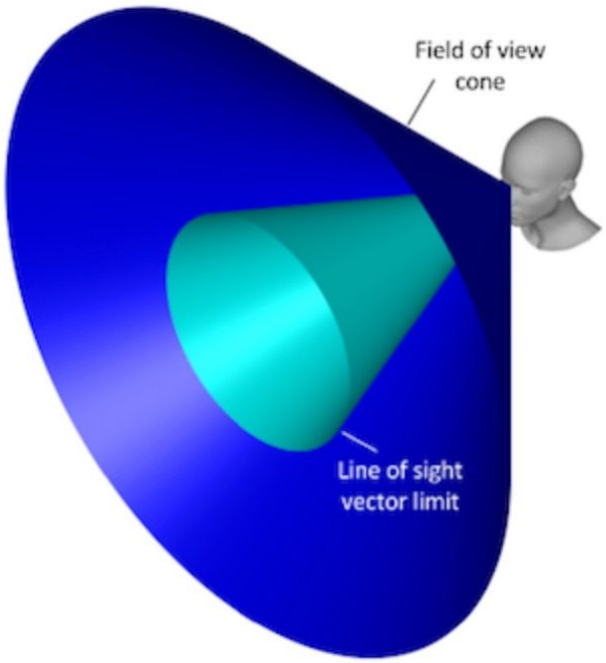
The operator is not included.

Non-rigid elements, such as harnesses and straps, are included in their position with a 5’ 9” operator in place.

If the device has more than one configuration used for a normal full flight profile (as demonstrated in the flight demonstration), the measurement is taken for the largest of any non-transient configuration used in flight or on the ground. Components that continuously rotate are treated as a full disc.

2.1.3. Sightlines
The operator field of view is the GoFly metric for the open-air flight experience. A cone with 90° aperture (provided by contest organizers), with the apex at the design eye position (the bridge of the operator's nose while in flight posture), must not intersect or overlap any part of the device other than transparencies that are not primary structure.

The axis of the cone must be within 20 degrees of the operator's line of sight vector. The line of sight must be horizontal and forward-facing for some steady and trimmed flight mode (e.g., hover or cruise), chosen by the team.



Conical keep-out zone illustration. Inner cone represents allowed deviation of axis from line of sight vector.

The operator (with clothing, helmet, etc.) is not included.

The entire swept path of any continuously moving or spinning component is considered opaque.

2.1.4. Ground transport

During tech inspection, teams will be required to demonstrate that the device, unpowered and unoccupied by the operator, can be moved from one ground location to another over a level hard surface. Unpowered ground aides such as dollies are allowed. All tasks required for the ground transport demonstration must be achievable by a single individual. Required lifting (not including carrying) should not exceed 80 lbs; required pushing/pulling should not exceed 50 lbs.

2.2. Flight Demonstration

For the flight demonstration, the device, with full operator (or dummy stand-in) weight, must complete a single flight profile that successfully includes all of the following tasks:

1. Takeoff and climb without violating the takeoff/landing envelope.
2. Conduct a speed run of six laps around a 1 nmi course.

3. Demonstrate the capability to abort a landing by performing a touch & go without violating the takeoff/landing envelope.
4. After loitering such that total flight demonstration endurance is greater than 20 minutes, descend and land without violating the takeoff/landing envelope.

2.2.1. Takeoff/landing envelope

The takeoff/landing envelope is a 30 foot diameter cylinder. The virtual walls of the envelope are 12 feet high.

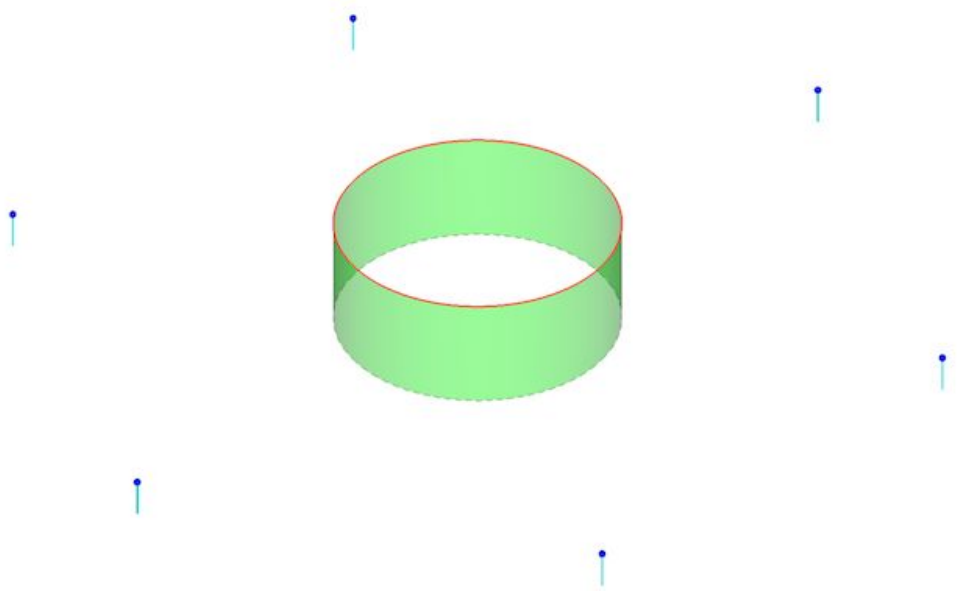


Illustration of 30 ft diameter, 12 ft high takeoff/landing envelope, including microphone placement 50 ft from envelope center.

In addition, 2.25” x 3.75” x 8” (nominal dimensions) bricks (available here) will be arranged to define the boundary on the ground. The bricks will be arranged approximately every 24 inches and stood upright to rest on the 2” x 8” side. If, at any time during the flight demonstration, a brick is knocked over by the device, operator, or downwash, the boundary is considered violated.

No part of the boundary may be violated by any part of the device or operator. Violating the boundary during ***any*** flight demonstration phase constitutes a failed flight demonstration attempt.

2.2.2. Noise measurement (NOISE)

Sound pressure level will be measured at six evenly spaced locations 50 feet from the center of the takeoff/landing envelope. The sound pressure level will be measured in decibels relative to 20 micropascals, with A frequency weighting, S time weighting, and using Class 2 or better equipment in current calibration.

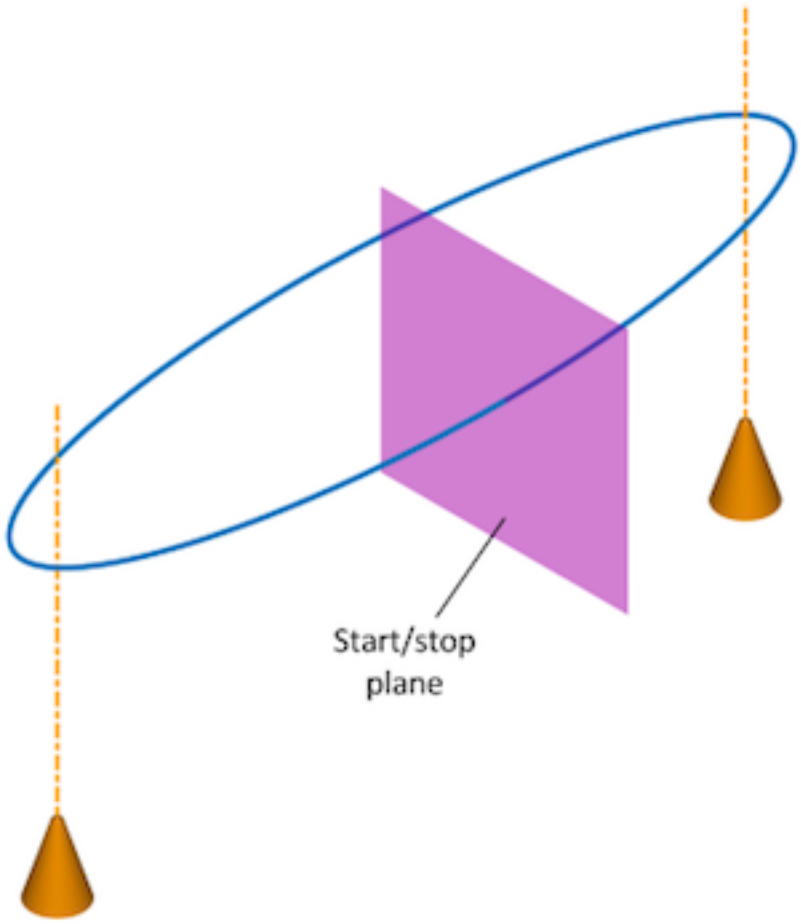
The maximum sound level will be determined at each of the six measurement locations. The arithmetic mean of the highest three of these values yields a sound level rating.

A sound level rating will be determined during the flight demonstration during takeoff and climb and during descent and landing (not during the touch & go). The higher of the two sound level readings in dBA is the ***noise*** score.

2.2.3. Speed measurement (SPEED)

The course is defined by two pylons (physical markers with infinite vertical projections) located 0.5 nmi apart.

A lap involves crossing the start/stop plane *in the air*, flying around both pylons, and then crossing the start/stop plane again.



Speed run sample course illustration showing start/stop plane and pylons with vertical projections (not to scale).

The 6 nmi nominal length of the course is divided by the total time for the speed run to yield the ***speed*** score in units of knots.

The speed run may be flown at any safe altitude out of ground effect (defined as at least 1 x the size measurement at all times). There is no guarantee that the entire course will be obstacle-free at altitudes below 50' AGL.

2.2.4. Touch & go

The touch & go maneuver must begin and end above 12 ft AGL. Contact with the ground must be inside the takeoff/landing envelope.

Contact with the ground must be only momentary. The device must be designed such that aborting a landing is possible with or without first touching the ground.

2.2.5. Total endurance

The timing for total endurance begins during takeoff at the moment when every part of the device or operator is no longer touching the ground.

The timing stops during landing at touchdown.

A total endurance less than the requirement constitutes a failed flight attempt.

Loitering flight to fulfill the endurance may be flown at any safe altitude out of ground effect.

2.2.6. Reserves

Emergency reserves for an additional ten minutes of flight and a landing will be demonstrated by weighing fuel consumed during the mission and fuel remaining.

Teams with devices that do not significantly change weight consuming energy during a flight must provide a means to demonstrate the full emergency reserve capability.

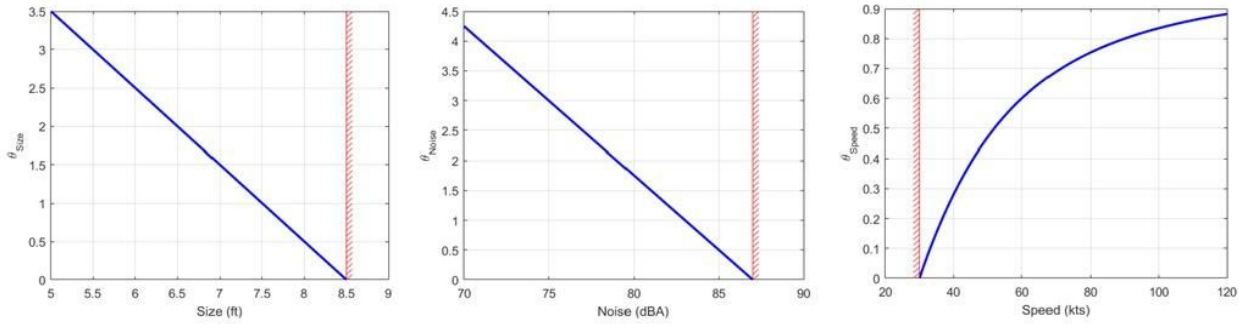
2.2.7. Harsh operator conditions

To prevent unacceptably harsh conditions for the operator, a contest-provided sensor package may be used during the flight demonstration to ensure that the operator or dummy does not endure extreme sustained g forces greater than 5 g or dangerous impulses from hard landings. Violating these limits during any flight demonstration phase may require repeating some or all of the flight demonstration.

3. Fly-Off Scoring

The final score is a function of the scored parameters as described in the Fly-Off Tasks. From each value, a score factor, θ, is determined, as shown in the following table and figure.

Scored parameter	Threshold	Score factor equation
Size (ft)	8.5 ft maximum	$\theta_{Size} = 8.5 - Size$
Noise (dBA)	87 dB_A maximum at 50'	$\theta_{Noise} = \frac{87 - Noise}{4}$
Speed (kts)	30 kts minimum	$\theta_{Speed} = \frac{Speed^2 - 900}{Speed^2 + 900}$



The various score factors are combined to determine the final score as follows:

$$FINAL\ SCORE = \theta_{Size} + \theta_{Noise} + \theta_{Speed}$$

To be compliant and eligible for the Grand Prize, smallest prize, or quietest prize, each scored parameter must meet the threshold.

4. Additional Requirements

The device must be designed and built to maximize the fly-off score while meeting or exceeding the following specifications.

4.1 General

4.1.1. Fly-off completion

The device must be able to successfully complete all fly-off tasks and judging criteria.

4.1.2. Flying conditions

The density altitude at the fly-off will be no more than 5000 ft. Maximum winds for a flight attempt will be no more than 15 knots (including no more than 5 knot gust factor).

The fly-off will be conducted under day VFR conditions. Low visibility, low ceilings, or precipitation should not be expected. No team will be expected to fly in unacceptable weather.

4.1.3. Unmanned option

The device must be designed to carry a human operator of normal size and weight. However, unmanned flight as a remotely piloted or autonomous UAV is allowed. The "operator" for an unmanned device must be an anthropomorphic test dummy (ATD) defined by 49 CFR part 572, subpart B (50th percentile male) or a GoFly-approved equivalent. Pre-approved equivalents are the Simulaids Rescue Randy models 9000 (with water ballast) and 1436. A GoFly-provided dummy will be available. Teams may also choose to provide their own, which may be modified within reason to include necessary avionics and actuators required for remotely piloting the device.

4.1.4. Operator weight

The operator (or ballasted dummy) weight must be 200 lbs or more. This includes clothing, gloves, helmet, personal parachute, other personal protective equipment, contest-provided GPS and sensor package, and any necessary operator-carried ballast to achieve the minimum operator weight.

4.1.5. Airworthiness

Teams are responsible for ensuring their device and operator are legally allowed to fly and are not in conflict with any FAA or other regulations both during testing and practice and at the fly-off.

4.1.6. Single unit

The device must remain a single unit throughout operation. No add-on, detachable, or disposable launch/landing aides are allowed.

4.1.7. Energy sources

Refueling or recharging of the device must utilize readily available and safe sources. Approved energy sources are electricity, automotive fuels, and aviation fuels. Other energy sources are allowed with pre-approval from GoFly.

Swapping of battery packs is allowed between flight attempts, but teams must still utilize rechargeable battery chemistries.

4.1.8. Reusability

The device must be reusable, i.e., it must be designed such that only the energy source (see above) must be replaced between flights.

4.2. Safety

4.2.1. Human-ratable

The intent of this competition is to develop technologies that can be rated for people to safely fly in the future. Consequently, the competition requires that all device architectures are, at the fundamental concept level, "human-ratable." The organizers define "human-ratable" as follows:

A device that has no systems or components, except for primary structure, in which a single point failure results in loss of an operator's life or limb.

Systems or components which, in the event of their failure, permit safe landing of the operator, may be of single string design.

4.2.2. Structure and component suitability

The primary structure may be a single point of failure if:

- adequate proof testing is performed, or
- it is designed to loads significantly higher than expected loads (safety factor ≥ 1.5) and its structural integrity is regularly inspected.

Adequate quality, performance, and service life of all components must meet appropriate requirements for the intended application.

4.2.3. Logged safe prior flight

A minimum of 5 flight hours without incident or configuration changes must be logged prior to the fly-off. This must include at least 10 takeoffs, 1 hour total of flight analogous to speed course flight, 10 go-around maneuvers, and 10 landings to a full stop and power-down.

Extremely minor configuration changes are allowed during these flights as long as they in no way negatively affect safety, they are declared to organizers, and at least one flight hour is logged after all changes.

4.2.4. Safety report

Teams are required to maintain and periodically submit a safety report. The safety report has no page limits or file size limits.

In the safety report, teams must:

- Identify any single-point system failure that makes the device unsafe as defined above.
- Propose design mitigations to the identified single point failures such that the design could be made fail-safe and human-ratable. Examples of mitigations may include enhancing component reliability, software development and testing, or utilizing emergency rescue ejection and parachute systems. Teams are strongly encouraged to incorporate as many of these mitigations into their fly-off entries as possible.

In addition, teams are strongly encouraged, but not required, to include in the safety report:

- Documentation of structural analysis and/or testing.
- Documentation and logs of flight testing or any other testing to date.
- A functional hazard analysis.

4.2.5. Team safety responsibility

Competition teams are solely responsible for the safe operation of their vehicles. This includes the safety of the operator, the vehicle, and any object or person on the ground. The organizers of the competition will verify that each report submitted addresses the above requirements. If the test teams do not address the above requirements, they will not be allowed to proceed in the competition. However, the organizers will not assess the adequacy of the submission from a safety perspective. The competition team is solely responsible for identifying all risks, mitigating them to the maximum extent possible, and determining if the residual risk is acceptable.