

# 2007 PAV Challenge Prize Event Summary

## NASA Centennial Challenge

### CAFE Foundation

The following is a summary of each contest event for the 2007 PAV Centennial Challenge. All entrant aircraft will be entered into each of the following contests.

#### PAV Handling Qualities Prize

The PAV Handling Qualities Prize will be awarded to the aircraft that best meets the mission profile of a PAV as an easy-to-fly and safe vehicle. Each PAV's handling characteristics, including ground handling, takeoff, maneuvering, slow flight, ride quality, stability, landing, field of view, and brake effectiveness will be evaluated by Pilot Evaluators. The scores of the Pilot Evaluators will be averaged. The Pilot Evaluators will come from the professional test pilot community and will be instructed on how to provide consistent evaluations. In addition to Handling Qualities, each team's PAV will be rated on Ease of Use and Consumer Attractiveness as described below.

The Pilot Evaluators' Ease of Use scores will be factored into the point totals for the Handling Qualities Prize and will address design features that enhance comfort, ease of entry and exit, systems operation, ergonomics, pilot workload, baggage stowage, maintenance access, and roadability, if applicable.

Consumer Attractiveness will be evaluated by a Consumer Jury that rates each vehicle as to its desirability in the marketplace based on relative value established by purchase price points, design features, and aesthetics. The Consumer Jury will be a diverse mix of adults from both within and outside the world of aviation.

A scoring system has been designed to allocate appropriate points to each focus.

#### PAV Efficiency Prize

The goal of the contest is to fairly and accurately determine each aircraft's overall trip cost by a realistic contest formula. The PAV Efficiency Prize will be awarded to the aircraft with the lowest trip cost as determined by the contest formula.

The contest will measure three parameters on each contestant vehicle after it completes a 400 mile race course. The three parameters are Trip Speed, Payload, and Fuel Cost. The contest formula handicaps Trip Speed according to the vehicle's Runway Distance Class

(RDC) by applying realistic Ground Travel Times (GTT). The longer the Runway Distance Class, the greater the GTT penalty will be.

The PAV Efficiency Prize is predicated on a "doorstep to doorstep" trip covering a distance "as the crow flies." Each vehicle shall complete its Efficiency Flight attempt by flying the prescribed closed pylon course of approximately 400 statute miles. This course will entail climb and descent segments and will include at least one mountaintop pylon that is approximately 7,000' MSL. Each aircraft's payload, speed, and fuel burn during the flight attempt will be measured. The score will be the quotient obtained from a numerator quantity consisting of total statute miles traveled times the 2/3 root of the number of pounds of non-fuel payload. That will be divided by a denominator quantity consisting of the sum of the dollar costs of the actual fuel burned during the flight plus the Ground Travel Cost (GTC). The GTC will be in USA dollars necessary to go from the aircraft to a simulated destination "doorway" plus the total travel time, which includes flight time, GTT and inter-modal delay (IMD). (IMD is the time one typically spends transitioning from one travel mode such as flying to another such as driving a rental car.) Maximum payload credit is 200 pounds per qualified seat, and credit will be based upon the actual payload carried.

CAFE Efficiency Score = [Miles traveled x (Wp<sup>0.667</sup>)] / [flight fuel cost + GTC + total travel time]

The flight fuel cost, whether avgas, mogas, diesel, jet A, or surplus electricity (watt-hours not replenished by solar cells during the flight) shall be according to the amount of fuel consumed and the fuel's commercial retail purchase price in Northern California at the time of the event. 400 statute miles was chosen as the course length because that is the typical range of modern popular automobiles. Payload, denoted as Wp, is in pounds; flight fuel cost is in USA dollars; total travel time is in minutes. Payload is taken to the 0.667 power to accommodate the scale effect advantage of larger vehicles and the typical car occupancy level of 1.3 to 1.4 persons.

### PAV Shortest Runway Prize

The PAV Shortest Runway Prize will be awarded to the PAV which exhibits the shortest PAV Runway Length. The PAV Runway length is determined by the greater of its takeoff distance from brake release to 50' AGL or its Community Noise Runway Requirement.

Automated differential GPS flight data equipment in the aircraft will measure the takeoff performance and ground track of the aircraft and telemetry this data to a ground based receiving station. To help ensure equitable wind and density conditions during the takeoffs, departures will be as close to one minute between aircraft as possible. The takeoffs may be postponed if conditions are unfavorable or unfair. If an equitable mathematical correction for wind and density can be derived, it may be used at the discretion of the CAFE Foundation.

### PAV Noise Prize

This event will measure both the Community Noise and Cabin Noise of each team's PAV on the dBA, slow scale. These measurements will be combined into a score. The PAV whose score is the lowest, indicating lowest combined noise emissions, will be the winner of the event.

The community noise of each PAV will be measured using traceable high-grade sound measuring equipment placed at three locations. The three locations are brake-release area, runway climb out area, and 1,000' AGL. The average of the noise emissions measured at the three measurement points will be used to calculate the amount of noise that each PAV emits to the community.

The placement of the microphones will depend upon the PAV's demonstrated takeoff distance. The brake release microphone (BRM) will be placed 1,000' from the brake release point of the PAV whose Runway Distance Class (RDC) is 2,700' perpendicular to the runway. The BRM will be placed 500' from the brake release point for aircraft whose RDC is 900'. The BRM will be placed 250' from the brake release point for PAVs whose RDC is 300'. The BRM will be placed 125' from the brake release point for PAVs whose RDC is 100'.

The takeoff overhead climb-out measurement will be recorded from a microphone placed straight down the runway from the brake release point at a distance 50% greater than the PAV's RDC. The longer the takeoff distance, the further away the microphone will be from the brake release point. The third Community Noise measurement will be made with a microphone placed on the ground 1,000' directly below the path of PAVs flying overhead at sustained takeoff power.

The Cabin Noise of each PAV will be measured during a full power top speed flight at a density altitude of 4,500'. The microphone will be placed near the pilot's right ear.

### PAV Top Speed Prize

For the Top Speed Prize, each vehicle will take off at gross weight and climb to no more than 5,000' density altitude. The top speed run will occur along the Russian River Valley for a distance of 15 miles at a density altitude of 4,500'. All aircraft must fly level during its speed attempt for at least 3 minutes. The Top Speed will be taken as the highest speed achieved in any interval during which the aircraft is within  $\pm 100'$  of 4,500' density altitude and has lost no more than 100' of altitude during the preceding 60 seconds. Only one run will be allowed.