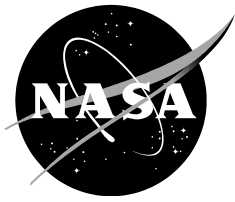


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Wind Tunnel and Hover Performance Test Results for Multicopter UAS Vehicles

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February 2018

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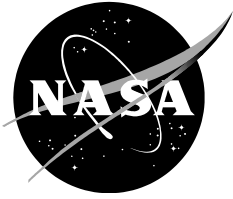
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Wind Tunnel and Hover Performance Test Results for Multicopter UAS Vehicles

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ABSTRACT

There is currently a lack of published data on the performance of multicopter unmanned aircraft system (UAS) vehicles, such as quadcopters and octocopters, often referred to collectively as drones. With the rapidly increasing popularity of multicopter UAS, there is interest in better characterizing the performance of this type of aircraft. By studying the performance of currently available vehicles, it will be possible to develop models for vehicles at this scale that can accurately predict performance and model trajectories. This data report describes a wind tunnel test that was recently performed in the U.S. Army 7- by 10-ft Wind Tunnel at NASA Ames Research Center. During this wind tunnel entry, five multicopter UAS vehicles were tested to determine forces and moments as well as electrical power as a function of wind speed, rotor speed, and vehicle attitude. The test is described here in detail, and the complete data are presented as an appendix.

NOMENCLATURE

BDAS	Basic Data Acquisition System
DELIVER	Design Environment for Novel Vertical Lift Vehicles
ESC	Electronic Speed Controller
FFT	Fast Fourier Transform
NDARC	NASA Design and Analysis of Rotorcraft
RVLT	Revolutionary Vertical Lift Technology
UAS	Unmanned Aircraft System
UTM	UAS Traffic Management
A	Rotor disk area, ft ²
C_T	Thrust coefficient, $T/\rho A(\Omega R)^2$
F_x, F_y, F_z	x-, y-, and z-force, lb
I_x	Current for ESC number x , A
M_x, M_y, M_z	x-, y-, and z-moment, ft-lb
q	Dynamic pressure, lb/ft ²
R	Rotor radius, ft
T	Thrust, lb
V_{esc}	ESC voltage, V
X_{qc}	Chordwise quarter chord location, in
Z_{qc}	Flapwise quarter chord location, in
α	Pitch angle, deg
ρ	Air density, slugs/ft ³
Ω	Rotor rotation speed, rad/s

INTRODUCTION

Multicopter unmanned aircraft have seen a rapid rise in production and utilization in the past few years. As the use of these vehicles continues to increase, research questions have emerged concerning their design, handling qualities, and control. In particular, three NASA projects/sub-projects—UAS Traffic Management (UTM), Design Environment for Novel Vertical Lift Vehicles (DELIVER), and Revolutionary Vertical Lift Technology (RVLT)—have an interest in determining the aerodynamic performance characteristics of multicopters.

DELIVER and RVLТ are focused on advancing the state of the art in design and analysis tools for vertical lift vehicles [Ref. 1]. DELIVER is particularly focused on small (less than 2-passenger) alternative propulsion concepts. Both DELIVER and RVLТ use a rotorcraft design software tool called NDARC (NASA Design and Analysis of Rotorcraft), which has been extensively validated for large (above 2-passenger) rotorcraft [Ref. 2]. Recent modifications to NDARC extended the propulsion models to include electric propulsion systems [Ref. 3]. The NDARC models should, in theory, be extensible to small multicopters, but have not yet been calibrated to existing aircraft. A research effort is currently underway to obtain data on small (up to approximately 10 lb) multicopters to aid in this calibration. The necessary data include rotor performance, airframe aerodynamics, battery and motor performance, and detailed component weights. The data gathered as part of this test will provide calibration data for rotor performance and airframe aerodynamics.

The UTM Project is developing a prototype system consisting of technologies that will enable safe, efficient operations at low-altitude, where a significant increase in unmanned aircraft flights is anticipated [Ref. 4]. One of the key requirements in implementing the system is an understanding of the capabilities of unmanned aircraft under a range of environmental conditions. In particular, there is a need to determine whether a given aircraft will be able to maintain control and/or station-keeping within a pre-defined area of airspace under forecasted weather conditions. Information that is critical to this type of understanding is the interaction between rotor RPM, vehicle air speed, and attitude on the forces and moments on the vehicle. The data collected from the test described here will be used to help populate the vehicle performance database that defines these interactions.

The vast majority of published research on multicopters focuses on dynamics and control of the vehicles, with little on experimental performance data. In recent years, there have been some tests on the small propellers used for multicopters. In particular, Brandt and Selig [Refs. 5 and 6] published a database of propeller performance data including thrust and shaft power in axial flow in a wind tunnel as well as at static conditions. There have also been limited results published for small quadcopter propellers in edgewise flight, such as Ref. 7. Flight test data has also been used to estimate quadcopter performance and enhance simulation models [Ref. 8].

To meet the data needs of UTM, DELIVER, and RVLТ research efforts, a jointly planned wind tunnel test was executed to determine the aerodynamic performance characteristics of five different multicopter aircraft. The primary goal of the test was to generate a high-quality set of data for multicopter performance that can be used for model development and validation. The test took place in the U.S. Army 7- by 10-ft wind tunnel at NASA Ames Research Center. Measurements included forces and moments on the multicopter rotors and airframes as well as electrical power as a function of speed, attitude, and rotor RPM. Complementary testing was performed to measure hover performance of multicopter rotors and complete vehicles. The results of the test were first presented in Ref. 9 along with an in-depth discussion of the results. This data report details the methods and procedures used to collect the data and contains all of the collected data in tabular format.

TEST OVERVIEW

Five aircraft were tested as part of this wind tunnel entry: 3D Robotics (3DR) SOLO, DJI Phantom 3 Advanced, 3D Robotics Iris+, Drone America x8 (DAX8), and Straight Up Imaging (SUI) Endurance [Refs. 10-14]. All five aircraft are commercially available multicopters whose primary mission is photographic surveillance. Table 1 summarizes the pertinent details of the five aircraft, and Figs. 1-5 show pictures of the vehicles installed in the wind tunnel. In addition to the full vehicles, three of the isolated rotors were tested in the wind tunnel (time constraints didn't permit testing all five isolated rotors), and this configuration is shown in Fig. 6 for the SUI Endurance.

Table 1. Multicopter test vehicle physical characteristics

Make/Model	Configuration	Length, in (incl. rotors)	Width, in (incl. rotors)	Rotor Diameter, in	Nominal Flight Weight, lb[★]
3DR SOLO	Quadcopter	21.5	21.5	10.0	3.3
DJI Phantom 3	Quadcopter	19.2	19.3	9.4	2.8
3DR Iris+	Quadcopter	20.0	25.7	9.6	2.8
Drone America x8	Octocopter	48.0	45.3	11.0	12.8
Straight Up Imaging Endurance	Quadcopter	35.1	35.1	15.0	6.0

[★]Including cameral payload

All of the vehicles were modified from their typical consumer configuration to facilitate testing in the wind tunnel, with internal electronic components being the most notable change. The brushless motors employed by all of the multicopters tested here require a three-phase switched DC power signal provided by an electronic speed controller (ESC). On production versions of the vehicles, the ESCs are typically embedded in custom circuit boards. Directly controlling the ESCs would therefore require access to the programming interface for the custom circuitry for each vehicle, which was an unnecessary complication for the test. Thus, the custom circuitry was removed and was replaced by off-the-shelf ESCs—one for each motor—for the wind tunnel test.

Different sets of ESCs, motors, and propellers were used for the five different vehicles. While the ESCs were installed specifically for the wind tunnel test, the motors and propellers used for each vehicle were those that came factory installed. The ESCs, motors, and propellers used for each vehicle during the wind tunnel test are listed in Table 2.

Table 2. Multirotor test vehicle hardware

Make/Model	ESC	Motor	Propeller
3DR SOLO	Castle Creations Talon 35	3DR 880 kV	Factory prop 10x4.5
DJI Phantom 3	Castle Creations Talon 25	DJI 2312 960 kV	Factory prop 9.4x5
3DR Iris+	Turnigy Plush 30	3DR 2213 950kV	Factory prop 9.5x4.5
Drone America x8	KDE XF-UAS35	KDE Direct 2814 XF 775 kV	T-Motor 11x3.7 CF
Straight Up Imaging Endurance	Turnigy Plush 30	T-Motor MN3508-29 380 kV	T-Motor 15x5 CF

A laser scanner was used after the test to obtain the exact geometries of the rotors that were tested. These geometries are given in Appendix A, including the blade cross sections, twist and chord distribution, and location of the quarter-chord of each cross section. The x-coordinate of the quarter-chord location, X_{qc} , is defined as positive towards the trailing edge from the leading edge. The z-coordinate, Z_{qc} , is positive in the thrust direction. One notable difference between the blade airfoils and those typically found on full-scale rotorcraft is the blunt trailing edge, particularly for the outboard blade sections. This blunt trailing edge is due to manufacturing limitations and likely has an effect on performance. This effect is addressed in some detail in Ref. 15.

The other primary modification was the removal of the camera gimbal in order to use the gimbal mounting holes to install the vehicles in the wind tunnel test section. Both the interface with the ESCs and the physical interface with the test vehicles are discussed further in the following section.



Figure 1. 3D Robotics SOLO



Figure 2. DJI Phantom 3 Advanced



Figure 3. 3D Robotics Iris+

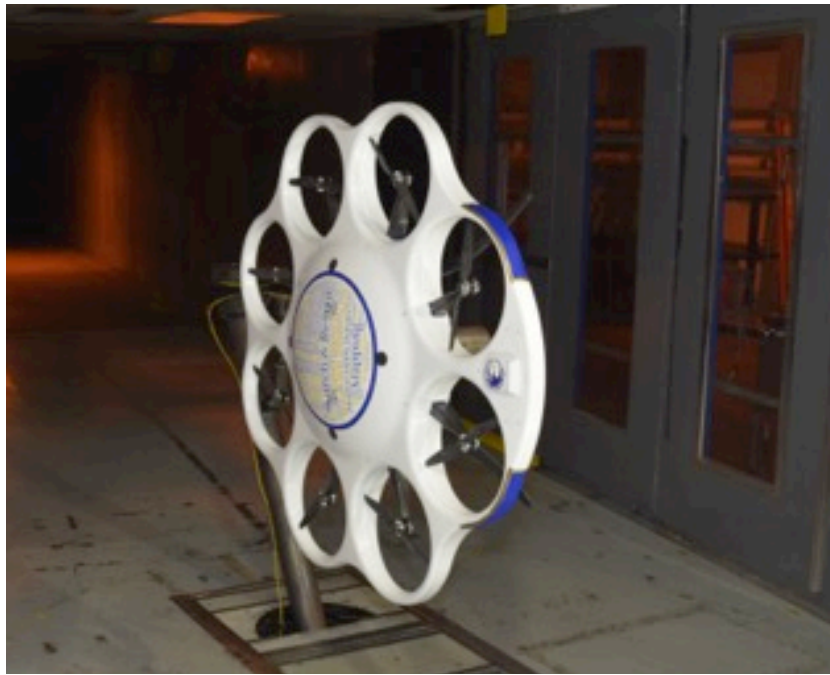


Figure 4. Drone America DAX8



Figure 5. SUI Endurance

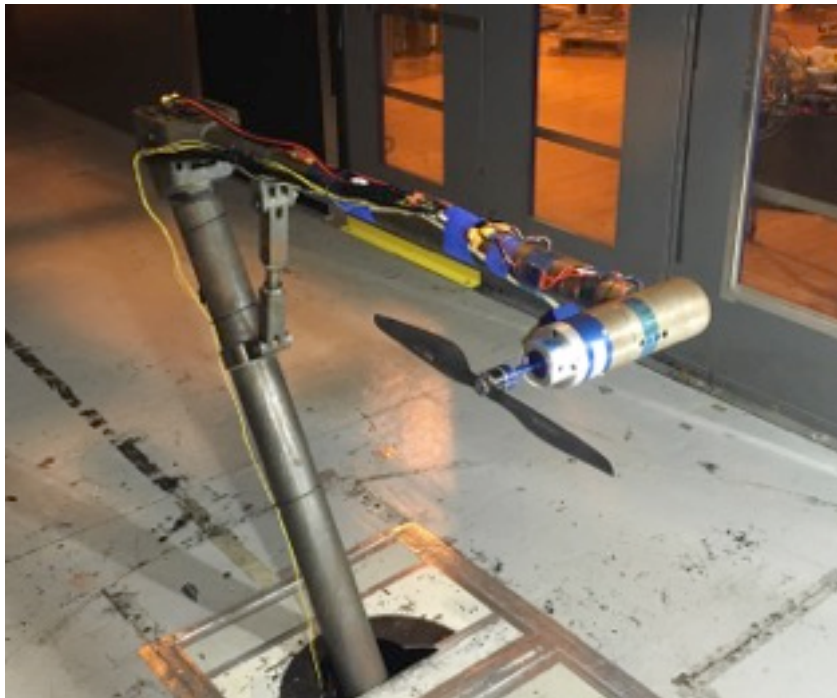


Figure 6. Isolated rotor – SUI Endurance

TEST DETAILS

The objective of the test was to measure forces, moments, and motor power as a function of wind speed, attitude, and rotor RPM for each test vehicle. Each of the five multicopter aircraft was run through a range of test conditions, including the full vehicle and bare airframe. Three of the five vehicles' rotors were also tested in isolation.

The following sections detail the data acquisition and model control systems that were used to meet the test objectives. Next, the model mounting hardware is described, followed by an overview of the testing procedures. Finally, the steps taken to reduce and correct the data are described.

Test Control and Measurement Systems

An overview of the test systems used for data acquisition, model control, and power delivery is shown in the schematic in Fig. 7, and is described below. These aircraft normally fly either autonomously or under radio control with batteries providing power. To eliminate battery safety concerns and eliminate testing downtime that would be required for battery charging, power was provided by a 3,000-watt Sorensen DC power supply. The power supply is capable of supplying up to 20 V DC power at up to 150 A, which is sufficient to power each of the test vehicles up to their respective maximum power. Power was delivered to the model via a pair of heavy-gauge welding cables and distributed through a wiring harness to each of the ESCs.

Two different data acquisition systems were used to collect data for this test. The primary data system was the Basic Data Acquisition System (BDAS), a LabVIEW-based system that can be configured to record tunnel conditions in addition to user data signals [Ref. 16]. For this test, the user data included the model angle of attack, the model forces and moments, and the voltage and current to each ESC. These signals were passed through a Pacific Instruments signal conditioning system to the BDAS system, which collected data at a rate of 1,024 samples per second and then computed the average over a 30 second data record.

The secondary data system contained both the software for commanding the ESC and a second LabVIEW program for recording and monitoring rotor RPM. Rotor speed control inputs were made by a human in the loop (usually the test engineer), to match the target RPM. Since radio control of the test vehicles was undesirable (due to concerns about radio interference), control was accomplished via a Pololu Mini Maestro servo controller with a wired connection to the test article. The servo controller has outputs for up to 12 servos, which can be controlled independently. The pulse-width modulated (PWM) signal used by RC aircraft servos is the same as that used by the ESCs, so this servo controller provided a convenient and low-cost means of sending commands to the ESC.

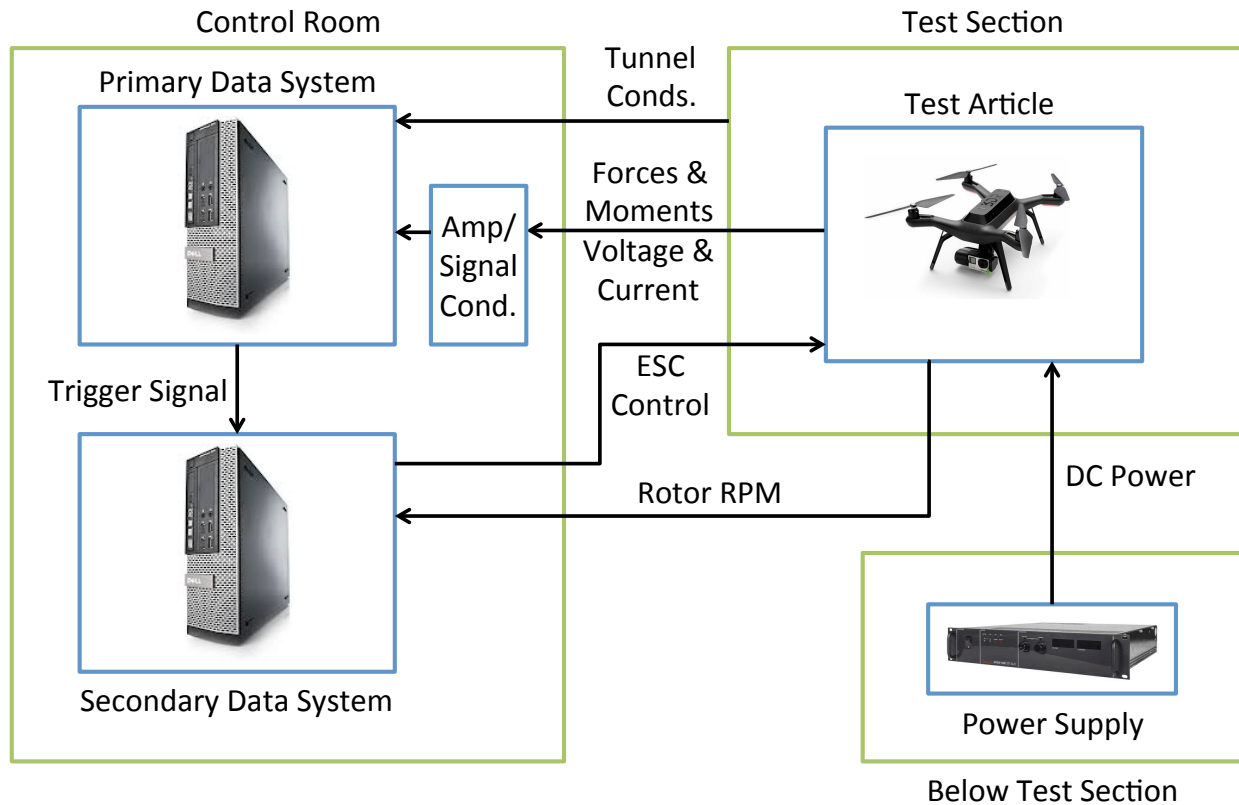


Figure 7. Schematic of data acquisition, control, and power systems

Rotor RPM measurements were made with Eagle Tree brushless motor RPM sensors. These sensors tap into the motor power leads and provide a sinusoidal output voltage signal with a frequency equal to the commutation frequency of the motor. All of the motors used for this test are 7-pole motors, with a commutation frequency of 7 times the rotation speed. The LabVIEW program mentioned above provides filtering on the signal and uses a Fast Fourier Transform (FFT) to isolate the commutation frequency and record rotation speed for each motor. Based on the resolution of the FFT as well as comparison with a handheld optical tachometer during test preparations, the accuracy of the RPM measurements was estimated to be ± 30 rpm. A typical operating rotor speed for the vehicles tested here is around 5,000 rpm, so the relative accuracy of the RPM measurements is better than $\pm 1\%$. Acquisition of the motor RPM data was triggered by a signal from the primary data system so that the data collected by both systems was properly synchronized.

To match typical flight conditions, the power supply voltage was set to match the maximum voltage that is used for flight versions of the five vehicles. For the DAX8, SUI Endurance, Phantom 3, and 3DR SOLO, the voltage was set to 16.8 V. For the 3DR Iris+, voltage was 12.6 V. In order to account for voltage sag due to line losses, the actual voltage was measured at the model, just before the power leads were split off to the individual ESCs. Electrical current to each ESC was measured by splicing a 5 m Ω current sense resistor into the ground side lead of the ESC and measuring the voltage drop across the resistor. The resistor had a tolerance of 1%, which contributed a small amount of uncertainty to the electrical current measurements.

The forces and moments were measured using six-axis load cells manufactured by JR3, Inc. The majority of testing was carried out using a JR3 model 30E15A4-I40-EF-50L six-axis load cell, which has maximum loads of 50 lb in the x- and y-directions, 100 lb in the z-direction, and maximum moments of 150 in-lb in all three directions. Manufacturer-stated accuracy of the load cells is 0.25% of full-scale. Sting balances typically have accuracies no worse than 0.1% of full-scale, so some accuracy was sacrificed in favor of lower cost and hardware risk. Measurement uncertainty for this test is addressed later in the Results section. The test plan originally called for a smaller 10-lb (x- and y-axis) load cell for the lighter quadcopters, but early testing revealed significant vibrations that exceeded the capacity of the 10-lb load cell. The 50-lb model was therefore used for all five vehicles.

Mounting and interface hardware

In order to expedite pitch movement using existing wind tunnel hardware and control systems, the vehicles were installed on the wind tunnel sting assembly (Figs. 1-6) at a 90-degree right roll angle, allowing the tunnel turntable to be used to vary the vehicle angle of attack. This allowed parameter sweeps with arbitrary values of angle of attack without requiring access to the model. Changing the model yaw angle required manual adjustment, but only a handful of yaw angles were tested per vehicle, so making yaw angle changes did not have a significant impact on testing time.

The interface hardware between the vehicles and the sting stand was designed to allow quick model changes. A drawing of the mounting hardware is shown in Fig. 8 and a close-up photograph of the mounting hardware is shown in Fig. 9. Note that the viewing angle is flipped 180 degrees between Figs. 8 and 9 to show the details of the hardware. Also shown in both images are the directions of the forces measured by the load cell and the direction of airflow relative to the model. The measurement axes are discussed in further detail in the Results section.

The yellow sting attachment bar (parallel to the x-axis in Fig. 8) was installed on the sting stand and was bolted in place for the duration of the test. The load cell is shown in gray, and the model interface plates were bolted on top of the load cell as shown. Each model has its own mounting plate with a 1.25-inch-diameter boss that inserted into the interface plate and was secured in place with four bolts. Figure 10 shows an example model mounting plate. Because each model has the same 1.25-inch boss, model changes could be made very quickly during the test.

Yaw changes were made by rotating the yaw stub (shown in dark blue in Fig. 8) below the load cell inside of the yaw tube, shown in orange. Two bolts could then be inserted into a series of threaded holes, allowing model yaw angles of 0, -5, -10, -30, -45, -60, and -90 deg (positive yaw defined as nose-right).

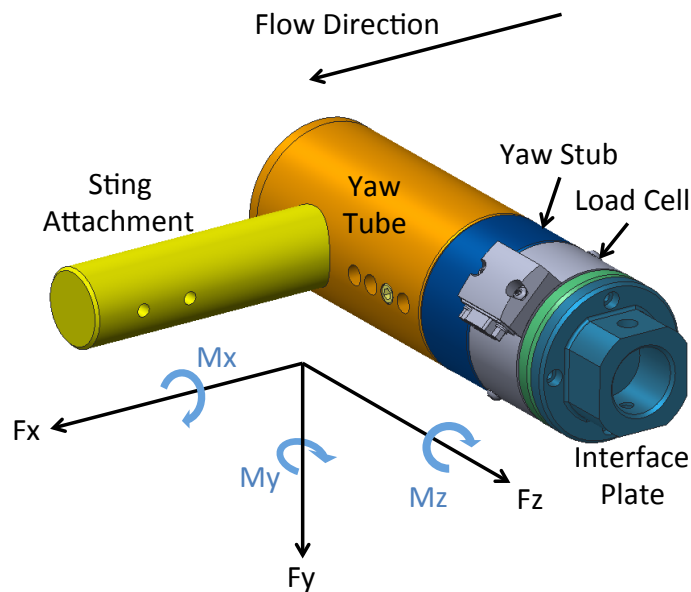


Figure 8. Model mounting hardware

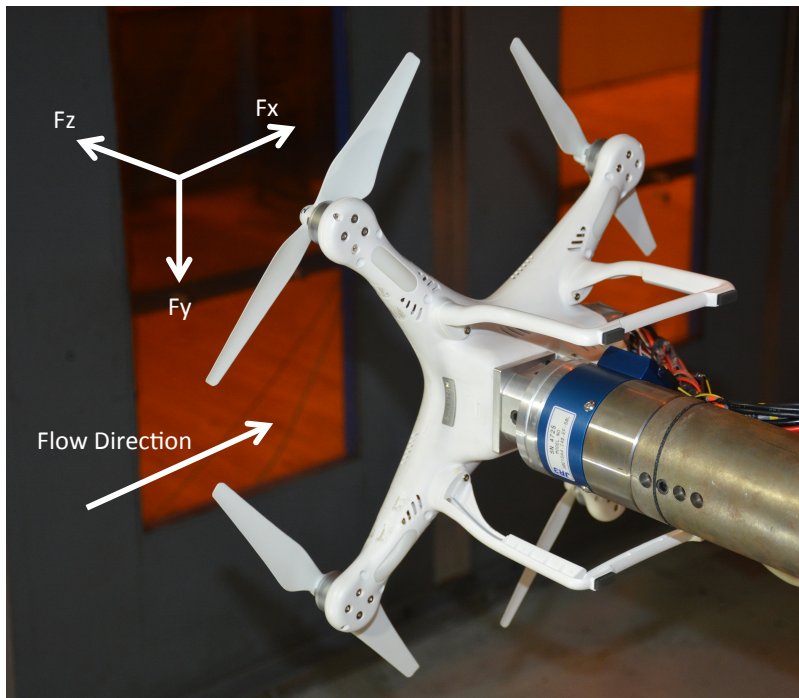


Figure 9. Close-up of DJI Phantom 3 mounted on sting stand



Figure 10. Model mounting plate for DJI Phantom 3

For the DJI and 3DR quadcopters, shown in Figs. 1-3, the camera gimbal mounting holes were used to support the vehicles and serve as attachment points to the interface hardware. The DAX8 octocopter (Fig. 4) and SUI Endurance quadcopter (Fig. 5) are heavier vehicles, so the camera mounting holes did not provide sufficient strength to support the vehicle weight and aerodynamic loads. For the latter two vehicles, the mounting hardware was attached directly to the vehicle chassis. For the Endurance, it was possible to attach the DJI Phantom mounting plate to the bottom chassis plate of the vehicle. For the DAX8, a set of metal struts had to be fabricated to attach to the vehicle inner structure as shown in Fig. 11.

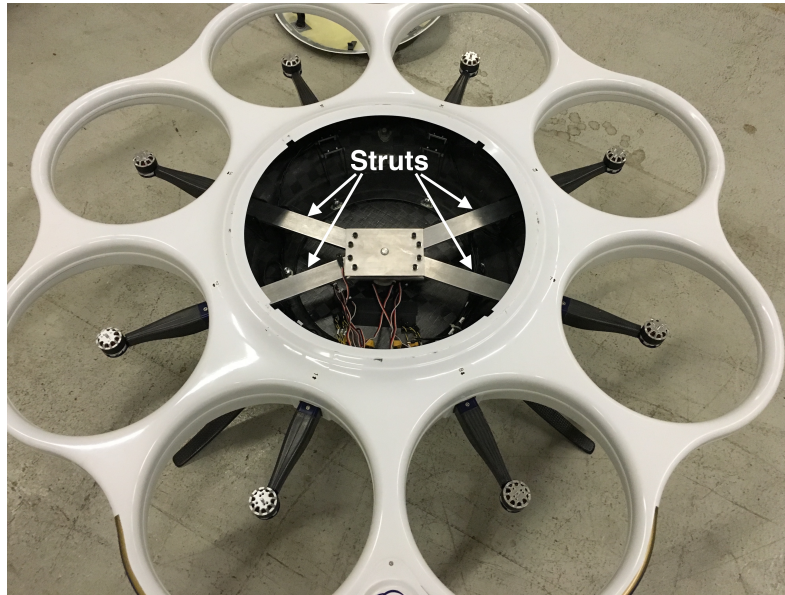


Figure 11. Drone America x8 internal mounting hardware

In addition to the wind tunnel measurements, the hover performance was measured for all five complete vehicles and all five isolated rotors. The DAX8 and SUI Endurance were hover tested in the test section of the 7- by 10-ft wind tunnel mounted at zero degrees pitch and yaw in the wind-on test configuration. The remaining three vehicles and all five isolated rotors were tested on the sting stand in a lab, as shown in Fig. 12. A clone of the BDAS system used in the wind tunnel was used for data acquisition in the lab. The range of hover test conditions is included with the full vehicle and isolated rotor test matrices in Tables B1 and B3.

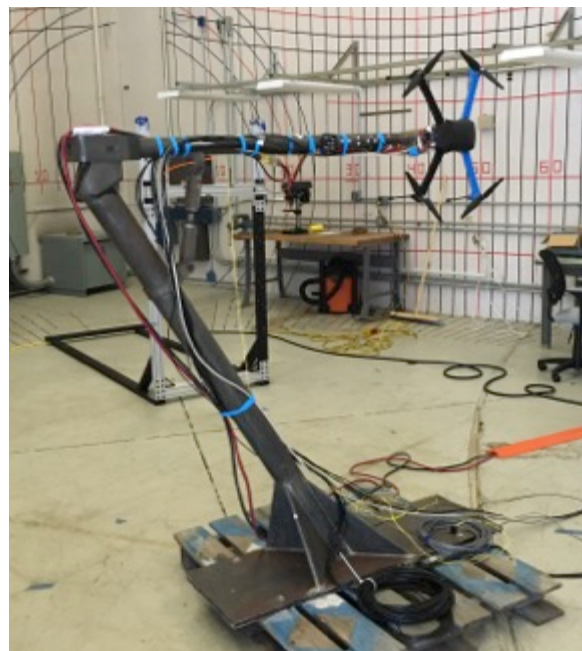


Figure 12. 3DR Iris+ hover test configuration

Test matrix and testing procedures

For each model, the test plan called for three different configurations to be tested in the wind tunnel: full vehicle, bare airframe (rotors removed), and isolated rotor. Time constraints limited the number of isolated rotors tested to three of the five vehicles. By testing the vehicles in these three configurations, it was possible to determine the performance of the rotors in isolation as well as the full vehicle performance, where rotor-to-rotor and rotor-to-airframe interactions have an effect. Additionally, the bare airframe runs provided measurements of the forces and moments on the vehicle structure, with the airframe drag being the primary measurement of interest.

In hover, both the full vehicles and isolated rotors were tested. Again, these measurements made it possible to quantify the isolated rotor performance as well as the effects of aerodynamic interactions between the rotors and airframe.

Rotor RPM was varied in two ways for the full vehicle configurations. First, the rotor speed was changed uniformly for all of the rotors on the vehicle in order to quantify the effects of RPM on the vehicle forces and moments, particularly lift and drag. Second, non-uniform rotor speeds were tested, where there was a difference in RPM either from front to back or from side to side. These differential RPM runs will allow quantification of the pitch and roll moments that can be induced by the rotors as well as provide estimates of the different rotor speeds required to trim pitching moment in forward flight. The uniform and differential RPM results are split into separate tables and labeled as such in Appendix C.

The primary variables for each test run were model angle of attack and rotor RPM. Each run started with a set of static and housekeeping points with wind off and wind on that were repeated at the end of the run to check for repeatability of measurements. To facilitate the application of aerodynamic tares, speed was set based on dynamic pressure, q . With speed and vehicle pitch fixed, RPM was swept from approximately 80 to 120 percent of the baseline RPM. All target rotor speeds were rounded to the nearest 100 rpm to make RPM adjustments easier. Baseline RPM was selected based on a thrust approximately equal to the manufacturers' specified nominal flight weight. Table 3 gives the baseline thrust and rotor speed for each of the five test vehicles.

Table 3. Baseline vehicle thrust and rotor RPM

Vehicle	Baseline Thrust (lb)	Baseline Rotor RPM
3DR SOLO	3.3	5,700
3DR Iris+	2.8	5,400
DJI Phantom 3 Advanced	2.8	5,300
Drone America DAX8	12.8	7,000
SUI Endurance	6.0	3,500

RPM for each rotor was adjusted manually on the secondary data acquisition system as described earlier. After testing the uniform RPM data points, differential rotor speed was tested to measure moments on the vehicles. The procedure was then repeated for a series of pitch angles. The test matrix for all of the vehicles is summarized in Table 4. The specific test matrices for each vehicle are presented in full in Tables B1-B3 in Appendix B. The bulk of testing concentrated on the full vehicle configurations at nominal speeds of 20 and 40 ft/s, with a limited number of runs at 60 and 80 ft/s. Due to time constraints, yaw sweeps as well as isolated rotor testing were limited to the 3DR SOLO, DAX8, and the SUI Endurance.

Table 4. Test matrix summary

Configuration	Pitch (deg)	Yaw (deg)	Airspeed (ft/s)	RPM (% baseline)
Full Vehicle	-40 – 40	-90 – 0	20 – 80	80 – 120
Bare Airframe	-40 – 40	-90 – 0	20 – 80	N/A
Rotor Only	-40 – 40	N/A	20 – 80	80 – 120
Hover	N/A	N/A	0	70 – 130

For the DAX8 and the Endurance, hover testing was done with the model mounted in the wind tunnel, due to limited availability of those two vehicles. The remaining three vehicles were hover tested in a lab. In the wind tunnel, the rotors are approximately six feet from the walls, so there is potential for recirculating air to affect the measurements. In the lab, the models were mounted on the sting stand, with the nearest wall approximately 30 feet away. Recirculation should therefore not be a problem for the data collected in the lab. The effects of recirculation for the hover tests in the tunnel have yet to be quantified.

Data reduction and corrections

Most of the data processing was performed in real time by the BDAS system. The two post-processing tasks required were temperature drift corrections and application of aerodynamic tares. During the test, it was observed that the final static points were not matching well with the initial static points. In particular, the z-force for the final static point was often 0.1 – 0.3 lb less than that for the initial static point on a given run. This drift was found to be well correlated with temperature changes in the test section. The measured drift with temperature is plotted in Fig. 13 along with the linear fit to the data for all six forces and moments. The slope of the linear fit that was used to apply the temperature corrections is also given.

The temperature typically increased from the beginning of a run to the end, because testing was carried out in the morning and early afternoon when exterior temperatures were rising. As the plots in Fig. 13 show, there is additional scatter in the data not related to temperature drift. This scatter can provide a first approximation of the uncertainty in the test measurements and is discussed further in the Measurement Uncertainty section.

The linear fit based on tunnel temperature was applied to the force measurements using the recorded temperature for each data point. The results of these corrections for an example run are shown in Fig. 14. The data shown are for the 3DR Iris+ at $q = 1.9 \text{ lb/ft}^2$, with pitch ranging from -5 to 0 deg and RPM from 4,300 to 6,500, plus differential RPM. In this particular case, the temperature increased from 54.6° F at the beginning of the run to 62.9° F at the end of the run. This temperature change resulted in the uncorrected z-force measurement for the final static point being 0.2 lb below the initial static point reading, or about 4% of the maximum force measured during this run. After application of the temperature drift correction, the final static point only differs from the initial static point by 0.003 lb.

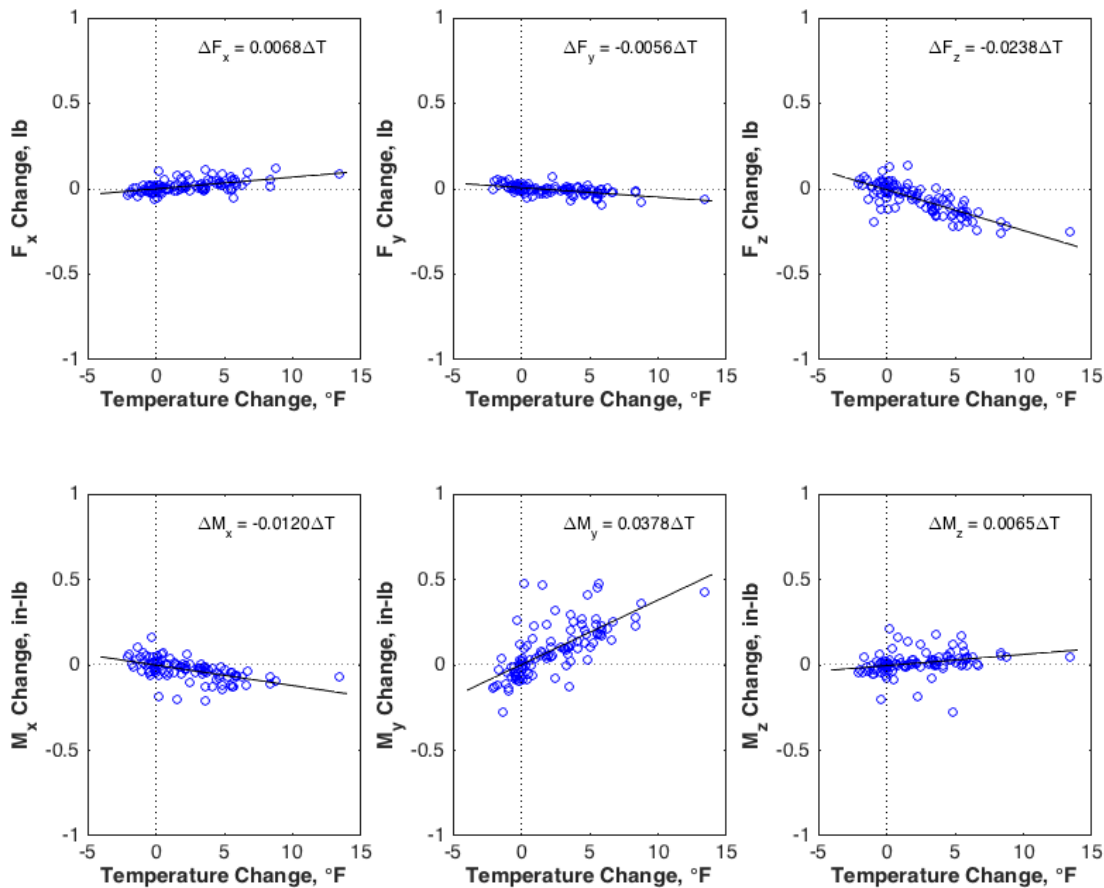


Figure 13. Variation of load cell static measurements with temperature

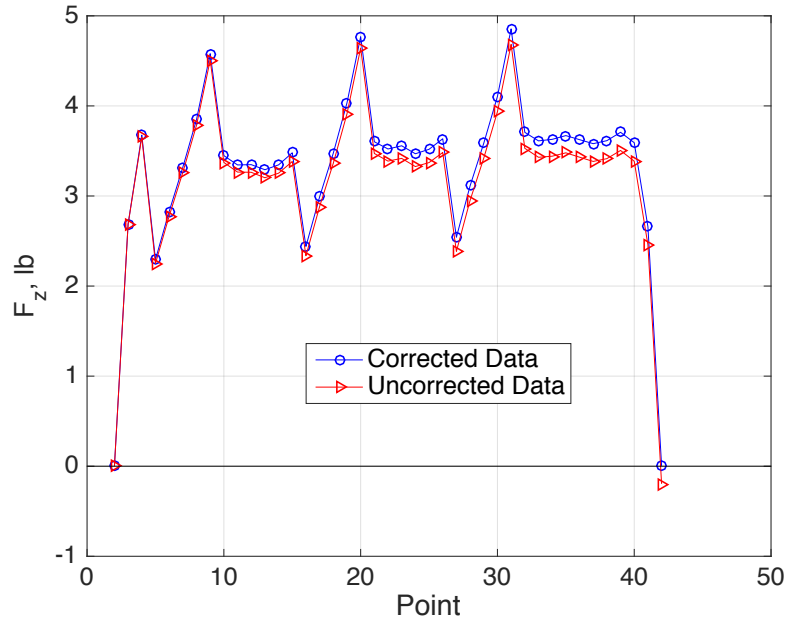


Figure 14. z-force for Run 63 – 3DR Iris+ with and without temperature drift corrections

Load cell aerodynamic tares for the full vehicles and bare airframes were measured with just the model interface plate installed as shown in Fig. 15 (note that this photo was not taken in the wind tunnel, but does show the configuration as tested for the aerodynamic tares). Not accounted for in the tares were the effect of the individual model mounting plates and the cables that supplied power and RPM commands to the vehicles. The mounting plates were not included, because putting them in the airstream in isolation would not be representative of their effects on the full model. The cables were not included, because with the vehicle removed, there was nothing to attach them to. A separate set of aerodynamic tares was measured for the isolated rotors, and this configuration is shown in Fig. 16. For the isolated rotor tares, all of the hardware shown in Fig. 6 was installed except for the rotor blade.

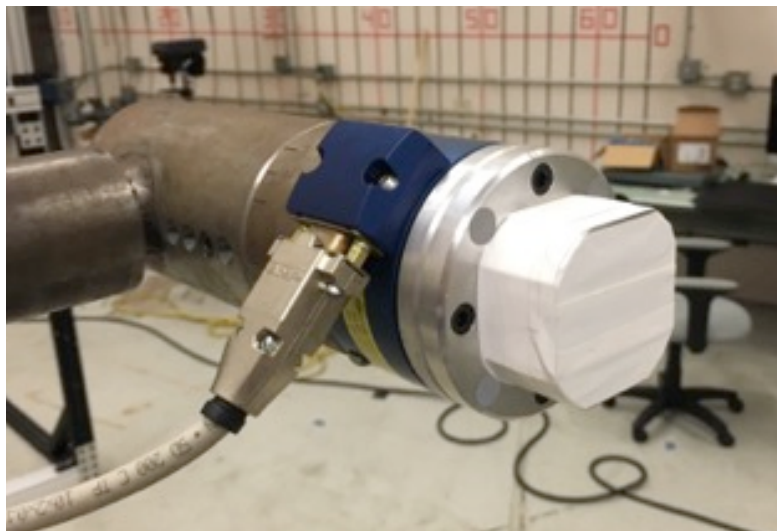


Figure 15. Full vehicle and bare airframe aerodynamic tare configuration

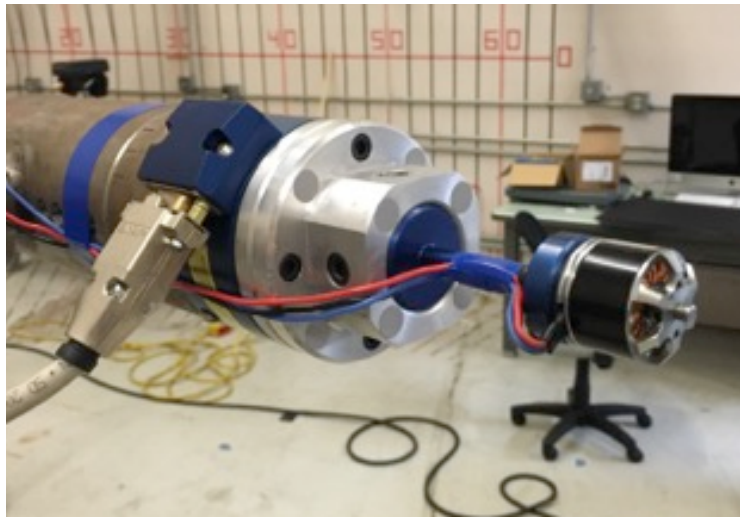


Figure 16. Isolated rotor aerodynamic tare configuration

Typically, in this type of wind tunnel test, weight tares would be required to account for changes in the model center of gravity relative to the load cell during model pitch changes. For this test, however, weight tares were not required, because the model was mounted on its side and the load cell moved with the model. In this configuration, the gravity vector of the model does not move relative to the load cell during pitch changes. The gravity vector does move relative to the load cell for model yaw changes, but a new data run was started any time the model yaw was changed, at which point the load cell measurements were re-zeroed.

RESULTS

Measured Data

An in-depth discussion of the results was given previously in Ref. 9. This data report presents the data corrected for temperature drift and aerodynamic tares (where applicable) in tabular format in Appendix C. The load cell measurements coincide with typical wind tunnel aircraft body axes [Ref. 17], as shown in Figs. 8 and 9. All of the data are reported in this body axis system:

- F_x – Axial force, positive aft
- F_y – Side force, positive right
- F_z – Thrust, positive up
- M_x – Roll moment, positive right side down
- M_y – Pitch moment, positive nose up
- M_z – Yaw moment, positive nose right

Note that the M_x and M_z axes do not follow a right-handed convention with their respective axes. Since the model is mounted at a 90 deg roll angle, the y- and z-directions of the load cell do not align with a typical wind tunnel coordinate system. The six-axis load cell was fixed to the model, so no angle transformations were required to translate the load cell measurements to body axes. The only transformation required then was a translation of the moments. For the measurements reported in Appendix C, the moment center for the full vehicle and bare airframe configurations is in the rotor plane at the point equidistant from all four (or eight) rotors. For the isolated rotor, the moment center is taken at the center of the rotor hub. The numbering of the rotors is shown in Fig. 17.

In addition to the force and moment data, the tunnel and atmospheric conditions are given so that appropriate non-dimensional values, such as thrust coefficient, can be calculated. Each data table is split into two or three sub-tables. For the full vehicle data tables, the tunnel conditions, vehicle attitude, and rotor speed are given in Table (a). The measurements of force, moment, ESC voltage, and ESC current are given in Table (b), and the calculated uncertainties for the force/moment and voltage/current measurements are given in Table (c). For the bare airframe and isolated rotor tests, Table (a) gives the tunnel and vehicle conditions as well as the force and moment and electrical voltage/current measurements, while the measurement uncertainties are given in Table (b). The uncertainties given are based on the analysis presented in the following section.

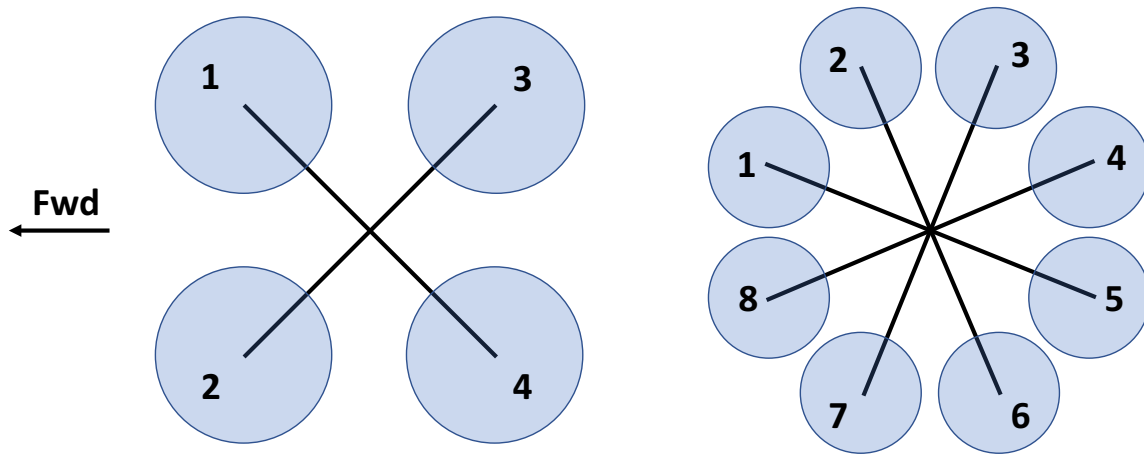


Figure 17. Rotor numbering (top-down view)

Measurement Uncertainty

The majority of the uncertainty analysis focuses on the force and moment measurements. ESC voltage and current measurement uncertainty is also briefly discussed in this section. As previously mentioned, the manufacturer’s stated uncertainty for the load cell is 0.25% of full scale. For the load cell that was used for the majority of testing, the capacity in the x- and y-directions is 50 lb. In the z-direction, the capacity is 100 lb, and the moment capacity is 150 in-lb in all three directions. This translates to an uncertainty of 0.13 lb in the x- and y-force measurements, 0.25 lb in the z-force measurements, and 0.38 in-lb in all three moment directions. Based on the error analysis presented below, the uncertainty is believed to be less than the manufacturer’s stated uncertainty for the load ranges measured during this test. The contributions to uncertainty for all six force and moment measurements are given in Table 5.

Check loads were performed both before and after the test in order to quantify the accuracy of the load cell over the load range tested. The results for the post-test check loads are shown in Fig. 18. Measurements were taken with both increasing and decreasing loads to check for hysteresis. If the load cell measurements were perfect, the measured loads would exactly follow the black line, with a slope of 1. The relative error for all of the check loads is fairly constant for the non-zero measurements, indicating that the slope of the sensitivity curve over this load range is slightly off. Based on the check load data, the uncertainty due to calibration error is largest in the x-direction, with a value of $\pm 0.020F_x$. This uncertainty is listed as “relative cal. error” in Table 5. As shown, the hysteresis is very small, with values in the hundredths of pounds or inch-pounds. The uncertainty in the x-direction due to hysteresis, for example, was measured as ± 0.021 lb.

The third source of force and moment measurement uncertainty that can be applied across all of the data runs is the repeatability of measurements. Ideally, the temperature-corrected forces and moments measured for the static point at the end of each run would be zero; however, there is scatter in these ending static points (previously shown in Fig. 13). The scatter of these points was used to determine the measurement uncertainty due to repeatability (the final row in Table 5). The 95% confidence interval for the uncertainty due to non-repeatability of data points is two times the standard deviation about the mean of the errors for the ending static points.

The final source of uncertainty, which must be calculated separately for each measurement, is the fact that the force and moment measurements are based on an average of unsteady load measurements. For each measurement taken during the test, the standard deviation was recorded. The 95% confidence interval about the mean due to measurement unsteadiness is $2\sigma/\sqrt{N}$, where σ is the standard deviation at a given data point and N is the number of samples. For the 30-second data records at 1,024 samples per second collected for this test, N equals 30,720.

The total force and moment measurement uncertainty is then calculated as the root-sum-square of the four different uncertainty sources. Figure 19 shows an example of the x- and z-force data with error bars for Run 63, which is the same run shown in Fig. 14. The error bars represent the total uncertainty, including the contributions shown in Table 5, as well as the 95% confidence interval about the mean of the unsteady load measurements. The maximum calculated uncertainty in the z-force for this run is 0.163 lb. For the x-direction, the maximum uncertainty is lower, at 0.127 lb, but represents a higher relative uncertainty. It should be noted that the majority of the force and moment measurement uncertainty comes from the repeatability of the measurements.

For the ESC voltage measurements, the standard deviation about the mean is the only quantifiable source of uncertainty. For the ESC current measurements, there are two sources: standard deviation about the mean and a factor of $\pm 1\%$ due to the resistor tolerance.

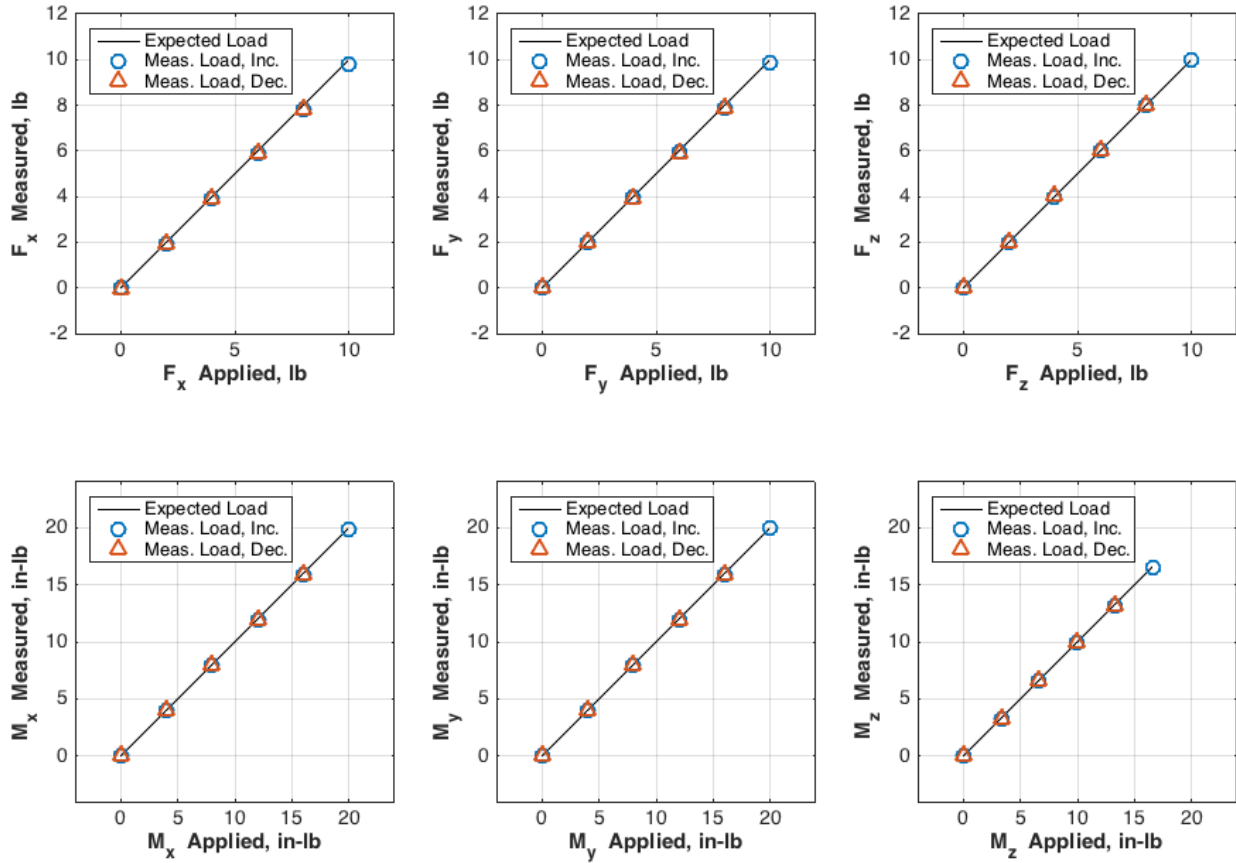


Figure 18. Check load results

Table 5. Force and moment measurement uncertainty contributions

Source	F_x	F_y	F_z	M_x	M_y	M_z
Relative Cal. Error	0.020	0.012	0.002	0.004	0.003	0.008
Hysteresis, lb or in-lb	0.021	0.011	0.052	0.010	0.032	0.018
Repeatability, lb or in-lb	0.085	0.055	0.123	0.148	0.269	0.191

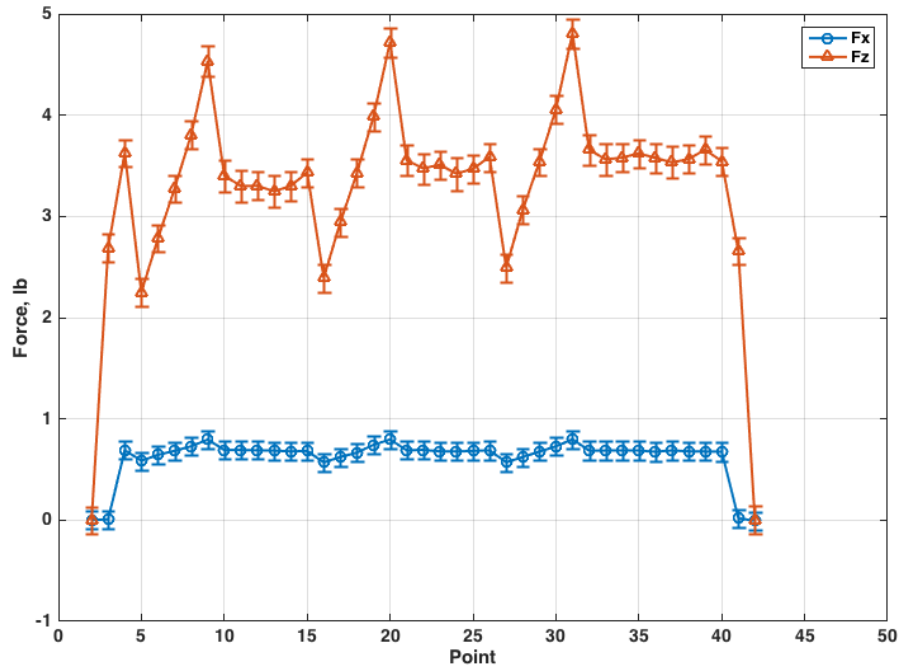


Figure 19. x- and z-force for Run 63 – 3DR Iris+ including uncertainty

CONCLUSIONS

The goal of this test was to generate a high-quality set of data for the performance of multicopter UAS vehicles. The intent is to use this data to enhance software tools in use both inside and outside of NASA to design and analyze multicopter vehicles. The applications targeted by this test are trajectory estimation and vehicle design and analysis, but there could certainly be others that will be able to make use of the data.

The test generated data for five different vehicles in both forward flight and in hover. The data include forces and moments and electrical power as a function of rotor RPM, airspeed, and vehicle attitude. This paper described the test setup and procedure as well as summarized the results of the test at a select number of operating conditions. The complete results are contained in Appendix C.

The data that were collected for the full vehicles as well as for the bare airframes and isolated rotors will allow for development and validation of analytical and numerical models at both the full vehicle and component levels. This breadth of validation data was previously unavailable in the public domain. The data produced by this research effort represent a significant step forward in advancing the understanding of multicopter UAS performance.

ACKNOWLEDGMENTS

A large team was required to accomplish this test, and the authors would like to acknowledge the contributions of all who were involved. In particular, the authors would like to thank Nili Gold and the 7- by 10-ft Wind Tunnel test crew for all the hard work they put in to ensure that the test ran smoothly. The NASA machine shop teams, led by Robert Kornienko and Vincent Derilo, produced the vehicle mounting hardware, which was absolutely critical to the success of the test. Tom Norman provided invaluable insights into wind tunnel testing and data reduction. Straight Up Imaging provided the Endurance vehicle for the wind tunnel test. The assistance of all of those who acted as safety loads monitors during the test is greatly appreciated. Eduardo Solis provided the scanned geometries of the various rotor blades. Three NASA projects supported this test: the UAS Traffic Management (UTM) Sub-project, under the Safe Autonomous Systems Operations (SASO) Project; the Design Environment for Novel Vertical Lift Vehicles (DELIVER) Sub-project, under the Convergent Aeronautics Solutions (CAS) Project; and the Revolutionary Vertical Lift Technology (RVL) Project.

REFERENCES

1. Gorton, S., López, I., and Theodore, C., “NASA Technology for Next Generation Vertical Lift Vehicles,” AIAA SciTech, Kissimmee, FL, January 2015.
2. Johnson, W., “NDARC: NASA Design and Analysis of Rotorcraft,” NASA/TP-2015-218751, April 2015.
3. Johnson, W., “Propulsion System Models for Rotorcraft Conceptual Design,” AHS 5th Decennial Aeromechanics Specialists’ Conference, San Francisco, CA, January 2014.
4. “UTM: Air Traffic Management for Low-Altitude Drones”, NASA facts, NF-2015-10-596-HQ.
5. Brandt, J. and Selig, M., “Propeller Performance Data at Low Reynolds Numbers,” 49th AIAA Aerospace Sciences Meeting, Orlando, FL, January 2011.
6. Brandt, J., Deters, R., Ananda, G., and Selig, M., “UIUC Propeller Data Site,” <http://m-selig.ae.illinois.edu/props/propDB.html>, accessed January 29, 2018.
7. Carroll, T., George, I.-R., Bramesfeld, G., and Raahemifar, K., “Design Optimization of Small Rotors in Quad-Rotor Configuration,” AIAA SciTech, San Diego, CA, January 2016.
8. Huang, H., Hoffmann, G., Waslander, S., and Tomlin, C., “Aerodynamics and Control of Autonomous Quadrotor Helicopters in Aggressive Maneuvering,” 2009 IEEE International Conference on Robotics and Automation, Kobe, Japan, May 2009.
9. Russell, C., Jung, J., Willink, G., and Glasner, B., “Wind Tunnel and Hover Performance Test Results for Multicopter UAS Vehicles,” AHS 72nd Annual Forum, West Palm Beach, FL, May 16-19, 2016.
10. “SOLO Specs: Just the facts,” <https://3dr.com/solo-gopro-drone-specs/>, accessed January 29, 2018.
11. “Phantom 3 Advanced Specs,” <http://www.dji.com/product/phantom-3-adv/info#specs>, accessed January 29, 2018.
12. “3DR Iris+,” <https://3dr.com/iris-plus/>, accessed March 28, 2016.
13. “Drone America – DAX8,” <http://www.droneamerica.com/systems/dax8>, accessed March 28, 2016.
14. “Products – Straight Up Imaging,” <http://www.straightupimaging.com/products/>, accessed March 28, 2016.
15. Russell, C. and Sekula, M., “Comprehensive Analysis Modeling of Small-Scale UAS Rotors,” AHS International 73rd Annual Forum, Fort Worth, TX, May 9-11, 2017.
16. Storms, B., Nishikawa, D., Mason, S, Hange, C., and Phillips, J., “BDAS 13.2 User Manual,” Rev. 2, February 2016.
17. Pope, A. and Goin, K., *High-Speed Wind Tunnel Testing*, Wiley, 1965, p. 242.

APPENDIX A: Rotor geometries

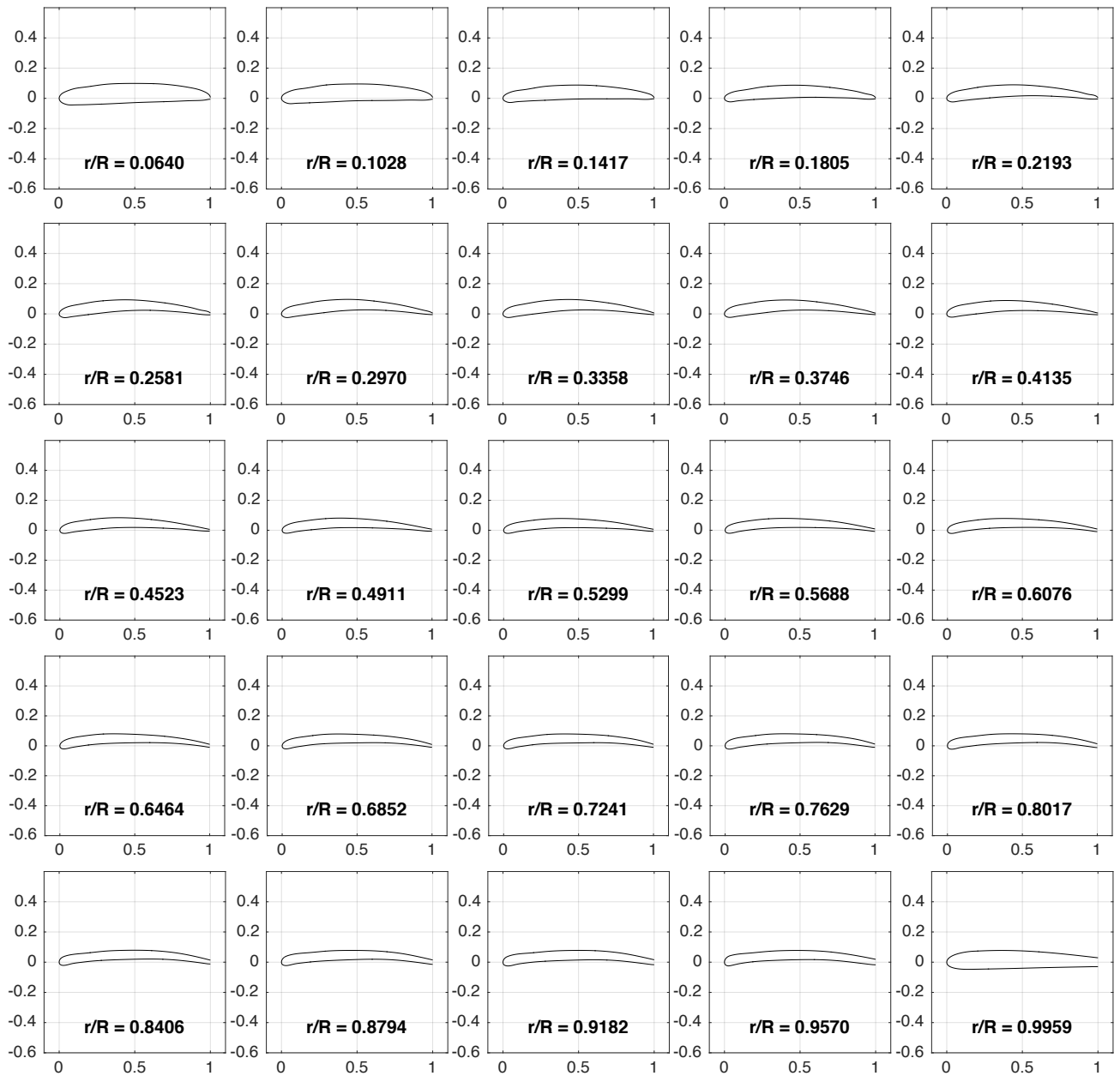


Figure A 1. 3DR SOLO blade airfoil geometry

Table A 1. 3DR SOLO blade geometry

Station (in)	r/R	Pitch (deg)	Chord (in)	X_{qc} (in)	Z_{qc} (in)
0.320	0.064	11.693	0.680	-0.129	-0.051
0.514	0.103	14.212	0.860	-0.134	-0.054
0.708	0.142	16.321	1.038	-0.136	-0.055
0.903	0.181	17.613	1.191	-0.136	-0.060
1.097	0.219	18.329	1.268	-0.136	-0.065
1.291	0.258	18.162	1.260	-0.142	-0.065
1.485	0.297	18.014	1.224	-0.146	-0.062
1.679	0.336	17.695	1.180	-0.147	-0.058
1.873	0.375	17.390	1.138	-0.146	-0.055
2.067	0.414	16.971	1.091	-0.145	-0.051
2.261	0.452	16.639	1.049	-0.144	-0.047
2.456	0.491	16.180	1.003	-0.143	-0.043
2.650	0.530	15.786	0.958	-0.141	-0.039
2.844	0.569	15.325	0.913	-0.139	-0.035
3.038	0.608	14.796	0.869	-0.136	-0.032
3.232	0.646	14.120	0.822	-0.134	-0.029
3.426	0.685	13.447	0.780	-0.131	-0.026
3.620	0.724	12.668	0.735	-0.129	-0.023
3.815	0.763	11.848	0.689	-0.126	-0.020
4.009	0.802	10.802	0.642	-0.124	-0.017
4.203	0.841	9.713	0.600	-0.122	-0.013
4.397	0.879	8.560	0.555	-0.119	-0.009
4.591	0.918	7.720	0.509	-0.113	-0.002
4.785	0.957	6.920	0.448	-0.097	0.006
4.979	0.996	10.121	0.236	0.034	0.017

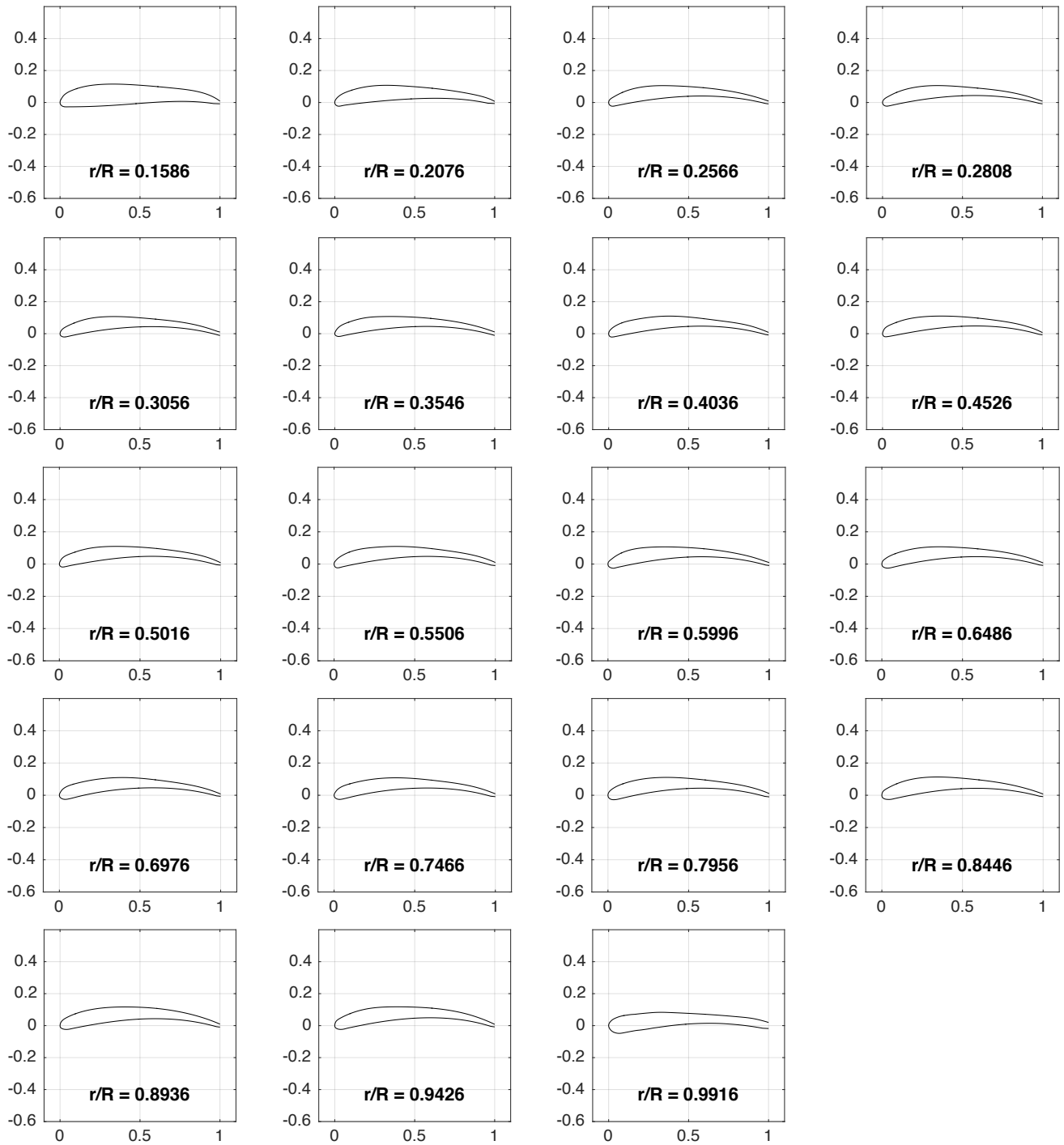


Figure A 2. DJI Phantom 3 blade airfoil geometry

Table A 2. DJI Phantom 3 blade geometry

Station (in)	r/R	Pitch (deg)	Chord (in)	X_{qc} (in)	Z_{qc} (in)
0.745	0.159	15.576	0.868	-0.097	0.005
0.976	0.208	18.060	1.058	-0.095	0.005
1.206	0.257	20.130	1.192	-0.090	0.001
1.320	0.281	20.485	1.219	-0.088	0.001
1.436	0.306	19.822	1.199	-0.092	0.002
1.667	0.355	18.234	1.119	-0.087	0.003
1.897	0.404	17.238	1.038	-0.076	0.009
2.127	0.453	16.053	0.965	-0.072	0.013
2.358	0.502	14.972	0.902	-0.068	0.017
2.588	0.551	14.420	0.844	-0.065	0.023
2.818	0.600	13.787	0.790	-0.061	0.028
3.049	0.649	13.184	0.743	-0.059	0.031
3.279	0.698	12.563	0.695	-0.056	0.033
3.509	0.747	12.037	0.648	-0.052	0.035
3.740	0.796	11.535	0.600	-0.049	0.038
3.970	0.845	11.060	0.553	-0.046	0.039
4.200	0.894	10.616	0.511	-0.046	0.038
4.430	0.943	10.017	0.473	-0.041	0.036
4.661	0.992	9.613	0.410	-0.033	0.048

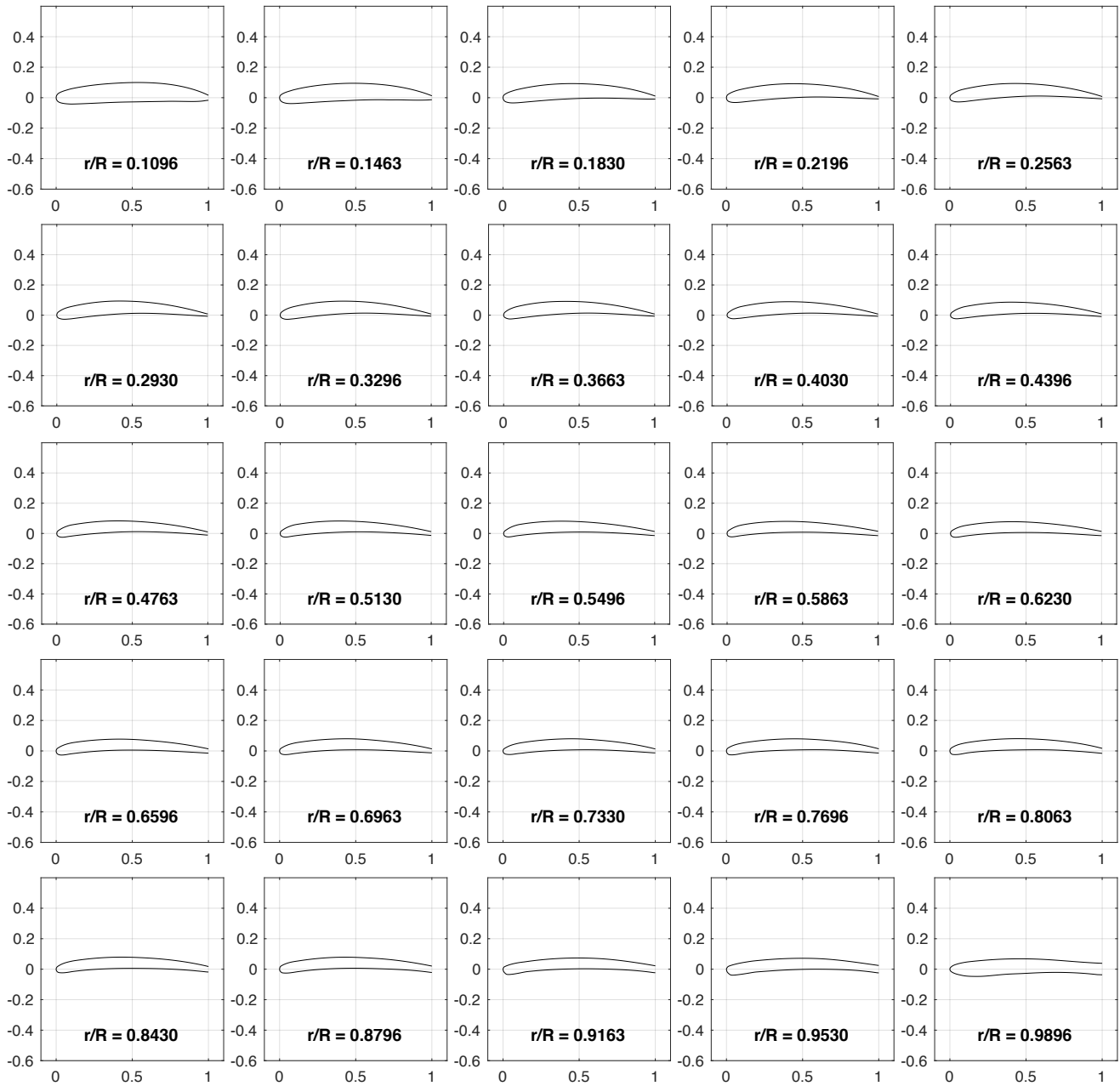


Figure A 3. 3DR Iris+ blade airfoil geometry

Table A 3. 3DR Iris+ blade geometry

Station (in)	r/R	Pitch (deg)	Chord (in)	X_{qc} (in)	Z_{qc} (in)
0.526	0.110	14.119	0.851	-0.158	0.030
0.702	0.146	16.311	0.997	-0.163	0.041
0.878	0.183	17.685	1.116	-0.166	0.046
1.054	0.220	18.445	1.194	-0.167	0.047
1.230	0.256	18.666	1.220	-0.169	0.044
1.406	0.293	18.439	1.200	-0.171	0.044
1.582	0.330	18.116	1.160	-0.172	0.046
1.758	0.366	17.524	1.115	-0.173	0.047
1.934	0.403	17.109	1.074	-0.173	0.049
2.110	0.440	16.727	1.028	-0.172	0.051
2.286	0.476	16.316	0.983	-0.171	0.051
2.462	0.513	15.698	0.941	-0.172	0.050
2.638	0.550	15.086	0.900	-0.173	0.049
2.814	0.586	14.512	0.859	-0.174	0.048
2.990	0.623	14.091	0.819	-0.174	0.049
3.166	0.660	13.593	0.780	-0.173	0.049
3.342	0.696	13.031	0.741	-0.172	0.048
3.518	0.733	12.562	0.701	-0.171	0.050
3.694	0.770	12.061	0.661	-0.169	0.051
3.870	0.806	11.468	0.619	-0.167	0.054
4.046	0.843	10.830	0.577	-0.164	0.057
4.222	0.880	9.992	0.538	-0.162	0.061
4.398	0.916	9.423	0.496	-0.159	0.070
4.574	0.953	9.209	0.431	-0.141	0.081
4.750	0.990	11.123	0.273	-0.049	0.092

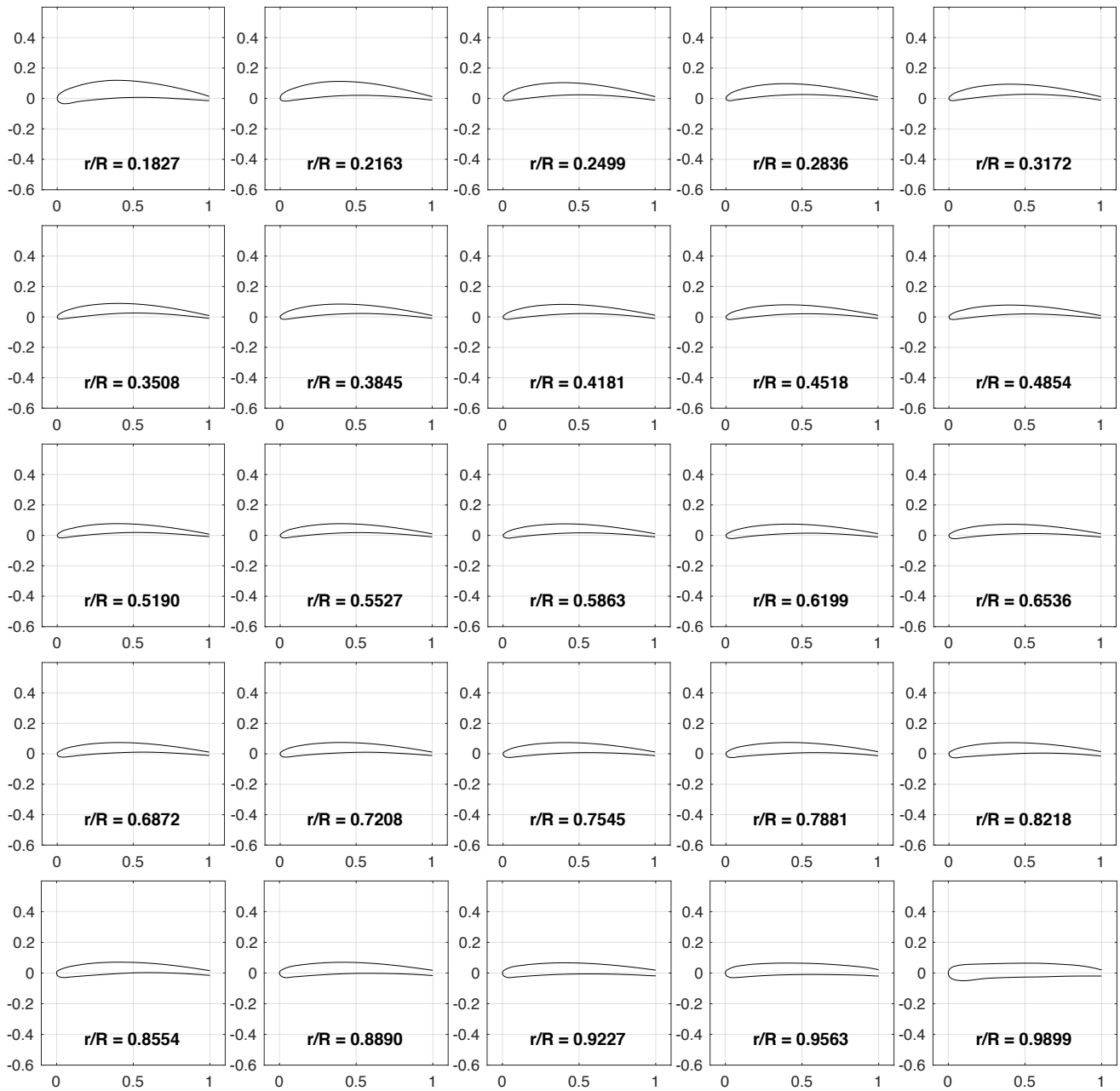


Figure A 4. Drone America DAx8 (T-Motor 11x3.7 CF) blade airfoil geometry

Table A 4. Drone America DAx8 (T-Motor 11x3.7 CF) blade geometry

Station (in)	r/R	Pitch (deg)	Chord (in)	X_{qc} (in)	Z_{qc} (in)
1.005	0.183	19.416	0.812	-0.128	0.029
1.190	0.216	21.184	0.930	-0.119	0.025
1.375	0.250	21.087	1.024	-0.114	0.027
1.560	0.284	19.268	1.088	-0.108	0.032
1.745	0.317	17.382	1.128	-0.108	0.038
1.930	0.351	15.641	1.143	-0.110	0.041
2.115	0.385	14.545	1.145	-0.111	0.042
2.300	0.418	13.728	1.138	-0.110	0.043
2.485	0.452	12.935	1.124	-0.112	0.045
2.670	0.485	12.023	1.108	-0.117	0.048
2.855	0.519	11.191	1.082	-0.124	0.050
3.040	0.553	10.468	1.051	-0.129	0.052
3.225	0.586	9.878	1.019	-0.136	0.056
3.410	0.620	9.389	0.985	-0.143	0.059
3.595	0.654	8.866	0.948	-0.147	0.061
3.780	0.687	8.378	0.917	-0.149	0.061
3.965	0.721	7.976	0.883	-0.153	0.061
4.150	0.755	7.740	0.846	-0.155	0.062
4.335	0.788	7.574	0.808	-0.157	0.063
4.520	0.822	7.359	0.764	-0.158	0.065
4.705	0.855	7.137	0.719	-0.157	0.069
4.890	0.889	6.689	0.669	-0.151	0.073
5.075	0.923	6.511	0.612	-0.139	0.082
5.260	0.956	6.497	0.533	-0.107	0.094
5.445	0.990	7.317	0.354	-0.004	0.107

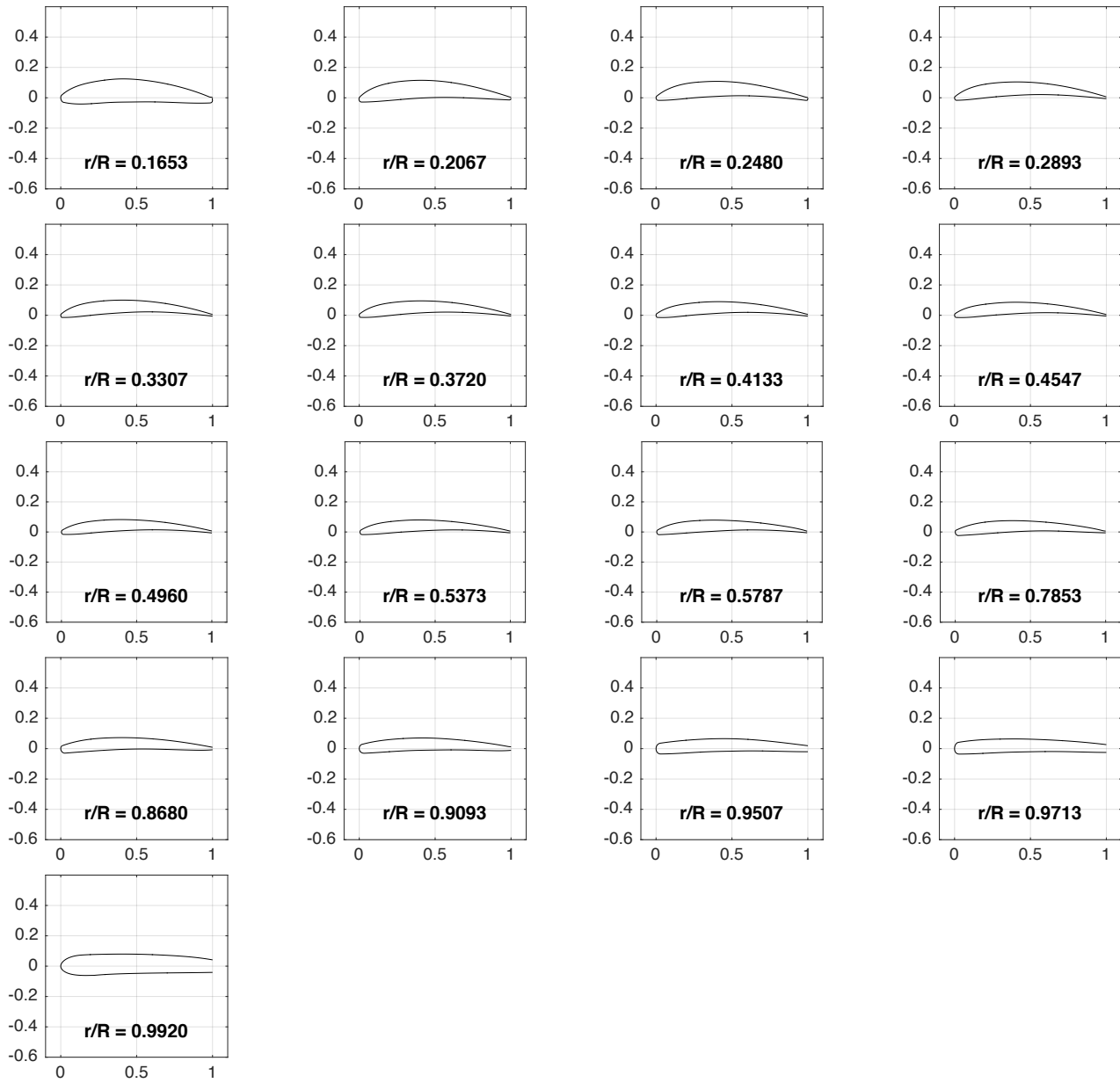


Figure A 5. SUI Endurance (T-Motor 15x5 CF) blade airfoil geometry

Table A 5. SUI Endurance (T-Motor 15x5 CF) blade geometry

Station (in)	r/R	Pitch (deg)	Chord (in)	X_{qc} (in)	Z_{qc} (in)
1.240	0.165	17.171	0.982	-0.169	0.028
1.550	0.207	17.284	1.101	-0.177	0.038
1.860	0.248	21.264	1.349	-0.148	0.025
2.170	0.289	19.863	1.449	-0.141	0.026
2.480	0.331	17.925	1.498	-0.135	0.027
2.790	0.372	16.355	1.511	-0.132	0.025
3.100	0.413	15.090	1.497	-0.132	0.025
3.410	0.455	13.921	1.467	-0.138	0.025
3.720	0.496	12.928	1.427	-0.145	0.028
4.030	0.537	12.168	1.379	-0.153	0.031
4.340	0.579	11.468	1.329	-0.159	0.031
5.890	0.785	9.385	1.008	-0.175	0.039
6.510	0.868	8.527	0.860	-0.173	0.047
6.820	0.909	8.128	0.764	-0.164	0.059
7.130	0.951	7.833	0.633	-0.136	0.079
7.285	0.971	7.629	0.530	-0.102	0.092
7.440	0.992	7.987	0.310	0.011	0.100

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APPENDIX B: Test Matrices

Table B 1. Full vehicle test matrix

Model	Nominal Speed, ft/s	Yaw Angle, deg	Pitch Angle [◆]	RPM [*]
3DR SOLO	20	0	-40 – 40	4,600 – 6,800 + Δ
	40	0	-40 – 40	4,600 – 6,800 + Δ
	80	0	-40 – -20	5,700 – 6,800
	20	-5	-40 – 40	4,600 – 6,800 + Δ
	40	-5	-40 – 40	4,600 – 6,800 + Δ
	40	-30	-10 – 10	4,000 – 6,300
	20	-45	-10 – 10	4,000 – 6,300 + Δ
	40	-45	-10 – 10	4,000 – 6,300
	40	-60	-10 – 10	4,000 – 6,300
	20	-90	-10 – 10	4,000 – 6,300 + Δ
	40	-90	-10 – 10	4,000 – 6,300
	0 (hover)	0	0	3,500 – 8,000 + Δ
DJI Phantom 3	20	0	-40 – 0	4,200 – 6,400 + Δ
	40	0	-40 – 0	4,200 – 6,400 + Δ
	0 (hover)	0	0	3,500 – 7,500 + Δ
3DR Iris+	20	0	-40 – 0	4,300 – 6,500 + Δ
	40	0	-40 – 0	4,300 – 6,500 + Δ
	0 (hover)	0	0	2,500 – 8,000 + Δ
Drone America x8	20	0	-40 – 20	5,000 – 7,400 + Δ
	40	0	-40 – 0	5,000 – 7,400 + Δ
	20	-5	-40 – 20	5,600 – 8,400 + Δ *
	40	-5	-40 – 0	5,600 – 8,400 + Δ *
	20	-30	-10 – 10	5,600 – 8,400*
	20	-45	-10 – 10	5,600 – 8,400 + Δ *
	20	-60	-10 – 10	5,600 – 8,400*
	20	-90	-10 – 10	5,600 – 8,400 + Δ *
	0 (hover)	0	0	4,500 – 9,000 + Δ
SUI Endurance	20	0	-40 – 40	2,800 – 4,200 + Δ
	40	0	-40 – 40	2,800 – 4,200 + Δ
	60	0	-40 – -20	4,200 – 5,000
	20	-5	-40 – 40	2,800 – 4,200 + Δ
	20	-30	-10 – 10	2,800 – 4,200
	20	-45	-10 – 10	2,800 – 4,200 + Δ
	20	-60	-10 – 10	2,800 – 4,200
	20	-90	-10 – 10	2,800 – 4,200 + Δ
	0 (hover)	0	0	1,500 – 4,600 + Δ

◆ Pitch angle is the angle of the tunnel turntable, so in terms of vehicle Euler angles, the pitch rotation would be executed first and the yaw angle second

* + Δ next to the RPM entries indicates that differential RPM values were tested in addition to the uniform RPM sweeps

* During testing of the DAX8, the baseline RPM was changed from 6,200 to 7,000 to better represent the baseline weight of the vehicle

Table B 2. Bare airframe test matrix

Model	Nominal Speed, ft/s	Yaw Angle, deg	Pitch Angle [♦]	RPM
3DR SOLO	20	0	-40 – 40	N/A
	40	0	-40 – 40	N/A
	80	0	-40 – 40	N/A
	20	-90	-10 – 10	N/A
	40	-90	-10 – 10	N/A
DJI Phantom 3	40	0	-40 – 40	N/A
3DR Iris+	20	0	-40 – 40	N/A
	40	0	-40 – 40	N/A
Drone America x8	20	0	-40 – 40	N/A
	20	0	-40 – 40	N/A
	20	-45	-10 – 10	N/A
	40	-90	-10 – 10	N/A
SUI Endurance	20	0	-40 – 40	N/A
	40	0	-40 – 40	N/A
	20	-90	-10 – 10	N/A

♦ Pitch angle is the angle of the tunnel turntable, so in terms of vehicle Euler angles, the pitch rotation would be executed first and the yaw angle second

Table B 3. Isolated rotor test matrix

Model	Nominal Speed, ft/s	Yaw Angle, deg	Pitch Angle	RPM
3DR SOLO	20	N/A	-40 – 40	4,600 – 6,800
	40	N/A	-40 – 0	5,700 – 6,800
	80	N/A	-40 – -20	5,700 – 8,600
	0 (hover)	N/A	0	2,500 – 8,000
DJI Phantom 3	0 (hover)	N/A	0	2,500 – 8,000
3DR Iris+	0 (hover)	N/A	0	2,500 – 8,000
Drone America x8	20	N/A	-10 – 0	6,200 – 8,400
	40	N/A	-20 – 0	6,200 – 8,400
	0 (hover)	N/A	0	2,500 – 8,500
SUI Endurance	20	N/A	-20 – 0	2,800 – 4,200
	0 (hover)	N/A	0	2,000 – 4,500

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APPENDIX C: Test Data Tables

Wind Tunnel Data - 3DR SOLO Full Vehicle

Table C1a. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 40 deg, RPM = 4,600 to 6,800 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
25	5	19.70	0.48	0.00246	0	-39.94	4600	4600	4600	4600
25	6	20.05	0.49	0.00246	0	-39.94	5100	5100	5100	5100
25	7	20.05	0.49	0.00246	0	-39.94	5700	5700	5700	5700
25	8	20.04	0.49	0.00246	0	-39.94	6300	6300	6300	6300
25	9	20.17	0.50	0.00246	0	-39.94	6800	6800	6800	6800
25	10	19.91	0.49	0.00246	0	-19.91	4600	4600	4600	4600
25	11	19.96	0.49	0.00246	0	-19.91	5100	5100	5100	5100
25	12	20.15	0.50	0.00246	0	-19.91	5700	5700	5700	5700
25	13	20.18	0.50	0.00246	0	-19.91	6300	6300	6300	6300
25	14	20.22	0.50	0.00246	0	-19.91	6800	6800	6800	6800
25	15	19.24	0.45	0.00245	0	-9.90	4600	4600	4600	4600
25	16	19.21	0.45	0.00245	0	-9.90	5100	5100	5100	5100
25	17	19.21	0.45	0.00245	0	-9.90	5700	5700	5700	5700
25	18	19.22	0.45	0.00245	0	-9.90	6300	6300	6300	6300
25	19	19.14	0.45	0.00245	0	-9.90	6800	6800	6800	6800
26	6	20.26	0.50	0.00243	0	-4.98	4600	4600	4600	4600
26	7	19.82	0.48	0.00243	0	-4.98	5100	5100	5100	5100
26	8	19.95	0.48	0.00243	0	-4.98	5700	5700	5700	5700
26	9	19.82	0.48	0.00243	0	-4.98	6300	6300	6300	6300
26	10	19.98	0.48	0.00243	0	-4.98	6800	6800	6800	6800
26	17	19.89	0.48	0.00242	0	-1.98	4600	4600	4600	4600
26	18	19.88	0.48	0.00242	0	-1.98	5100	5100	5100	5100
26	19	19.95	0.48	0.00242	0	-1.98	5700	5700	5700	5700
26	20	19.92	0.48	0.00242	0	-1.98	6300	6300	6300	6300
26	21	19.85	0.48	0.00242	0	-1.98	6800	6800	6800	6800
26	28	19.12	0.44	0.00242	0	-0.04	4600	4600	4600	4600
26	30	20.45	0.50	0.00241	0	-0.04	5100	5100	5100	5100
26	31	20.42	0.50	0.00241	0	-0.04	5700	5700	5700	5700
26	32	20.44	0.50	0.00241	0	-0.04	6300	6300	6300	6300
26	33	20.29	0.50	0.00241	0	-0.04	6800	6800	6800	6800
27	6	20.46	0.50	0.00239	0	2.04	4600	4600	4600	4600
27	7	20.29	0.49	0.00239	0	2.04	5100	5100	5100	5100
27	8	20.04	0.48	0.00239	0	2.04	5700	5700	5700	5700
27	9	20.03	0.48	0.00239	0	2.04	6300	6300	6300	6300
27	10	19.99	0.48	0.00239	0	2.04	6800	6800	6800	6800
27	17	20.23	0.49	0.00238	0	5.03	4600	4600	4600	4600
27	18	20.25	0.49	0.00238	0	5.03	5100	5100	5100	5100
27	19	20.11	0.48	0.00238	0	5.03	5700	5700	5700	5700
27	20	19.81	0.47	0.00238	0	5.03	6300	6300	6300	6300
27	21	19.84	0.47	0.00238	0	5.03	6800	6800	6800	6800
28	5	20.30	0.48	0.00235	0	9.95	4600	4600	4600	4600
28	6	20.24	0.48	0.00235	0	9.95	5100	5100	5100	5100
28	7	20.04	0.47	0.00235	0	9.95	5700	5700	5700	5700
28	8	19.61	0.45	0.00235	0	9.95	6300	6300	6300	6300
28	9	19.45	0.44	0.00235	0	9.95	6800	6800	6800	6800
28	16	20.23	0.48	0.00234	0	19.96	4600	4600	4600	4600
28	17	19.95	0.47	0.00234	0	19.96	5100	5100	5100	5100
28	18	19.62	0.45	0.00234	0	19.96	5700	5700	5700	5700
28	19	20.48	0.49	0.00234	0	19.96	6300	6300	6300	6300
28	20	20.34	0.48	0.00234	0	19.96	6800	6800	6800	6800
28	21	20.04	0.47	0.00234	0	39.99	4600	4600	4600	4600
28	22	19.43	0.44	0.00234	0	39.99	5100	5100	5100	5100
28	23	20.34	0.48	0.00234	0	39.99	5700	5700	5700	5700
28	24	18.60	0.40	0.00234	0	39.99	6300	6300	6300	6300
28	25	20.40	0.49	0.00234	0	39.99	6800	6800	6800	6800

Table C1b. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 40 deg, RPM = 4,600 to 6,800 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
25	5	0.238	-0.002	1.663	0.033	0.633	0.013	16.827	1.468	1.645	1.518	1.510
25	6	0.286	-0.013	2.207	0.109	0.915	-0.018	16.799	1.888	2.135	2.075	1.922
25	7	0.323	-0.002	2.849	0.110	1.315	-0.073	16.761	2.582	2.917	2.737	2.639
25	8	0.369	-0.006	3.532	0.197	1.477	-0.079	16.715	3.488	3.861	3.632	3.535
25	9	0.427	0.003	4.268	0.161	1.788	-0.137	16.669	4.296	4.801	4.503	4.361
25	10	0.347	-0.015	2.266	0.235	1.788	-0.023	16.826	1.507	1.590	1.588	1.556
25	11	0.371	-0.028	2.743	0.214	2.089	-0.026	16.797	1.998	2.095	2.124	2.065
25	12	0.425	-0.020	3.441	0.143	2.667	-0.070	16.760	2.615	2.850	2.840	2.682
25	13	0.476	-0.010	4.221	-0.010	3.283	-0.055	16.715	3.454	3.778	3.644	3.510
25	14	0.519	0.004	4.918	0.083	3.431	-0.068	16.668	4.434	4.680	4.596	4.395
25	15	0.339	-0.026	2.397	0.164	2.329	-0.026	16.823	1.528	1.655	1.581	1.595
25	16	0.380	-0.020	2.952	0.138	2.707	0.019	16.796	1.930	2.124	2.113	1.952
25	17	0.420	-0.010	3.594	0.257	3.161	0.036	16.761	2.611	2.873	2.737	2.691
25	18	0.473	-0.004	4.379	0.095	3.709	0.017	16.713	3.609	3.805	3.538	3.585
25	19	0.507	0.013	5.071	0.234	3.977	-0.069	16.666	4.475	4.806	4.426	4.411
26	6	0.358	-0.019	2.545	-0.052	2.993	0.055	16.817	1.490	1.738	1.558	1.564
26	7	0.388	-0.024	3.027	-0.039	3.184	0.071	16.794	2.005	2.207	2.115	2.051
26	8	0.440	-0.004	3.732	-0.045	3.751	0.064	16.758	2.767	3.007	2.728	2.605
26	9	0.506	0.008	4.551	0.055	4.333	0.066	16.711	3.715	3.938	3.557	3.481
26	10	0.557	0.006	5.252	-0.027	4.723	0.074	16.664	4.654	4.893	4.398	4.271
26	17	0.328	-0.023	2.530	0.062	3.294	0.004	16.820	1.628	1.729	1.654	1.470
26	18	0.368	-0.026	3.021	0.062	3.572	0.031	16.791	1.999	2.298	2.115	2.037
26	19	0.428	-0.017	3.743	0.007	4.117	0.019	16.758	2.811	2.985	2.698	2.554
26	20	0.499	-0.002	4.537	0.045	4.670	0.016	16.711	3.744	3.945	3.519	3.421
26	21	0.542	0.002	5.262	-0.039	5.099	0.034	16.662	4.702	5.025	4.374	4.284
26	28	0.297	-0.032	2.503	0.094	3.495	-0.013	16.818	1.490	1.735	1.534	1.536
26	30	0.370	-0.039	3.084	0.034	4.005	0.002	16.794	2.020	2.249	2.048	1.973
26	31	0.422	-0.024	3.771	-0.021	4.478	-0.031	16.756	2.830	2.998	2.748	2.569
26	32	0.493	-0.013	4.564	-0.070	5.018	0.003	16.711	3.745	3.941	3.534	3.364
26	33	0.551	-0.010	5.263	-0.111	5.376	0.019	16.662	4.689	4.955	4.398	4.171
27	6	0.350	-0.016	2.606	0.006	3.810	0.020	16.816	1.594	1.774	1.653	1.580
27	7	0.397	-0.021	3.113	-0.027	4.144	0.051	16.791	2.103	2.353	2.042	2.016
27	8	0.448	-0.003	3.770	-0.093	4.610	0.001	16.756	2.865	3.043	2.703	2.563
27	9	0.522	0.004	4.574	-0.221	5.066	0.056	16.710	3.809	3.971	3.543	3.328
27	10	0.582	0.003	5.278	-0.281	5.450	0.074	16.662	4.753	4.967	4.364	4.100
27	17	0.345	-0.015	2.630	-0.051	4.390	0.011	16.814	1.678	1.920	1.614	1.537
27	18	0.390	-0.021	3.109	0.014	4.685	0.040	16.792	2.169	2.332	2.004	1.987
27	19	0.442	0.002	3.807	-0.001	5.218	-0.001	16.754	2.894	3.146	2.691	2.581
27	20	0.516	0.003	4.609	-0.126	5.677	0.056	16.708	3.816	4.121	3.519	3.299
27	21	0.566	0.008	5.280	-0.155	6.024	0.104	16.662	4.832	5.100	4.259	4.113
28	5	0.352	-0.001	2.617	-0.031	5.227	0.046	16.814	1.746	1.902	1.583	1.419
28	6	0.410	-0.000	3.087	0.016	5.720	0.070	16.791	2.206	2.374	2.009	1.895
28	7	0.465	0.018	3.751	-0.119	6.247	0.050	16.755	2.932	3.126	2.637	2.499
28	8	0.537	0.020	4.559	-0.248	6.377	0.104	16.708	3.897	4.152	3.429	3.259
28	9	0.584	0.010	5.223	-0.450	6.610	0.165	16.662	4.854	5.096	4.221	4.028
28	16	0.327	0.025	2.835	-0.110	5.885	0.136	16.814	1.788	1.935	1.575	1.496
28	17	0.380	0.029	3.263	-0.157	6.985	0.153	16.788	2.299	2.518	1.990	1.903
28	18	0.439	0.033	3.820	-0.309	8.047	0.159	16.753	3.054	3.290	2.551	2.482
28	19	0.509	0.035	4.610	-0.458	9.050	0.191	16.704	4.060	4.252	3.407	3.204
28	20	0.516	-0.001	5.551	-0.270	11.634	0.242	16.653	5.265	5.478	4.102	4.044
28	21	0.230	0.032	3.334	-0.251	2.969	0.120	16.813	1.666	1.777	1.739	1.654
28	22	0.242	0.034	3.827	-0.305	3.011	0.114	16.788	2.146	2.269	2.181	1.922
28	23	0.260	0.023	4.650	-0.221	3.206	0.067	16.746	2.901	3.114	2.964	2.930
28	24	0.274	0.031	5.258	-0.281	6.130	0.188	16.693	4.039	4.207	3.803	3.726
28	25	0.319	0.037	6.175	-0.623	6.833	0.251	16.645	5.032	5.068	4.706	4.578

Table C1c. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 40 deg, RPM = 4,600 to 6,800 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
25	5	0.088	0.057	0.134	0.150	0.272	0.192	0.001	0.028	0.031	0.029	0.028
25	6	0.089	0.058	0.135	0.156	0.289	0.208	0.001	0.035	0.039	0.037	0.035
25	7	0.089	0.057	0.134	0.149	0.277	0.197	0.001	0.045	0.049	0.047	0.045
25	8	0.091	0.056	0.134	0.149	0.279	0.197	0.001	0.056	0.061	0.058	0.056
25	9	0.105	0.057	0.135	0.151	0.306	0.194	0.001	0.065	0.071	0.067	0.065
25	10	0.088	0.057	0.134	0.150	0.274	0.193	0.001	0.029	0.031	0.030	0.029
25	11	0.091	0.059	0.136	0.157	0.299	0.213	0.001	0.036	0.038	0.038	0.037
25	12	0.091	0.057	0.135	0.150	0.282	0.200	0.001	0.045	0.049	0.048	0.046
25	13	0.094	0.057	0.135	0.151	0.285	0.201	0.001	0.056	0.060	0.058	0.056
25	14	0.126	0.058	0.139	0.154	0.345	0.197	0.001	0.065	0.071	0.068	0.066
25	15	0.088	0.057	0.134	0.151	0.274	0.193	0.001	0.029	0.031	0.030	0.029
25	16	0.091	0.060	0.137	0.158	0.301	0.217	0.001	0.036	0.039	0.038	0.036
25	17	0.092	0.057	0.135	0.150	0.285	0.199	0.001	0.045	0.049	0.046	0.046
25	18	0.098	0.057	0.135	0.151	0.291	0.203	0.001	0.057	0.060	0.057	0.057
25	19	0.129	0.058	0.139	0.155	0.350	0.198	0.001	0.066	0.072	0.067	0.066
26	6	0.088	0.058	0.134	0.151	0.276	0.193	0.001	0.029	0.032	0.030	0.030
26	7	0.091	0.060	0.136	0.160	0.297	0.218	0.001	0.037	0.039	0.038	0.038
26	8	0.092	0.057	0.135	0.150	0.284	0.202	0.001	0.047	0.050	0.047	0.045
26	9	0.100	0.057	0.136	0.152	0.297	0.204	0.001	0.059	0.062	0.057	0.055
26	10	0.141	0.058	0.140	0.155	0.376	0.199	0.001	0.069	0.072	0.067	0.065
26	17	0.088	0.057	0.134	0.151	0.277	0.193	0.001	0.030	0.033	0.031	0.029
26	18	0.091	0.060	0.136	0.160	0.294	0.220	0.001	0.038	0.040	0.038	0.037
26	19	0.091	0.057	0.135	0.150	0.283	0.203	0.001	0.048	0.050	0.047	0.045
26	20	0.101	0.057	0.136	0.151	0.301	0.202	0.001	0.058	0.062	0.057	0.055
26	21	0.128	0.058	0.139	0.154	0.346	0.200	0.001	0.069	0.074	0.067	0.064
26	28	0.088	0.058	0.134	0.152	0.275	0.193	0.001	0.029	0.032	0.030	0.029
26	30	0.092	0.060	0.137	0.160	0.304	0.219	0.001	0.037	0.040	0.037	0.037
26	31	0.091	0.057	0.135	0.150	0.284	0.202	0.001	0.047	0.050	0.047	0.045
26	32	0.102	0.057	0.136	0.151	0.302	0.202	0.001	0.059	0.062	0.057	0.054
26	33	0.143	0.058	0.140	0.155	0.381	0.200	0.001	0.069	0.073	0.067	0.064
27	6	0.088	0.057	0.135	0.152	0.278	0.193	0.001	0.031	0.033	0.030	0.030
27	7	0.092	0.061	0.136	0.161	0.302	0.226	0.001	0.038	0.041	0.038	0.036
27	8	0.091	0.057	0.135	0.151	0.283	0.202	0.001	0.048	0.051	0.046	0.045
27	9	0.110	0.057	0.138	0.152	0.323	0.199	0.001	0.059	0.062	0.057	0.054
27	10	0.143	0.058	0.141	0.154	0.381	0.200	0.001	0.070	0.073	0.066	0.063
27	17	0.089	0.057	0.135	0.151	0.285	0.193	0.001	0.031	0.035	0.031	0.030
27	18	0.092	0.061	0.136	0.161	0.294	0.228	0.001	0.039	0.041	0.038	0.036
27	19	0.092	0.057	0.135	0.150	0.285	0.201	0.001	0.049	0.052	0.047	0.045
27	20	0.107	0.057	0.137	0.151	0.314	0.201	0.001	0.060	0.064	0.057	0.054
27	21	0.116	0.060	0.136	0.159	0.328	0.211	0.001	0.070	0.075	0.066	0.063
28	5	0.089	0.058	0.136	0.153	0.288	0.195	0.001	0.033	0.035	0.030	0.028
28	6	0.093	0.060	0.137	0.158	0.301	0.224	0.001	0.039	0.042	0.037	0.035
28	7	0.092	0.057	0.135	0.151	0.285	0.203	0.001	0.049	0.052	0.046	0.044
28	8	0.108	0.057	0.137	0.151	0.317	0.202	0.001	0.060	0.064	0.056	0.054
28	9	0.146	0.058	0.140	0.158	0.380	0.204	0.001	0.070	0.075	0.064	0.062
28	16	0.089	0.058	0.136	0.152	0.287	0.194	0.001	0.033	0.035	0.030	0.029
28	17	0.093	0.060	0.136	0.157	0.296	0.217	0.001	0.041	0.044	0.037	0.036
28	18	0.093	0.058	0.136	0.151	0.289	0.205	0.001	0.051	0.054	0.045	0.043
28	19	0.109	0.057	0.137	0.152	0.318	0.204	0.001	0.062	0.066	0.056	0.053
28	20	0.155	0.060	0.141	0.161	0.398	0.207	0.001	0.075	0.079	0.064	0.062
28	21	0.088	0.058	0.135	0.152	0.279	0.194	0.001	0.032	0.033	0.032	0.031
28	22	0.090	0.059	0.135	0.156	0.284	0.209	0.001	0.039	0.041	0.039	0.037
28	23	0.092	0.057	0.135	0.153	0.283	0.203	0.001	0.049	0.052	0.050	0.049
28	24	0.099	0.057	0.138	0.153	0.298	0.199	0.001	0.063	0.066	0.060	0.059
28	25	0.133	0.059	0.142	0.157	0.358	0.204	0.001	0.073	0.075	0.071	0.068

Table C2a. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg, RPM = 4,000 to 6,800 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
29	4	40.37	1.90	0.00233	0	-39.95	4600	4600	4600	4600
29	5	40.38	1.90	0.00233	0	-39.95	5100	5100	5100	5100
29	6	40.42	1.90	0.00233	0	-39.95	5700	5700	5700	5700
29	7	40.67	1.93	0.00233	0	-39.95	6300	6300	6300	6300
29	8	40.82	1.94	0.00233	0	-39.95	6800	6800	6800	6800
29	9	40.11	1.87	0.00233	0	-19.91	4600	4600	4600	4600
29	10	40.44	1.91	0.00233	0	-19.91	5100	5100	5100	5100
29	11	40.04	1.87	0.00233	0	-19.91	5700	5700	5700	5700
29	12	39.88	1.85	0.00233	0	-19.91	6300	6300	6300	6300
29	13	40.10	1.87	0.00233	0	-19.91	6800	6800	6800	6800
29	14	40.53	1.91	0.00233	0	-9.92	4600	4600	4600	4600
29	15	40.24	1.89	0.00233	0	-10.03	5100	5100	5100	5100
29	16	40.19	1.88	0.00233	0	-9.90	5700	5700	5700	5700
29	17	40.06	1.87	0.00233	0	-10.05	6300	6300	6300	6300
29	18	39.95	1.86	0.00233	0	-9.93	6800	6800	6800	6800
29	25	40.83	1.94	0.00233	0	-4.98	4600	4600	4600	4600
29	26	40.76	1.94	0.00233	0	-4.98	5100	5100	5100	5100
29	27	40.55	1.92	0.00233	0	-4.98	5700	5700	5700	5700
29	28	40.73	1.93	0.00233	0	-4.98	6300	6300	6300	6300
29	29	40.60	1.92	0.00233	0	-4.98	6800	6800	6800	6800
29	36	39.70	1.84	0.00233	0	-1.98	4600	4600	4600	4600
29	37	39.55	1.82	0.00233	0	-1.98	5100	5100	5100	5100
29	38	40.49	1.91	0.00233	0	-1.98	5700	5700	5700	5700
29	39	40.29	1.89	0.00233	0	-1.98	6300	6300	6300	6300
29	40	40.15	1.88	0.00233	0	-1.98	6800	6800	6800	6800
31	5	39.32	1.89	0.00244	0	-0.04	4600	4600	4600	4600
31	6	38.89	1.85	0.00245	0	-0.04	5100	5100	5100	5100
31	7	39.36	1.89	0.00245	0	-0.04	5700	5700	5700	5700
31	8	39.11	1.87	0.00245	0	-0.04	6300	6300	6300	6300
31	9	38.97	1.86	0.00245	0	-0.04	6800	6800	6800	6800
31	18	39.54	1.91	0.00245	0	2.03	4600	4600	4600	4600
31	19	39.34	1.89	0.00245	0	2.03	5100	5100	5100	5100
31	20	39.57	1.92	0.00245	0	2.03	5700	5700	5700	5700
31	21	39.21	1.88	0.00245	0	2.03	6300	6300	6300	6300
31	25	38.86	1.85	0.00245	0	5.03	4000	4000	4000	4000
31	27	39.16	1.88	0.00245	0	5.03	4600	4600	4600	4600
31	28	39.13	1.87	0.00245	0	5.03	5100	5100	5100	5100
31	29	38.92	1.85	0.00245	0	5.03	5700	5700	5700	5700
31	30	38.95	1.86	0.00245	0	5.03	6300	6300	6300	6300
32	5	39.70	1.92	0.00244	0	9.95	4000	4000	4000	4000
32	6	39.66	1.92	0.00244	0	9.95	4600	4600	4600	4600
32	7	39.57	1.91	0.00244	0	9.95	5100	5100	5100	5100
32	8	39.55	1.91	0.00244	0	9.95	5700	5700	5700	5700
32	9	39.47	1.90	0.00244	0	9.95	6300	6300	6300	6300
32	13	39.86	1.94	0.00244	0	19.96	4000	4000	4000	4000
32	14	39.77	1.93	0.00244	0	19.95	4600	4600	4600	4600
32	15	39.86	1.94	0.00244	0	19.95	5100	5100	5100	5100
32	16	39.70	1.92	0.00244	0	19.96	5700	5700	5700	5700
32	17	39.42	1.89	0.00243	0	19.96	6300	6300	6300	6300
32	18	39.40	1.89	0.00243	0	39.98	4000	4000	4000	4000
32	19	39.65	1.91	0.00243	0	39.98	4600	4600	4600	4600
32	20	39.22	1.87	0.00243	0	39.98	5100	5100	5100	5100
32	22	39.93	1.94	0.00243	0	39.99	5700	5700	5700	5700

Table C2b. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg, RPM = 4,000 to 6,800 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
29	4	0.528	-0.008	0.383	-0.093	-0.241	0.045	16.842	1.026	1.263	1.187	1.128
29	5	0.559	-0.004	0.773	-0.098	-0.022	0.030	16.818	1.603	1.722	1.673	1.518
29	6	0.608	0.000	1.311	-0.066	0.339	0.045	16.787	2.156	2.321	2.248	2.205
29	7	0.661	0.003	1.881	-0.059	0.777	0.055	16.747	2.809	3.138	2.962	2.861
29	8	0.703	0.004	2.386	-0.226	1.031	0.107	16.710	3.515	3.886	3.720	3.541
29	9	0.832	-0.029	1.892	0.042	1.522	0.159	16.823	1.393	1.574	1.521	1.419
29	10	0.907	-0.034	2.382	-0.005	2.015	0.167	16.797	1.813	2.182	1.994	2.006
29	11	0.970	-0.027	3.044	-0.033	2.918	0.146	16.764	2.479	2.725	2.668	2.565
29	12	1.026	-0.031	3.760	-0.027	3.742	0.103	16.721	3.196	3.592	3.478	3.373
29	13	1.078	-0.034	4.372	-0.105	4.234	0.115	16.681	4.012	4.312	4.255	4.078
29	14	0.838	-0.026	2.582	0.011	3.175	0.028	16.820	1.545	1.655	1.657	1.596
29	15	0.897	-0.032	3.131	0.022	3.995	0.059	16.794	1.922	2.162	2.054	1.946
29	16	0.988	-0.037	3.790	-0.071	4.982	0.118	16.757	2.679	2.885	2.718	2.676
29	17	1.075	-0.039	4.535	0.082	6.038	0.139	16.712	3.534	3.803	3.492	3.454
29	18	1.143	-0.036	5.165	0.092	6.521	0.199	16.669	4.418	4.692	4.269	4.197
29	25	0.787	-0.020	2.876	0.079	4.446	0.087	16.817	1.622	1.810	1.583	1.514
29	26	0.841	-0.015	3.455	-0.034	5.387	0.107	16.789	2.171	2.344	2.061	1.993
29	27	0.921	-0.011	4.163	-0.050	6.799	0.116	16.750	2.994	3.108	2.705	2.618
29	28	1.040	-0.020	4.884	-0.050	7.647	0.179	16.703	3.940	4.045	3.487	3.465
29	29	1.101	-0.022	5.578	0.102	8.377	0.144	16.654	4.871	5.156	4.285	4.253
29	36	0.719	-0.006	3.022	-0.017	5.219	0.108	16.814	1.733	1.906	1.577	1.592
29	37	0.764	-0.007	3.604	-0.069	6.313	0.113	16.786	2.360	2.429	2.154	1.888
29	38	0.875	-0.007	4.346	-0.076	7.736	0.117	16.746	3.118	3.261	2.735	2.643
29	39	0.987	-0.012	5.098	-0.033	8.978	0.160	16.696	4.133	4.319	3.529	3.495
29	40	1.044	-0.017	5.768	0.011	9.796	0.163	16.649	5.017	5.358	4.292	4.239
31	5	0.750	0.014	3.295	0.055	5.741	0.067	16.813	1.859	2.100	1.641	1.564
31	6	0.770	0.007	3.906	0.016	7.053	0.024	16.779	2.196	2.694	2.054	2.061
31	7	0.855	0.012	4.713	0.028	8.819	0.034	16.740	3.364	3.508	2.893	2.782
31	8	0.961	0.011	5.494	0.136	10.032	-0.002	16.690	4.437	4.593	3.787	3.729
31	9	1.049	0.006	6.237	0.247	11.138	-0.019	16.637	5.434	5.762	4.623	4.553
31	18	0.728	-0.000	3.346	0.172	6.231	0.011	16.810	1.938	2.126	1.589	1.594
31	19	0.755	-0.001	3.968	0.035	7.720	0.004	16.781	2.658	2.689	2.221	2.052
31	20	0.822	0.004	4.781	0.062	9.671	0.015	16.739	3.446	3.596	2.851	2.844
31	21	0.919	0.004	5.600	0.144	11.396	-0.001	16.685	4.532	4.780	3.737	3.670
31	25	0.617	-0.022	2.759	0.115	5.142	-0.037	16.836	1.446	1.518	1.177	1.179
31	27	0.675	-0.015	3.415	0.188	6.873	-0.008	16.807	2.028	2.248	1.529	1.663
31	28	0.714	-0.029	4.025	0.185	8.634	-0.060	16.779	2.690	2.960	2.189	2.028
31	29	0.762	-0.014	4.825	0.136	10.837	-0.000	16.736	3.536	3.784	2.780	2.738
31	30	0.852	-0.016	5.718	0.096	13.104	0.014	16.681	4.778	4.972	3.667	3.666
32	5	0.598	0.004	3.145	0.018	4.560	0.006	16.834	1.503	1.622	1.153	1.258
32	6	0.643	0.020	3.828	-0.044	6.744	0.064	16.805	2.059	2.314	1.585	1.581
32	7	0.694	0.008	4.384	-0.065	8.722	0.009	16.773	2.461	2.962	2.016	2.072
32	8	0.748	0.009	5.091	-0.090	11.953	0.051	16.731	3.803	3.995	2.742	2.704
32	9	0.847	0.002	5.972	-0.048	15.087	0.059	16.674	5.073	5.305	3.683	3.595
32	13	0.461	0.004	3.714	-0.039	3.172	0.030	16.827	1.466	1.635	1.404	1.286
32	14	0.483	0.012	4.574	-0.065	4.926	0.039	16.797	2.111	2.331	1.785	1.888
32	15	0.546	0.017	5.240	-0.082	6.666	0.069	16.768	2.871	2.890	2.293	2.253
32	16	0.624	0.014	5.955	-0.130	10.162	0.059	16.726	3.800	4.093	2.839	2.811
32	17	0.699	0.019	6.800	-0.108	13.620	0.095	16.667	5.188	5.421	3.809	3.719
32	18	0.379	-0.003	4.149	-0.020	2.372	0.036	16.822	1.624	1.712	1.552	1.490
32	19	0.364	-0.001	5.115	0.053	2.589	0.020	16.796	2.042	2.261	2.049	2.054
32	20	0.359	0.008	6.025	0.009	3.245	0.036	16.762	2.795	2.804	2.671	2.847
32	22	0.389	0.011	7.120	-0.076	5.729	-0.003	16.716	3.602	3.768	3.376	3.522

Table C2c. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg, RPM = 4,000 to 6,800 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
29	4	0.089	0.057	0.135	0.151	0.284	0.193	0.001	0.021	0.024	0.023	0.022
29	5	0.091	0.059	0.135	0.156	0.289	0.216	0.001	0.029	0.032	0.030	0.029
29	6	0.091	0.057	0.134	0.150	0.280	0.201	0.001	0.038	0.041	0.039	0.038
29	7	0.103	0.057	0.135	0.150	0.310	0.196	0.001	0.047	0.051	0.049	0.047
29	8	0.145	0.057	0.137	0.154	0.387	0.196	0.001	0.055	0.060	0.058	0.055
29	9	0.091	0.058	0.137	0.154	0.297	0.195	0.001	0.027	0.030	0.029	0.028
29	10	0.096	0.061	0.137	0.160	0.311	0.234	0.001	0.034	0.038	0.036	0.036
29	11	0.097	0.059	0.135	0.152	0.292	0.216	0.001	0.043	0.047	0.046	0.044
29	12	0.117	0.057	0.138	0.153	0.340	0.200	0.001	0.052	0.058	0.056	0.054
29	13	0.153	0.060	0.136	0.162	0.403	0.205	0.001	0.061	0.066	0.065	0.061
29	14	0.091	0.060	0.138	0.157	0.301	0.197	0.001	0.029	0.031	0.031	0.029
29	15	0.098	0.062	0.138	0.162	0.318	0.236	0.001	0.036	0.039	0.037	0.036
29	16	0.098	0.059	0.136	0.153	0.295	0.223	0.001	0.046	0.049	0.047	0.046
29	17	0.133	0.058	0.141	0.154	0.377	0.200	0.001	0.057	0.060	0.057	0.055
29	18	0.191	0.060	0.144	0.161	0.487	0.208	0.001	0.066	0.070	0.066	0.063
29	25	0.091	0.061	0.138	0.160	0.303	0.197	0.001	0.031	0.034	0.030	0.029
29	26	0.098	0.065	0.139	0.169	0.332	0.250	0.001	0.039	0.041	0.038	0.037
29	27	0.100	0.059	0.136	0.154	0.301	0.225	0.001	0.049	0.052	0.047	0.045
29	28	0.141	0.058	0.141	0.156	0.402	0.207	0.001	0.061	0.063	0.057	0.056
29	29	0.211	0.063	0.141	0.168	0.532	0.221	0.001	0.072	0.075	0.066	0.065
29	36	0.092	0.058	0.143	0.154	0.333	0.196	0.001	0.033	0.035	0.030	0.030
29	37	0.099	0.064	0.139	0.167	0.342	0.245	0.001	0.042	0.043	0.038	0.036
29	38	0.099	0.060	0.136	0.154	0.300	0.229	0.001	0.051	0.053	0.048	0.045
29	39	0.130	0.058	0.139	0.156	0.375	0.209	0.001	0.063	0.066	0.058	0.056
29	40	0.195	0.061	0.145	0.163	0.503	0.216	0.001	0.073	0.078	0.066	0.064
31	5	0.091	0.064	0.136	0.165	0.290	0.198	0.001	0.034	0.038	0.032	0.030
31	6	0.099	0.073	0.140	0.185	0.340	0.294	0.001	0.041	0.045	0.038	0.038
31	7	0.102	0.059	0.137	0.153	0.316	0.225	0.001	0.053	0.056	0.049	0.047
31	8	0.122	0.059	0.137	0.158	0.342	0.235	0.001	0.066	0.069	0.060	0.058
31	9	0.184	0.061	0.153	0.164	0.476	0.207	0.001	0.077	0.081	0.069	0.068
31	18	0.091	0.060	0.139	0.158	0.308	0.197	0.001	0.035	0.037	0.031	0.030
31	19	0.098	0.066	0.140	0.172	0.338	0.253	0.001	0.045	0.046	0.040	0.037
31	20	0.102	0.059	0.138	0.153	0.313	0.219	0.001	0.054	0.058	0.049	0.048
31	21	0.148	0.059	0.139	0.159	0.404	0.208	0.001	0.068	0.072	0.059	0.058
31	25	0.090	0.068	0.137	0.164	0.279	0.199	0.001	0.027	0.029	0.023	0.024
31	27	0.091	0.061	0.140	0.160	0.313	0.198	0.001	0.036	0.039	0.031	0.031
31	28	0.101	0.067	0.142	0.172	0.359	0.258	0.001	0.046	0.048	0.039	0.037
31	29	0.102	0.059	0.137	0.153	0.316	0.221	0.001	0.057	0.059	0.048	0.047
31	30	0.147	0.059	0.139	0.160	0.407	0.232	0.001	0.070	0.074	0.060	0.058
32	5	0.089	0.072	0.137	0.167	0.287	0.201	0.001	0.028	0.030	0.023	0.024
32	6	0.090	0.060	0.141	0.159	0.314	0.198	0.001	0.038	0.041	0.031	0.030
32	7	0.110	0.064	0.151	0.165	0.437	0.235	0.001	0.044	0.050	0.038	0.038
32	8	0.109	0.058	0.140	0.152	0.340	0.207	0.001	0.059	0.062	0.049	0.046
32	9	0.143	0.060	0.139	0.162	0.405	0.243	0.001	0.074	0.077	0.060	0.058
32	13	0.089	0.059	0.138	0.153	0.279	0.194	0.001	0.029	0.031	0.027	0.026
32	14	0.089	0.063	0.137	0.160	0.287	0.197	0.001	0.038	0.041	0.035	0.035
32	15	0.098	0.061	0.141	0.159	0.345	0.224	0.001	0.048	0.050	0.042	0.041
32	16	0.097	0.058	0.137	0.152	0.301	0.205	0.001	0.060	0.063	0.050	0.048
32	17	0.107	0.058	0.136	0.155	0.320	0.234	0.001	0.075	0.078	0.062	0.060
32	18	0.089	0.061	0.135	0.155	0.275	0.197	0.001	0.030	0.032	0.029	0.028
32	19	0.089	0.059	0.135	0.154	0.279	0.195	0.001	0.038	0.040	0.037	0.037
32	20	0.093	0.063	0.137	0.163	0.305	0.228	0.001	0.047	0.048	0.046	0.046
32	22	0.095	0.058	0.136	0.152	0.298	0.206	0.001	0.058	0.061	0.056	0.056

Table C3a. Full Vehicle: 3DR SOLO, nominal speed 80 ft/s, yaw = 0 deg, pitch = -40 to -20 deg, RPM = 5,700 to 6,800 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
57	9	79.98	7.56	0.00236	0	-39.95	5700	5700	5700	5700
57	10	80.33	7.62	0.00236	0	-39.95	6300	6300	6300	6300
57	11	80.39	7.63	0.00236	0	-39.95	6800	6800	6800	6800
57	12	80.17	7.58	0.00236	0	-29.94	5700	5700	5700	5700
57	13	80.44	7.63	0.00236	0	-29.95	6300	6300	6300	6300
57	14	80.46	7.63	0.00236	0	-29.95	6800	6800	6800	6800
57	15	80.04	7.54	0.00235	0	-19.92	5700	5700	5700	5700
57	16	79.87	7.51	0.00235	0	-19.92	6300	6300	6300	6300

**Table C3b. Full Vehicle: 3DR SOLO, nominal speed 80 ft/s, yaw = 0 deg, pitch = -40 to -20 deg,
RPM = 5,700 to 6,800 (uniform) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
57	9	1.671	-0.103	-3.035	0.332	-4.667	-0.051	16.812	0.455	0.724	0.937	0.891
57	10	1.749	-0.114	-2.820	0.420	-4.332	-0.086	16.785	0.944	1.279	1.482	1.373
57	11	1.804	-0.109	-2.580	0.439	-4.140	-0.034	16.757	1.380	1.814	1.987	1.840
57	12	2.295	-0.006	-0.802	0.443	-2.291	0.156	16.762	1.488	1.825	1.754	1.722
57	13	2.362	-0.014	-0.382	0.604	-1.572	0.108	16.727	2.119	2.561	2.421	2.345
57	14	2.423	-0.022	0.075	0.632	-1.200	0.091	16.691	2.787	3.283	3.012	2.932
57	15	2.792	-0.035	1.972	0.717	0.202	0.280	16.716	2.368	2.752	2.459	2.434
57	16	2.873	-0.032	2.644	0.598	1.357	0.325	16.675	3.135	3.541	3.291	3.189

**Table C3c. Full Vehicle: 3DR SOLO, nominal speed 80 ft/s, yaw = 0 deg, pitch = -40 to -20 deg,
RPM = 5,700 to 6,800 (uniform) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
57	9	0.097	0.057	0.135	0.150	0.285	0.201	0.000	0.011	0.014	0.017	0.016
57	10	0.111	0.057	0.135	0.150	0.321	0.195	0.000	0.019	0.024	0.026	0.024
57	11	0.163	0.057	0.135	0.156	0.418	0.200	0.001	0.026	0.031	0.033	0.031
57	12	0.103	0.058	0.135	0.152	0.289	0.214	0.001	0.028	0.032	0.030	0.031
57	13	0.127	0.057	0.137	0.153	0.352	0.202	0.001	0.037	0.042	0.040	0.039
57	14	0.236	0.059	0.139	0.166	0.577	0.209	0.001	0.045	0.051	0.048	0.047
57	15	0.115	0.061	0.138	0.155	0.318	0.245	0.001	0.041	0.046	0.042	0.041
57	16	0.193	0.058	0.144	0.157	0.540	0.204	0.001	0.050	0.055	0.052	0.051

Table C4a. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -5 deg, pitch = -40 to 40 deg, RPM = 4,600 to 6,800 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
33	6	19.93	0.48	0.00241	-5	-39.95	4600	4600	4600	4600
33	7	20.28	0.50	0.00241	-5	-39.95	5100	5100	5100	5100
33	8	19.32	0.45	0.00241	-5	-39.95	5700	5700	5700	5700
33	9	19.64	0.47	0.00241	-5	-39.95	6300	6300	6300	6300
33	10	19.89	0.48	0.00241	-5	-39.95	6800	6800	6800	6800
33	11	19.87	0.48	0.00241	-5	-19.92	4600	4600	4600	4600
33	12	19.73	0.47	0.00241	-5	-19.92	5100	5100	5100	5100
33	13	20.04	0.48	0.00241	-5	-19.92	5700	5700	5700	5700
33	14	20.08	0.49	0.00241	-5	-19.92	6300	6300	6300	6300
33	15	20.11	0.49	0.00241	-5	-19.92	6800	6800	6800	6800
33	16	19.82	0.47	0.00240	-5	-9.90	4600	4600	4600	4600
33	17	19.72	0.47	0.00240	-5	-9.91	5100	5100	5100	5100
33	18	19.87	0.47	0.00240	-5	-9.91	5700	5700	5700	5700
33	19	19.83	0.47	0.00240	-5	-9.91	6300	6300	6300	6300
33	20	19.81	0.47	0.00240	-5	-9.91	6800	6800	6800	6800
33	27	19.74	0.47	0.00240	-5	-4.98	4600	4600	4600	4600
33	28	19.78	0.47	0.00240	-5	-4.98	5100	5100	5100	5100
33	29	19.74	0.47	0.00239	-5	-4.98	5700	5700	5700	5700
33	30	19.73	0.47	0.00239	-5	-4.98	6300	6300	6300	6300
33	31	19.55	0.46	0.00239	-5	-4.98	6800	6800	6800	6800
33	38	19.77	0.47	0.00239	-5	-1.98	4600	4600	4600	4600
33	39	19.68	0.46	0.00238	-5	-1.98	5100	5100	5100	5100
33	40	19.55	0.46	0.00238	-5	-1.98	5700	5700	5700	5700
33	41	19.45	0.45	0.00238	-5	-1.98	6300	6300	6300	6300
33	42	19.63	0.46	0.00238	-5	-1.98	6800	6800	6800	6800
33	49	19.88	0.47	0.00237	-5	-0.05	4600	4600	4600	4600
33	50	19.69	0.46	0.00237	-5	-0.04	5100	5100	5100	5100
33	52	19.86	0.47	0.00237	-5	-0.04	5700	5700	5700	5700
33	53	19.65	0.46	0.00237	-5	-0.04	6300	6300	6300	6300
33	54	19.73	0.46	0.00237	-5	-0.05	6800	6800	6800	6800
34	6	20.61	0.49	0.00233	-5	2.04	4600	4600	4600	4600
34	7	20.47	0.49	0.00233	-5	2.03	5100	5100	5100	5100
34	8	20.36	0.48	0.00233	-5	2.03	5700	5700	5700	5700
34	9	20.21	0.47	0.00233	-5	2.03	6300	6300	6300	6300
34	10	20.21	0.47	0.00232	-5	2.03	6800	6800	6800	6800
34	17	20.53	0.49	0.00232	-5	5.03	4600	4600	4600	4600
34	18	20.35	0.48	0.00232	-5	5.03	5100	5100	5100	5100
34	19	20.31	0.48	0.00232	-5	5.03	5700	5700	5700	5700
34	20	20.09	0.47	0.00232	-5	5.03	6300	6300	6300	6300
34	21	20.02	0.46	0.00232	-5	5.03	6800	6800	6800	6800
34	28	20.39	0.48	0.00232	-5	9.95	4600	4600	4600	4600
34	29	20.12	0.47	0.00232	-5	9.95	5100	5100	5100	5100
34	30	20.00	0.46	0.00232	-5	9.95	5700	5700	5700	5700
34	31	19.74	0.45	0.00232	-5	9.95	6300	6300	6300	6300
34	32	20.17	0.47	0.00232	-5	9.95	6800	6800	6800	6800
34	39	19.82	0.45	0.00231	-5	19.96	4600	4600	4600	4600
34	40	19.20	0.43	0.00231	-5	19.96	5100	5100	5100	5100
34	41	20.37	0.48	0.00231	-5	19.96	5700	5700	5700	5700
34	42	20.26	0.48	0.00231	-5	19.96	6300	6300	6300	6300
34	43	19.94	0.46	0.00231	-5	19.96	6800	6800	6800	6800
34	44	21.05	0.51	0.00231	-5	39.99	4600	4600	4600	4600
34	45	19.80	0.45	0.00231	-5	39.99	5100	5100	5100	5100
34	46	19.15	0.42	0.00231	-5	39.99	5700	5700	5700	5700
34	47	17.50	0.35	0.00231	-5	39.99	6300	6300	6300	6300
34	48	20.36	0.48	0.00231	-5	39.99	6800	6800	6800	6800

Table C4b. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -5 deg, pitch = -40 to 40 deg, RPM = 4,600 to 6,800 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
33	6	0.237	-0.015	1.720	-0.155	0.812	0.065	16.826	1.407	1.617	1.509	1.466
33	7	0.277	-0.023	2.194	-0.152	1.018	0.028	16.799	1.762	2.072	1.982	1.888
33	8	0.302	-0.019	2.847	-0.274	1.430	0.033	16.764	2.535	2.842	2.682	2.588
33	9	0.341	-0.021	3.535	-0.244	1.821	0.013	16.718	3.407	3.738	3.574	3.403
33	10	0.385	-0.023	4.177	-0.282	2.031	-0.005	16.674	4.264	4.648	4.373	4.227
33	11	0.323	-0.036	2.272	-0.271	1.828	0.064	16.824	1.377	1.583	1.598	1.502
33	12	0.356	-0.028	2.753	-0.384	2.123	0.049	16.799	1.847	2.062	2.072	1.976
33	13	0.405	-0.025	3.412	-0.445	2.553	0.062	16.763	2.546	2.785	2.793	2.593
33	14	0.447	-0.029	4.171	-0.461	3.081	0.080	16.717	3.372	3.734	3.611	3.431
33	15	0.484	-0.023	4.871	-0.658	3.381	0.146	16.670	4.277	4.639	4.511	4.215
33	16	0.338	-0.040	2.528	-0.178	2.361	-0.048	16.822	1.450	1.648	1.624	1.532
33	17	0.372	-0.034	3.010	-0.253	2.732	-0.078	16.796	1.909	2.163	2.045	1.921
33	18	0.423	-0.024	3.630	-0.373	3.164	-0.096	16.760	2.655	2.854	2.801	2.576
33	19	0.457	-0.027	4.371	-0.402	3.704	-0.033	16.714	3.464	3.788	3.625	3.415
33	20	0.509	-0.037	5.074	-0.476	4.055	0.045	16.670	4.420	4.662	4.425	4.216
33	27	0.344	-0.039	2.605	-0.131	2.647	-0.002	16.820	1.484	1.717	1.617	1.598
33	28	0.377	-0.028	3.093	-0.267	3.080	-0.008	16.794	1.933	2.226	2.112	2.009
33	29	0.419	-0.017	3.716	-0.463	3.673	-0.031	16.759	2.714	2.939	2.769	2.584
33	30	0.455	-0.032	4.476	-0.616	4.377	0.082	16.714	3.674	3.842	3.602	3.327
33	31	0.501	-0.044	5.157	-0.714	4.637	0.138	16.667	4.504	4.869	4.374	4.158
33	38	0.339	-0.046	2.647	-0.146	2.946	-0.017	16.819	1.567	1.685	1.644	1.616
33	39	0.371	-0.049	3.112	-0.208	3.383	-0.056	16.794	1.994	2.213	2.046	1.983
33	40	0.411	-0.019	3.738	-0.572	4.004	0.007	16.760	2.703	2.920	2.779	2.492
33	41	0.449	-0.040	4.505	-0.628	4.726	0.065	16.713	3.607	3.901	3.594	3.314
33	42	0.502	-0.056	5.180	-0.717	4.983	0.124	16.667	4.582	4.911	4.384	4.079
33	49	0.337	-0.053	2.698	-0.033	3.286	-0.028	16.817	1.541	1.741	1.569	1.559
33	50	0.370	-0.040	3.187	-0.236	3.722	-0.013	16.793	2.112	2.292	2.031	2.131
33	52	0.409	-0.022	3.783	-0.553	4.534	0.016	16.759	2.736	2.978	2.694	2.502
33	53	0.449	-0.031	4.535	-0.702	5.165	0.105	16.712	3.674	3.917	3.534	3.271
33	54	0.504	-0.050	5.216	-0.789	5.416	0.150	16.666	4.577	4.887	4.328	4.008
34	6	0.376	-0.001	2.607	-0.363	3.237	0.090	16.821	1.565	1.743	1.485	1.587
34	7	0.420	0.001	3.104	-0.312	3.508	0.075	16.794	2.106	2.311	1.960	2.088
34	8	0.446	0.030	3.664	-0.694	4.296	0.094	16.762	2.752	2.975	2.682	2.477
34	9	0.502	0.033	4.401	-0.886	4.953	0.183	16.717	3.675	3.910	3.459	3.139
34	10	0.555	0.004	5.048	-0.924	5.169	0.195	16.670	4.572	4.932	4.201	3.916
34	17	0.382	0.023	2.636	-0.470	3.663	0.162	16.819	1.630	1.785	1.566	1.585
34	18	0.422	0.012	3.118	-0.454	4.031	0.132	16.794	2.032	2.333	1.948	2.026
34	19	0.451	0.036	3.700	-0.810	4.772	0.130	16.760	2.838	3.035	2.685	2.468
34	20	0.501	0.040	4.439	-0.982	5.395	0.229	16.715	3.743	3.986	3.456	3.176
34	21	0.550	0.018	5.076	-1.076	5.744	0.297	16.669	4.644	4.957	4.180	3.890
34	28	0.357	0.030	2.659	-0.555	4.732	0.193	16.819	1.641	1.850	1.454	1.558
34	29	0.403	0.038	3.126	-0.574	5.153	0.235	16.795	2.104	2.307	1.941	1.958
34	30	0.433	0.055	3.721	-1.003	6.104	0.232	16.760	2.822	3.066	2.626	2.381
34	31	0.481	0.040	4.453	-1.153	6.557	0.296	16.715	3.803	4.063	3.401	3.149
34	32	0.539	0.025	5.121	-1.362	7.247	0.359	16.670	4.759	4.994	4.204	3.834
34	39	0.296	0.066	2.831	-1.208	5.395	0.210	16.818	1.753	1.834	1.613	1.494
34	40	0.335	0.065	3.189	-1.441	6.525	0.197	16.792	2.185	2.460	1.993	1.794
34	41	0.398	0.064	3.850	-1.705	8.037	0.215	16.756	3.011	3.258	2.626	2.304
34	42	0.445	0.038	4.541	-1.662	8.926	0.287	16.711	3.967	4.209	3.448	3.099
34	43	0.426	-0.015	5.490	-0.655	10.766	0.325	16.656	5.108	5.436	4.178	4.023
34	44	0.179	0.061	3.371	-1.040	3.473	0.175	16.816	1.596	1.771	1.669	1.620
34	45	0.196	0.046	3.797	-1.060	3.524	0.149	16.790	2.059	2.324	2.195	2.038
34	46	0.179	0.026	4.388	-1.317	3.203	0.285	16.753	2.772	3.028	2.931	2.820
34	47	0.154	0.017	4.901	-1.119	5.910	0.295	16.705	3.704	4.023	3.684	3.567
34	48	0.239	-0.005	6.038	-1.357	8.644	0.484	16.648	5.128	5.349	4.444	4.322

Table C4c. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -5 deg, pitch = -40 to 40 deg, RPM = 4,600 to 6,800 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
33	6	0.088	0.057	0.134	0.150	0.272	0.192	0.001	0.027	0.030	0.028	0.028
33	7	0.089	0.058	0.134	0.154	0.278	0.206	0.001	0.034	0.037	0.036	0.034
33	8	0.089	0.057	0.134	0.149	0.276	0.197	0.001	0.044	0.048	0.045	0.045
33	9	0.092	0.056	0.135	0.149	0.281	0.197	0.001	0.055	0.059	0.057	0.055
33	10	0.104	0.057	0.136	0.150	0.303	0.195	0.001	0.064	0.070	0.067	0.064
33	11	0.088	0.057	0.134	0.150	0.274	0.193	0.001	0.028	0.030	0.030	0.029
33	12	0.090	0.060	0.135	0.158	0.283	0.215	0.001	0.035	0.038	0.037	0.035
33	13	0.091	0.057	0.135	0.150	0.280	0.196	0.001	0.044	0.048	0.048	0.044
33	14	0.095	0.057	0.135	0.151	0.286	0.203	0.001	0.055	0.059	0.057	0.055
33	15	0.120	0.059	0.136	0.153	0.336	0.198	0.001	0.063	0.070	0.068	0.064
33	16	0.088	0.057	0.134	0.151	0.275	0.193	0.001	0.029	0.031	0.031	0.029
33	17	0.091	0.060	0.135	0.157	0.289	0.216	0.001	0.036	0.039	0.037	0.036
33	18	0.091	0.057	0.135	0.150	0.282	0.197	0.001	0.045	0.049	0.048	0.045
33	19	0.105	0.057	0.137	0.151	0.310	0.198	0.001	0.055	0.060	0.058	0.055
33	20	0.146	0.058	0.141	0.152	0.382	0.200	0.001	0.065	0.071	0.067	0.063
33	27	0.088	0.059	0.134	0.154	0.276	0.193	0.001	0.029	0.032	0.031	0.029
33	28	0.092	0.060	0.136	0.158	0.290	0.220	0.001	0.037	0.039	0.038	0.036
33	29	0.092	0.057	0.135	0.151	0.283	0.200	0.001	0.047	0.049	0.047	0.045
33	30	0.106	0.057	0.137	0.151	0.313	0.199	0.001	0.057	0.060	0.057	0.055
33	31	0.130	0.059	0.139	0.155	0.352	0.204	0.001	0.067	0.073	0.067	0.063
33	38	0.088	0.059	0.134	0.153	0.275	0.194	0.001	0.030	0.033	0.030	0.030
33	39	0.091	0.064	0.135	0.166	0.285	0.241	0.001	0.036	0.040	0.038	0.036
33	40	0.091	0.057	0.135	0.150	0.280	0.198	0.001	0.047	0.049	0.047	0.044
33	41	0.100	0.057	0.136	0.151	0.296	0.203	0.001	0.057	0.061	0.058	0.054
33	42	0.146	0.059	0.140	0.153	0.383	0.200	0.001	0.069	0.072	0.067	0.063
33	49	0.088	0.059	0.134	0.154	0.276	0.195	0.001	0.030	0.033	0.030	0.029
33	50	0.091	0.063	0.135	0.165	0.292	0.234	0.001	0.038	0.041	0.038	0.037
33	52	0.091	0.057	0.135	0.151	0.281	0.201	0.001	0.047	0.049	0.047	0.044
33	53	0.100	0.058	0.136	0.152	0.301	0.201	0.001	0.058	0.062	0.057	0.054
33	54	0.162	0.058	0.141	0.153	0.418	0.201	0.001	0.069	0.072	0.066	0.063
34	6	0.088	0.059	0.135	0.156	0.277	0.195	0.001	0.030	0.033	0.029	0.030
34	7	0.093	0.061	0.135	0.161	0.292	0.226	0.001	0.038	0.041	0.037	0.037
34	8	0.092	0.057	0.135	0.151	0.283	0.204	0.001	0.046	0.050	0.046	0.043
34	9	0.112	0.057	0.138	0.151	0.327	0.199	0.001	0.058	0.062	0.056	0.052
34	10	0.144	0.059	0.138	0.155	0.380	0.205	0.001	0.068	0.073	0.064	0.060
34	17	0.089	0.059	0.135	0.155	0.280	0.195	0.001	0.031	0.034	0.030	0.030
34	18	0.092	0.061	0.135	0.160	0.291	0.226	0.001	0.037	0.041	0.036	0.037
34	19	0.095	0.057	0.136	0.151	0.292	0.200	0.001	0.048	0.051	0.047	0.042
34	20	0.103	0.057	0.136	0.151	0.308	0.202	0.001	0.059	0.062	0.057	0.053
34	21	0.153	0.059	0.140	0.157	0.395	0.206	0.001	0.068	0.075	0.065	0.060
34	28	0.089	0.058	0.135	0.154	0.283	0.195	0.001	0.032	0.035	0.028	0.030
34	29	0.092	0.060	0.135	0.160	0.290	0.221	0.001	0.038	0.041	0.036	0.036
34	30	0.094	0.057	0.136	0.151	0.291	0.201	0.001	0.048	0.052	0.046	0.042
34	31	0.119	0.057	0.138	0.151	0.342	0.199	0.001	0.060	0.063	0.056	0.053
34	32	0.178	0.059	0.144	0.156	0.447	0.207	0.001	0.069	0.074	0.065	0.060
34	39	0.089	0.058	0.135	0.153	0.281	0.195	0.001	0.033	0.034	0.031	0.029
34	40	0.092	0.060	0.135	0.158	0.288	0.215	0.001	0.040	0.043	0.037	0.034
34	41	0.096	0.058	0.137	0.152	0.294	0.206	0.001	0.050	0.054	0.046	0.042
34	42	0.117	0.057	0.139	0.151	0.334	0.201	0.001	0.062	0.065	0.056	0.052
34	43	0.175	0.059	0.144	0.157	0.432	0.206	0.001	0.074	0.079	0.065	0.062
34	44	0.088	0.058	0.134	0.152	0.276	0.195	0.001	0.031	0.033	0.032	0.030
34	45	0.090	0.059	0.135	0.156	0.281	0.208	0.001	0.038	0.041	0.039	0.037
34	46	0.092	0.057	0.135	0.153	0.283	0.202	0.001	0.048	0.051	0.049	0.047
34	47	0.097	0.057	0.137	0.154	0.293	0.199	0.001	0.059	0.063	0.059	0.057
34	48	0.145	0.060	0.144	0.160	0.379	0.207	0.001	0.074	0.078	0.069	0.066

Table C5a. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -5 deg, pitch = -40 to 40 deg, RPM = 4,000 to 6,800 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
36	5	39.26	1.89	0.00245	-5	-39.95	4600	4600	4600	4600
36	6	39.35	1.90	0.00245	-5	-39.95	5100	5100	5100	5100
36	7	39.34	1.90	0.00245	-5	-39.95	5700	5700	5700	5700
36	8	39.35	1.90	0.00245	-5	-39.95	6300	6300	6300	6300
36	9	39.53	1.91	0.00245	-5	-39.95	6800	6800	6800	6800
36	10	39.85	1.94	0.00245	-5	-19.91	4600	4600	4600	4600
36	11	39.99	1.96	0.00245	-5	-19.92	5100	5100	5100	5100
36	12	38.91	1.85	0.00245	-5	-19.92	5700	5700	5700	5700
36	13	38.91	1.85	0.00245	-5	-19.92	6300	6300	6300	6300
36	14	38.78	1.84	0.00245	-5	-19.91	6800	6800	6800	6800
36	15	39.89	1.95	0.00245	-5	-9.91	4600	4600	4600	4600
36	16	39.35	1.90	0.00245	-5	-9.90	5100	5100	5100	5100
36	17	39.43	1.90	0.00245	-5	-9.91	5700	5700	5700	5700
36	18	38.84	1.85	0.00245	-5	-9.90	6300	6300	6300	6300
37	5	39.18	1.88	0.00245	-5	-4.98	4600	4600	4600	4600
37	6	39.60	1.92	0.00245	-5	-4.98	5100	5100	5100	5100
37	7	39.63	1.92	0.00245	-5	-4.98	5700	5700	5700	5700
37	8	39.51	1.91	0.00244	-5	-4.98	6300	6300	6300	6300
37	12	39.49	1.90	0.00244	-5	-1.98	4600	4600	4600	4600
37	13	39.40	1.90	0.00244	-5	-1.98	5100	5100	5100	5100
37	14	39.36	1.89	0.00244	-5	-1.98	5700	5700	5700	5700
37	15	39.23	1.88	0.00244	-5	-1.98	6300	6300	6300	6300
37	25	39.62	1.91	0.00244	-5	0.12	4000	4000	4000	4000
37	19	39.65	1.92	0.00244	-5	-0.05	4600	4600	4600	4600
37	20	39.21	1.87	0.00244	-5	0.12	5100	5100	5100	5100
37	21	39.07	1.86	0.00244	-5	0.12	5700	5700	5700	5700
37	23	39.04	1.86	0.00244	-5	0.12	6300	6300	6300	6300
38	5	39.56	1.90	0.00243	-5	2.03	4000	4000	4000	4000
38	6	39.20	1.86	0.00243	-5	2.03	4600	4600	4600	4600
38	7	38.84	1.83	0.00243	-5	2.03	5100	5100	5100	5100
38	8	40.13	1.95	0.00242	-5	2.03	5700	5700	5700	5700
38	9	39.96	1.93	0.00242	-5	2.03	6300	6300	6300	6300
38	13	39.98	1.93	0.00242	-5	5.03	4000	4000	4000	4000
38	14	39.57	1.89	0.00242	-5	5.03	4600	4600	4600	4600
38	15	39.56	1.89	0.00242	-5	5.03	5100	5100	5100	5100
38	16	39.23	1.86	0.00242	-5	5.03	5700	5700	5700	5700
38	17	39.52	1.89	0.00242	-5	5.03	6300	6300	6300	6300
39	5	39.81	1.91	0.00241	-5	9.95	4000	4000	4000	4000
39	6	39.75	1.90	0.00241	-5	9.95	4600	4600	4600	4600
39	7	39.17	1.85	0.00241	-5	9.95	5100	5100	5100	5100
39	8	39.32	1.86	0.00241	-5	9.95	5700	5700	5700	5700
39	9	39.12	1.84	0.00241	-5	9.95	6300	6300	6300	6300
39	13	40.15	1.94	0.00241	-5	19.95	4000	4000	4000	4000
39	14	39.80	1.90	0.00241	-5	19.95	4600	4600	4600	4600
39	15	39.71	1.90	0.00240	-5	19.95	5100	5100	5100	5100
39	16	39.68	1.89	0.00240	-5	19.95	5700	5700	5700	5700
39	17	39.62	1.89	0.00240	-5	19.95	6300	6300	6300	6300
39	19	39.63	1.89	0.00240	-5	39.98	4000	4000	4000	4000
39	20	39.16	1.84	0.00240	-5	39.98	4600	4600	4600	4600
39	21	39.59	1.88	0.00240	-5	39.98	5100	5100	5100	5100
39	22	39.20	1.84	0.00240	-5	39.98	5700	5700	5700	5700
39	23	39.67	1.89	0.00240	-5	39.98	6300	6300	6300	6300

Table C5b. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -5 deg, pitch = -40 to 40 deg, RPM = 4,000 to 6,800 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
36	5	0.558	-0.049	0.585	0.141	-0.235	0.013	16.842	1.189	1.428	1.298	1.265
36	6	0.587	-0.045	1.011	0.101	-0.007	0.016	16.820	1.744	1.883	1.740	1.718
36	7	0.642	-0.046	1.607	0.081	0.414	0.053	16.784	2.222	2.547	2.430	2.341
36	8	0.692	-0.059	2.257	0.056	0.996	0.076	16.740	3.108	3.441	3.223	3.117
36	9	0.744	-0.056	2.838	0.089	1.315	0.100	16.699	3.790	4.305	3.987	3.845
36	10	0.867	-0.088	2.097	0.130	1.537	0.033	16.825	1.456	1.679	1.631	1.554
36	11	0.936	-0.080	2.616	0.060	2.129	0.080	16.801	1.921	2.136	2.087	2.110
36	12	0.958	-0.101	3.319	0.050	3.158	0.039	16.764	2.594	2.854	2.826	2.713
36	13	1.006	-0.104	4.120	-0.161	4.067	-0.001	16.721	3.413	3.701	3.703	3.538
36	14	1.036	-0.097	4.817	-0.136	4.721	0.031	16.676	4.186	4.574	4.542	4.319
36	15	0.891	-0.112	2.873	0.143	2.872	-0.106	16.823	1.535	1.732	1.671	1.558
36	16	0.954	-0.114	3.451	0.043	3.487	-0.041	16.797	2.044	2.249	2.143	2.195
36	17	1.034	-0.135	4.167	-0.013	4.580	0.000	16.758	2.723	3.006	2.809	2.833
36	18	1.074	-0.106	4.909	-0.240	5.854	0.072	16.712	3.726	3.994	3.713	3.561
37	5	0.794	-0.086	3.101	-0.093	4.227	-0.030	16.817	1.668	1.928	1.611	1.560
37	6	0.866	-0.092	3.700	-0.182	5.138	0.008	16.790	2.167	2.459	2.081	2.053
37	7	0.941	-0.106	4.425	-0.389	6.470	0.108	16.751	3.047	3.231	2.807	2.782
37	8	1.044	-0.104	5.212	-0.365	7.335	0.116	16.702	4.012	4.202	3.710	3.706
37	12	0.785	-0.079	3.283	-0.172	4.962	-0.040	16.813	1.980	1.954	1.599	1.616
37	13	0.826	-0.091	3.876	-0.249	6.047	-0.048	16.786	2.504	2.554	2.038	2.191
37	14	0.890	-0.113	4.633	-0.373	7.417	0.036	16.748	3.151	3.401	2.788	2.798
37	15	0.989	-0.108	5.421	-0.553	8.666	0.066	16.696	4.275	4.432	3.768	3.713
37	25	0.690	-0.089	2.606	0.011	4.109	-0.090	16.842	1.424	1.508	1.149	1.146
37	19	0.760	-0.086	3.356	-0.112	5.456	-0.058	16.811	1.901	2.058	1.596	1.556
37	20	0.791	-0.093	3.973	-0.315	6.694	-0.060	16.780	2.511	2.695	2.205	2.356
37	21	0.849	-0.119	4.729	-0.459	8.185	-0.007	16.744	3.301	3.440	2.802	2.883
37	23	0.956	-0.126	5.540	-0.543	9.396	0.040	16.691	4.387	4.578	3.731	3.801
38	5	0.689	-0.061	2.735	-0.102	4.390	-0.018	16.841	1.356	1.521	1.159	1.149
38	6	0.734	-0.059	3.406	-0.191	5.763	0.011	16.813	1.896	2.058	1.642	1.551
38	7	0.769	-0.081	4.040	-0.339	7.162	-0.053	16.784	2.601	2.631	2.178	2.065
38	8	0.858	-0.103	4.849	-0.584	9.067	-0.011	16.742	3.399	3.568	2.856	2.778
38	9	0.964	-0.101	5.691	-0.776	10.561	0.060	16.688	4.494	4.764	3.717	3.738
38	13	0.661	-0.061	2.838	-0.078	4.646	-0.082	16.841	1.460	1.531	1.190	1.144
38	14	0.714	-0.055	3.506	-0.230	6.287	-0.059	16.812	1.943	2.142	1.645	1.529
38	15	0.763	-0.054	4.116	-0.386	7.869	-0.016	16.782	2.649	2.762	2.114	2.154
38	16	0.788	-0.085	4.906	-0.581	10.230	-0.069	16.738	3.569	3.736	2.840	2.726
38	17	0.900	-0.098	5.799	-0.800	11.941	-0.041	16.684	4.678	4.928	3.727	3.663
39	5	0.613	-0.040	3.146	-0.040	4.282	-0.083	16.836	1.452	1.670	1.142	1.292
39	6	0.664	-0.043	3.839	-0.273	6.372	-0.144	16.807	2.073	2.311	1.683	1.780
39	7	0.696	-0.046	4.394	-0.609	8.361	-0.207	16.776	2.607	3.097	2.117	1.993
39	8	0.737	-0.062	5.121	-1.164	11.112	-0.204	16.732	3.698	3.913	3.012	2.575
39	9	0.852	-0.086	5.962	-1.629	13.825	-0.193	16.677	4.905	5.201	3.910	3.430
39	13	0.482	-0.041	3.741	-0.297	2.803	-0.059	16.830	1.502	1.616	1.403	1.324
39	14	0.521	-0.026	4.534	-0.461	4.613	-0.118	16.801	2.108	2.279	1.908	1.819
39	15	0.567	-0.022	5.155	-1.013	6.655	-0.143	16.773	2.812	2.945	2.379	1.969
39	16	0.628	-0.018	5.928	-1.443	9.801	-0.096	16.729	3.811	3.998	3.017	2.601
39	17	0.714	-0.036	6.752	-1.988	12.935	-0.079	16.672	5.121	5.333	4.010	3.353
39	19	0.390	-0.077	4.188	-0.185	2.383	-0.133	16.825	1.530	1.594	1.468	1.459
39	20	0.375	-0.061	5.092	-0.352	2.620	-0.099	16.798	2.180	2.112	2.178	1.968
39	21	0.375	-0.047	6.034	-0.564	3.364	-0.076	16.767	2.778	2.655	2.607	2.622
39	22	0.398	-0.028	6.977	-1.189	6.063	-0.167	16.724	3.574	3.708	3.478	3.150
39	23	0.472	-0.020	8.025	-1.925	8.346	-0.169	16.671	4.783	4.800	4.408	3.881

Table C5c. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -5 deg, pitch = -40 to 40 deg, RPM = 4,000 to 6,800 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
36	5	0.089	0.057	0.134	0.150	0.277	0.192	0.001	0.023	0.026	0.025	0.024
36	6	0.091	0.061	0.135	0.161	0.290	0.223	0.001	0.031	0.034	0.032	0.031
36	7	0.091	0.057	0.134	0.150	0.282	0.200	0.001	0.039	0.044	0.042	0.040
36	8	0.094	0.057	0.134	0.150	0.283	0.205	0.001	0.049	0.055	0.052	0.050
36	9	0.143	0.057	0.136	0.151	0.386	0.195	0.001	0.058	0.065	0.061	0.058
36	10	0.090	0.057	0.136	0.152	0.291	0.193	0.001	0.028	0.032	0.031	0.029
36	11	0.096	0.065	0.138	0.167	0.317	0.241	0.001	0.035	0.038	0.038	0.036
36	12	0.098	0.057	0.136	0.151	0.301	0.204	0.001	0.045	0.048	0.048	0.046
36	13	0.108	0.058	0.136	0.154	0.315	0.209	0.001	0.054	0.058	0.058	0.056
36	14	0.160	0.059	0.141	0.155	0.431	0.202	0.001	0.063	0.068	0.069	0.065
36	15	0.091	0.058	0.138	0.153	0.305	0.195	0.001	0.029	0.032	0.031	0.030
36	16	0.099	0.067	0.139	0.174	0.331	0.252	0.001	0.037	0.040	0.039	0.038
36	17	0.098	0.057	0.137	0.151	0.303	0.205	0.001	0.047	0.050	0.048	0.047
36	18	0.121	0.059	0.137	0.157	0.340	0.219	0.001	0.058	0.062	0.059	0.056
37	5	0.092	0.059	0.139	0.155	0.314	0.196	0.001	0.032	0.035	0.031	0.030
37	6	0.099	0.079	0.138	0.198	0.325	0.306	0.001	0.040	0.043	0.038	0.038
37	7	0.102	0.060	0.137	0.154	0.312	0.220	0.001	0.050	0.053	0.048	0.046
37	8	0.130	0.060	0.136	0.158	0.364	0.244	0.001	0.062	0.065	0.059	0.058
37	12	0.092	0.058	0.140	0.154	0.322	0.196	0.001	0.035	0.035	0.031	0.031
37	13	0.099	0.068	0.139	0.177	0.328	0.248	0.001	0.042	0.045	0.037	0.039
37	14	0.109	0.059	0.139	0.154	0.337	0.215	0.001	0.052	0.056	0.048	0.047
37	15	0.135	0.060	0.138	0.159	0.377	0.229	0.001	0.065	0.068	0.060	0.058
37	25	0.090	0.066	0.136	0.164	0.281	0.198	0.001	0.027	0.028	0.023	0.023
37	19	0.091	0.061	0.138	0.161	0.299	0.198	0.001	0.034	0.036	0.031	0.031
37	20	0.099	0.065	0.138	0.172	0.331	0.239	0.001	0.043	0.046	0.039	0.040
37	21	0.104	0.059	0.138	0.153	0.320	0.215	0.001	0.053	0.056	0.049	0.048
37	23	0.141	0.060	0.140	0.157	0.393	0.218	0.001	0.066	0.070	0.060	0.060
38	5	0.090	0.067	0.136	0.164	0.279	0.199	0.001	0.026	0.028	0.023	0.023
38	6	0.091	0.063	0.138	0.165	0.300	0.200	0.001	0.035	0.037	0.031	0.030
38	7	0.099	0.072	0.139	0.183	0.326	0.276	0.001	0.044	0.046	0.039	0.039
38	8	0.103	0.059	0.137	0.153	0.317	0.221	0.001	0.055	0.057	0.049	0.047
38	9	0.161	0.060	0.141	0.157	0.442	0.211	0.001	0.067	0.071	0.059	0.059
38	13	0.090	0.067	0.137	0.164	0.280	0.199	0.001	0.027	0.029	0.024	0.023
38	14	0.091	0.062	0.138	0.162	0.305	0.200	0.001	0.036	0.038	0.032	0.030
38	15	0.101	0.071	0.141	0.181	0.346	0.268	0.001	0.044	0.047	0.039	0.038
38	16	0.108	0.059	0.139	0.152	0.334	0.208	0.001	0.057	0.059	0.049	0.047
38	17	0.160	0.060	0.142	0.156	0.446	0.225	0.001	0.069	0.074	0.060	0.058
39	5	0.090	0.065	0.138	0.162	0.280	0.198	0.001	0.028	0.031	0.023	0.025
39	6	0.091	0.061	0.139	0.160	0.313	0.200	0.001	0.038	0.041	0.032	0.032
39	7	0.096	0.067	0.139	0.172	0.321	0.254	0.001	0.046	0.051	0.040	0.038
39	8	0.105	0.059	0.138	0.152	0.327	0.207	0.001	0.059	0.062	0.051	0.045
39	9	0.168	0.061	0.142	0.158	0.468	0.218	0.001	0.072	0.077	0.063	0.056
39	13	0.089	0.061	0.135	0.157	0.277	0.197	0.001	0.029	0.030	0.028	0.027
39	14	0.089	0.060	0.137	0.156	0.292	0.196	0.001	0.038	0.041	0.036	0.034
39	15	0.093	0.065	0.137	0.166	0.304	0.242	0.001	0.047	0.049	0.043	0.037
39	16	0.098	0.059	0.136	0.152	0.302	0.206	0.001	0.060	0.063	0.052	0.046
39	17	0.121	0.058	0.139	0.153	0.347	0.211	0.001	0.075	0.078	0.064	0.055
39	19	0.089	0.059	0.135	0.154	0.275	0.196	0.001	0.029	0.031	0.029	0.028
39	20	0.089	0.058	0.136	0.154	0.284	0.195	0.001	0.038	0.038	0.038	0.036
39	21	0.092	0.064	0.136	0.167	0.293	0.236	0.001	0.047	0.047	0.045	0.044
39	22	0.094	0.058	0.136	0.152	0.294	0.205	0.001	0.059	0.060	0.057	0.052
39	23	0.106	0.057	0.137	0.154	0.315	0.202	0.001	0.071	0.073	0.068	0.061

Table C6a. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -30 deg, pitch = -10 to 10 deg, RPM = 4,000 to 6,300 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
40	6	40.39	1.95	0.00239	-30	-9.90	4000	4000	4000	4000
40	7	40.22	1.93	0.00239	-30	-9.90	4600	4600	4600	4600
40	8	40.40	1.95	0.00239	-30	-9.90	5100	5100	5100	5100
40	9	40.01	1.91	0.00239	-30	-9.91	5700	5700	5700	5700
40	10	39.84	1.90	0.00239	-30	-9.90	6300	6300	6300	6300
40	11	40.17	1.93	0.00239	-30	-4.98	4000	4000	4000	4000
40	12	39.71	1.88	0.00239	-30	-4.98	4600	4600	4600	4600
40	13	39.58	1.87	0.00238	-30	-4.98	5100	5100	5100	5100
40	14	39.48	1.86	0.00238	-30	-4.99	5700	5700	5700	5700
40	15	39.66	1.87	0.00238	-30	-4.98	6300	6300	6300	6300
41	5	40.27	1.92	0.00237	-30	-1.98	4000	4000	4000	4000
41	6	40.10	1.91	0.00237	-30	-1.98	4600	4600	4600	4600
41	7	40.03	1.90	0.00237	-30	-1.98	5100	5100	5100	5100
41	8	40.06	1.90	0.00237	-30	-1.98	5700	5700	5700	5700
41	9	39.77	1.87	0.00237	-30	-1.98	6300	6300	6300	6300
41	10	40.11	1.91	0.00237	-30	-0.04	4000	4000	4000	4000
41	11	40.01	1.90	0.00237	-30	-0.05	4600	4600	4600	4600
41	12	39.86	1.88	0.00237	-30	-0.05	5100	5100	5100	5100
41	13	40.37	1.93	0.00237	-30	-0.04	5700	5700	5700	5700
41	14	40.37	1.93	0.00237	-30	-0.05	6300	6300	6300	6300
41	15	40.32	1.92	0.00237	-30	2.03	4000	4000	4000	4000
41	16	40.19	1.91	0.00237	-30	2.03	4600	4600	4600	4600
41	17	40.31	1.92	0.00236	-30	2.03	5100	5100	5100	5100
41	18	40.31	1.92	0.00236	-30	2.03	5700	5700	5700	5700
41	19	40.09	1.90	0.00236	-30	2.03	6300	6300	6300	6300
41	20	40.09	1.90	0.00236	-30	5.03	4000	4000	4000	4000
41	21	40.42	1.93	0.00236	-30	5.03	4600	4600	4600	4600
41	22	40.17	1.91	0.00236	-30	5.03	5100	5100	5100	5100
41	23	40.05	1.90	0.00236	-30	5.03	5700	5700	5700	5700
41	24	39.74	1.87	0.00236	-30	5.03	6300	6300	6300	6300
41	25	40.22	1.91	0.00236	-30	9.95	4000	4000	4000	4000
41	26	40.01	1.89	0.00236	-30	9.95	4600	4600	4600	4600
41	27	40.17	1.91	0.00236	-30	9.95	5100	5100	5100	5100
41	28	39.90	1.88	0.00236	-30	9.95	5700	5700	5700	5700
41	29	40.35	1.92	0.00236	-30	9.95	6300	6300	6300	6300

Table C6b. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -30 deg, pitch = -10 to 10 deg, RPM = 4,000 to 6,300 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
40	6	0.695	-0.477	2.161	-0.368	2.111	-0.000	16.846	0.954	1.273	1.175	1.153
40	7	0.756	-0.529	2.807	-0.745	2.886	-0.026	16.818	1.436	1.889	1.691	1.653
40	8	0.810	-0.582	3.378	-1.004	3.534	0.007	16.795	1.942	2.327	2.144	2.095
40	9	0.843	-0.625	4.098	-1.496	4.607	-0.026	16.757	2.610	3.085	2.816	2.697
40	10	0.896	-0.668	4.828	-1.920	5.483	-0.131	16.710	3.559	4.100	3.721	3.503
40	11	0.650	-0.440	2.519	-0.708	2.481	-0.029	16.841	1.190	1.302	1.264	1.154
40	12	0.680	-0.472	3.130	-1.102	3.262	-0.066	16.818	1.559	1.886	1.570	1.600
40	13	0.721	-0.504	3.715	-1.440	3.916	-0.014	16.787	2.132	2.427	2.227	2.016
40	14	0.783	-0.566	4.495	-1.827	4.818	-0.043	16.747	2.916	3.346	3.067	2.800
40	15	0.842	-0.618	5.347	-2.346	5.833	-0.047	16.697	3.885	4.343	3.976	3.629
41	5	0.666	-0.407	2.714	-0.721	2.058	-0.134	16.702	1.264	1.396	1.304	1.167
41	6	0.710	-0.437	3.386	-1.197	2.804	-0.211	16.673	1.783	2.006	1.818	1.661
41	7	0.761	-0.462	3.989	-1.597	3.449	-0.151	16.644	2.285	2.566	2.425	2.139
41	8	0.811	-0.527	4.736	-2.177	4.402	-0.070	16.605	3.067	3.468	3.148	2.737
41	9	0.867	-0.569	5.638	-2.589	5.595	-0.122	16.552	4.089	4.682	4.041	3.664
41	10	0.657	-0.399	2.850	-0.784	2.039	-0.202	16.700	1.293	1.443	1.337	1.195
41	11	0.707	-0.422	3.540	-1.337	2.793	-0.267	16.671	1.791	2.085	1.806	1.616
41	12	0.735	-0.452	4.135	-1.834	3.508	-0.281	16.642	2.417	2.650	2.477	1.977
41	13	0.806	-0.508	4.925	-2.409	4.540	-0.185	16.601	3.180	3.584	3.127	2.800
41	14	0.870	-0.541	5.829	-2.911	5.635	-0.170	16.547	4.191	4.782	4.105	3.660
41	15	0.654	-0.379	2.967	-0.807	1.954	-0.085	16.697	1.320	1.535	1.402	1.163
41	16	0.688	-0.392	3.705	-1.436	2.779	-0.210	16.670	1.857	2.141	1.912	1.540
41	17	0.731	-0.426	4.338	-1.971	3.710	-0.239	16.640	2.297	2.744	2.508	2.128
41	18	0.791	-0.483	5.117	-2.715	4.776	-0.242	16.596	3.299	3.661	3.143	2.761
41	19	0.856	-0.524	6.028	-3.156	5.802	-0.292	16.542	4.358	4.917	4.119	3.675
41	20	0.628	-0.363	3.120	-0.853	1.990	-0.127	16.696	1.397	1.549	1.374	1.176
41	21	0.672	-0.389	3.920	-1.506	2.790	-0.273	16.665	2.065	2.193	1.992	1.635
41	22	0.708	-0.398	4.593	-2.106	3.653	-0.297	16.639	2.674	2.849	2.507	1.918
41	23	0.755	-0.426	5.421	-2.994	4.972	-0.319	16.591	3.529	3.835	3.257	2.930
41	24	0.805	-0.473	6.316	-3.617	6.072	-0.423	16.536	4.517	5.094	4.182	3.727
41	25	0.572	-0.333	3.378	-1.160	1.923	-0.261	16.695	1.472	1.657	1.528	1.154
41	26	0.611	-0.341	4.245	-1.741	2.552	-0.360	16.662	2.036	2.268	2.164	1.667
41	27	0.664	-0.358	4.998	-2.249	3.458	-0.374	16.628	2.751	2.968	2.760	2.227
41	28	0.713	-0.389	5.896	-3.243	4.756	-0.441	16.581	3.659	4.053	3.505	2.975
41	29	0.781	-0.425	6.929	-4.366	6.022	-0.540	16.522	4.766	5.349	4.639	3.849

Table C6c. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -30 deg, pitch = -10 to 10 deg, RPM = 4,000 to 6,300 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
40	6	0.091	0.066	0.135	0.168	0.275	0.198	0.001	0.021	0.025	0.023	0.022
40	7	0.091	0.060	0.137	0.158	0.297	0.200	0.001	0.028	0.034	0.031	0.031
40	8	0.098	0.069	0.138	0.178	0.302	0.267	0.001	0.036	0.041	0.038	0.037
40	9	0.095	0.063	0.136	0.161	0.295	0.212	0.001	0.045	0.052	0.048	0.046
40	10	0.151	0.088	0.142	0.224	0.426	0.205	0.001	0.057	0.064	0.059	0.056
40	11	0.090	0.062	0.135	0.161	0.275	0.197	0.001	0.023	0.026	0.024	0.023
40	12	0.091	0.060	0.136	0.160	0.292	0.202	0.001	0.030	0.035	0.032	0.030
40	13	0.096	0.063	0.137	0.167	0.304	0.236	0.001	0.039	0.043	0.040	0.037
40	14	0.096	0.062	0.136	0.162	0.295	0.217	0.001	0.049	0.054	0.051	0.047
40	15	0.132	0.078	0.141	0.199	0.376	0.219	0.001	0.060	0.067	0.063	0.057
41	5	0.090	0.064	0.136	0.162	0.274	0.198	0.001	0.025	0.027	0.025	0.023
41	6	0.092	0.061	0.137	0.162	0.301	0.204	0.001	0.033	0.037	0.034	0.031
41	7	0.097	0.066	0.138	0.172	0.305	0.243	0.001	0.041	0.045	0.042	0.038
41	8	0.099	0.063	0.136	0.165	0.299	0.218	0.001	0.052	0.056	0.052	0.047
41	9	0.139	0.084	0.142	0.205	0.403	0.218	0.001	0.062	0.070	0.063	0.058
41	10	0.091	0.065	0.135	0.165	0.275	0.198	0.001	0.025	0.028	0.026	0.024
41	11	0.092	0.060	0.136	0.159	0.293	0.200	0.001	0.034	0.038	0.034	0.031
41	12	0.097	0.063	0.137	0.166	0.302	0.231	0.001	0.043	0.045	0.043	0.038
41	13	0.097	0.061	0.136	0.161	0.291	0.223	0.001	0.052	0.058	0.052	0.046
41	14	0.139	0.082	0.141	0.210	0.395	0.211	0.001	0.064	0.072	0.064	0.058
41	15	0.090	0.061	0.135	0.158	0.275	0.198	0.001	0.026	0.029	0.027	0.023
41	16	0.091	0.059	0.136	0.156	0.290	0.201	0.001	0.035	0.038	0.035	0.031
41	17	0.096	0.064	0.136	0.168	0.293	0.244	0.001	0.042	0.047	0.043	0.038
41	18	0.095	0.061	0.136	0.159	0.290	0.219	0.001	0.054	0.059	0.053	0.048
41	19	0.149	0.084	0.145	0.222	0.414	0.205	0.001	0.066	0.073	0.064	0.058
41	20	0.090	0.063	0.136	0.163	0.274	0.198	0.001	0.027	0.030	0.027	0.024
41	21	0.091	0.059	0.136	0.158	0.292	0.201	0.001	0.037	0.039	0.036	0.031
41	22	0.095	0.065	0.136	0.169	0.289	0.245	0.001	0.046	0.049	0.044	0.037
41	23	0.096	0.062	0.136	0.163	0.293	0.213	0.001	0.058	0.061	0.054	0.049
41	24	0.130	0.077	0.140	0.201	0.370	0.209	0.001	0.068	0.075	0.065	0.059
41	25	0.090	0.062	0.135	0.161	0.275	0.197	0.001	0.028	0.031	0.029	0.023
41	26	0.091	0.059	0.135	0.158	0.287	0.200	0.001	0.037	0.041	0.039	0.032
41	27	0.093	0.063	0.136	0.167	0.286	0.227	0.001	0.046	0.050	0.047	0.041
41	28	0.095	0.062	0.136	0.161	0.292	0.219	0.001	0.058	0.064	0.058	0.050
41	29	0.118	0.071	0.138	0.187	0.338	0.214	0.001	0.072	0.079	0.070	0.061

Table C7a. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 4,000 to 6,300 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
42	6	20.55	0.50	0.00237	-45	-9.90	4000	4000	4000	4000
42	7	20.29	0.49	0.00237	-45	-9.90	4600	4600	4600	4600
42	8	20.23	0.48	0.00237	-45	-9.90	5100	5100	5100	5100
42	9	20.11	0.48	0.00237	-45	-9.90	5700	5700	5700	5700
42	10	20.09	0.48	0.00237	-45	-9.90	6300	6300	6300	6300
42	15	20.18	0.48	0.00237	-45	-4.98	4000	4000	4000	4000
42	16	20.13	0.48	0.00237	-45	-4.98	4600	4600	4600	4600
42	17	20.00	0.47	0.00237	-45	-4.98	5100	5100	5100	5100
42	18	20.10	0.48	0.00237	-45	-4.98	5700	5700	5700	5700
42	19	20.01	0.47	0.00237	-45	-4.98	6300	6300	6300	6300
42	24	20.40	0.49	0.00237	-45	-1.98	4000	4000	4000	4000
42	25	20.39	0.49	0.00237	-45	-1.98	4600	4600	4600	4600
42	26	20.27	0.49	0.00237	-45	-1.98	5100	5100	5100	5100
42	27	20.15	0.48	0.00237	-45	-1.98	5700	5700	5700	5700
42	28	20.12	0.48	0.00237	-45	-1.98	6300	6300	6300	6300
43	5	20.51	0.50	0.00237	-45	-0.04	4000	4000	4000	4000
43	6	20.61	0.50	0.00237	-45	-0.04	4600	4600	4600	4600
43	7	19.99	0.47	0.00237	-45	-0.04	5100	5100	5100	5100
43	8	19.99	0.47	0.00237	-45	-0.04	5700	5700	5700	5700
43	9	19.77	0.46	0.00237	-45	-0.04	6300	6300	6300	6300
43	14	20.24	0.49	0.00237	-45	2.03	4000	4000	4000	4000
43	15	20.07	0.48	0.00237	-45	2.03	4600	4600	4600	4600
43	16	20.00	0.47	0.00237	-45	2.03	5100	5100	5100	5100
43	17	19.79	0.46	0.00237	-45	2.03	5700	5700	5700	5700
43	18	19.68	0.46	0.00237	-45	2.03	6300	6300	6300	6300
45	5	19.64	0.47	0.00245	-45	5.03	4000	4000	4000	4000
45	6	19.60	0.47	0.00245	-45	5.03	4600	4600	4600	4600
45	7	19.63	0.47	0.00245	-45	5.03	5100	5100	5100	5100
45	8	19.49	0.47	0.00245	-45	5.03	5700	5700	5700	5700
45	9	19.57	0.47	0.00245	-45	5.03	6300	6300	6300	6300
45	14	19.58	0.47	0.00245	-45	9.95	4000	4000	4000	4000
45	15	19.57	0.47	0.00245	-45	9.95	4600	4600	4600	4600
45	16	19.42	0.46	0.00245	-45	9.95	5100	5100	5100	5100
45	17	19.44	0.46	0.00245	-45	9.95	5700	5700	5700	5700
45	18	19.28	0.46	0.00245	-45	9.95	6300	6300	6300	6300

Table C7b. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 4,000 to 6,300 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
42	6	0.234	-0.189	1.899	-1.020	1.560	-0.011	16.711	0.959	1.222	1.167	1.050
42	7	0.261	-0.211	2.407	-1.309	1.880	0.009	16.687	1.417	1.668	1.616	1.519
42	8	0.277	-0.234	2.871	-1.602	2.132	-0.013	16.661	1.857	2.176	2.082	2.028
42	9	0.305	-0.249	3.518	-2.058	2.561	-0.009	16.627	2.549	2.900	2.731	2.561
42	10	0.354	-0.278	4.220	-2.511	2.856	-0.200	16.582	3.355	3.725	3.534	3.402
42	15	0.215	-0.170	2.021	-1.162	1.786	0.015	16.710	1.057	1.274	1.150	1.114
42	16	0.245	-0.201	2.568	-1.523	2.140	0.014	16.684	1.424	1.727	1.614	1.547
42	17	0.262	-0.230	3.028	-1.788	2.514	-0.000	16.660	1.927	2.262	2.057	1.974
42	18	0.277	-0.255	3.659	-2.170	2.886	-0.020	16.623	2.620	2.950	2.764	2.662
42	19	0.323	-0.266	4.363	-2.655	3.100	-0.191	16.579	3.498	3.793	3.583	3.431
42	24	0.208	-0.159	2.092	-1.305	1.901	0.039	16.710	1.035	1.272	1.148	1.088
42	25	0.242	-0.200	2.634	-1.566	2.296	-0.028	16.684	1.515	1.805	1.593	1.536
42	26	0.260	-0.225	3.093	-1.857	2.632	-0.017	16.660	1.931	2.279	2.002	1.952
42	27	0.276	-0.253	3.714	-2.254	3.020	-0.035	16.624	2.636	2.963	2.699	2.602
42	28	0.312	-0.271	4.440	-2.725	3.431	-0.219	16.579	3.524	3.850	3.475	3.417
43	5	0.198	-0.158	2.115	-1.444	1.903	-0.004	16.709	1.051	1.292	1.110	1.069
43	6	0.235	-0.194	2.662	-1.687	2.341	-0.037	16.683	1.545	1.858	1.583	1.546
43	7	0.251	-0.215	3.091	-1.887	2.646	-0.010	16.661	1.934	2.232	1.980	1.845
43	8	0.272	-0.253	3.724	-2.278	3.153	-0.045	16.623	2.698	3.057	2.647	2.671
43	9	0.304	-0.281	4.412	-2.607	3.491	-0.265	16.579	3.560	3.924	3.459	3.405
43	14	0.186	-0.143	2.135	-1.483	1.956	-0.005	16.709	1.071	1.316	1.094	1.095
43	15	0.219	-0.183	2.662	-1.755	2.381	-0.033	16.685	1.539	1.875	1.596	1.565
43	16	0.244	-0.221	3.137	-1.923	2.881	-0.061	16.659	1.992	2.370	1.935	2.009
43	17	0.268	-0.256	3.779	-2.215	3.519	-0.084	16.622	2.717	3.105	2.634	2.659
43	18	0.289	-0.275	4.475	-2.708	3.932	-0.256	16.578	3.586	3.995	3.396	3.464
45	5	0.195	-0.157	2.245	-1.528	2.034	-0.061	16.812	1.150	1.373	1.132	1.143
45	6	0.230	-0.196	2.827	-1.727	2.620	-0.093	16.788	1.554	1.960	1.578	1.494
45	7	0.253	-0.219	3.359	-2.070	3.077	-0.101	16.761	1.918	2.429	1.960	2.022
45	8	0.288	-0.277	3.974	-2.314	3.684	-0.134	16.725	2.808	3.224	2.680	2.754
45	9	0.313	-0.315	4.730	-2.658	4.327	-0.299	16.679	3.716	4.157	3.428	3.563
45	14	0.180	-0.143	2.377	-2.122	1.947	-0.087	16.813	1.132	1.324	1.135	1.124
45	15	0.209	-0.169	2.979	-2.289	2.618	-0.138	16.786	1.750	1.810	1.615	1.601
45	16	0.233	-0.197	3.512	-2.258	3.423	-0.204	16.759	2.091	2.465	1.988	2.203
45	17	0.269	-0.249	4.133	-2.598	4.107	-0.230	16.724	2.914	3.209	2.654	2.730
45	18	0.293	-0.304	4.840	-2.704	4.915	-0.417	16.677	3.780	4.293	3.330	3.523

**Table C7c. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg,
RPM = 4,000 to 6,300 (uniform) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
42	6	0.089	0.058	0.134	0.152	0.273	0.197	0.001	0.021	0.024	0.023	0.021
42	7	0.089	0.059	0.135	0.156	0.282	0.198	0.001	0.028	0.032	0.030	0.029
42	8	0.092	0.060	0.135	0.159	0.282	0.204	0.001	0.035	0.039	0.037	0.036
42	9	0.091	0.060	0.135	0.159	0.283	0.199	0.001	0.044	0.049	0.047	0.044
42	10	0.096	0.066	0.136	0.174	0.291	0.201	0.001	0.054	0.059	0.056	0.054
42	15	0.089	0.058	0.134	0.153	0.273	0.197	0.000	0.022	0.024	0.022	0.022
42	16	0.090	0.059	0.135	0.155	0.284	0.197	0.001	0.029	0.032	0.030	0.029
42	17	0.092	0.060	0.135	0.162	0.285	0.204	0.001	0.036	0.040	0.037	0.035
42	18	0.093	0.061	0.136	0.164	0.287	0.201	0.001	0.045	0.050	0.047	0.045
42	19	0.101	0.072	0.136	0.183	0.301	0.205	0.001	0.056	0.060	0.056	0.054
42	24	0.089	0.058	0.134	0.153	0.273	0.197	0.001	0.022	0.025	0.022	0.022
42	25	0.090	0.058	0.135	0.155	0.285	0.196	0.001	0.030	0.033	0.030	0.029
42	26	0.092	0.060	0.136	0.160	0.287	0.204	0.001	0.036	0.041	0.037	0.036
42	27	0.091	0.061	0.135	0.160	0.282	0.200	0.001	0.046	0.050	0.046	0.045
42	28	0.100	0.073	0.135	0.181	0.305	0.200	0.001	0.056	0.061	0.056	0.054
43	5	0.089	0.058	0.134	0.153	0.273	0.198	0.001	0.022	0.025	0.022	0.021
43	6	0.090	0.060	0.135	0.158	0.283	0.197	0.001	0.030	0.034	0.029	0.029
43	7	0.091	0.061	0.135	0.161	0.282	0.204	0.001	0.037	0.040	0.036	0.034
43	8	0.091	0.061	0.136	0.162	0.285	0.198	0.001	0.046	0.050	0.046	0.045
43	9	0.105	0.075	0.137	0.200	0.309	0.199	0.001	0.056	0.061	0.056	0.055
43	14	0.089	0.059	0.134	0.154	0.273	0.197	0.001	0.022	0.025	0.022	0.022
43	15	0.089	0.059	0.135	0.157	0.281	0.196	0.001	0.030	0.034	0.030	0.029
43	16	0.093	0.061	0.135	0.161	0.282	0.209	0.001	0.036	0.042	0.036	0.037
43	17	0.091	0.061	0.135	0.161	0.284	0.200	0.001	0.047	0.052	0.046	0.045
43	18	0.101	0.071	0.137	0.186	0.300	0.205	0.001	0.056	0.063	0.055	0.054
45	5	0.089	0.059	0.134	0.155	0.274	0.197	0.001	0.023	0.026	0.022	0.022
45	6	0.090	0.059	0.134	0.157	0.280	0.196	0.001	0.030	0.034	0.030	0.029
45	7	0.092	0.062	0.136	0.165	0.287	0.208	0.001	0.037	0.042	0.036	0.037
45	8	0.092	0.061	0.135	0.161	0.285	0.203	0.001	0.047	0.052	0.046	0.046
45	9	0.105	0.074	0.137	0.200	0.304	0.210	0.001	0.059	0.064	0.056	0.056
45	14	0.089	0.058	0.134	0.153	0.274	0.197	0.001	0.023	0.025	0.023	0.022
45	15	0.090	0.059	0.135	0.157	0.281	0.196	0.001	0.032	0.034	0.031	0.030
45	16	0.093	0.061	0.135	0.163	0.284	0.212	0.001	0.038	0.042	0.036	0.038
45	17	0.093	0.063	0.136	0.168	0.288	0.202	0.001	0.049	0.053	0.046	0.046
45	18	0.109	0.080	0.138	0.212	0.317	0.211	0.001	0.060	0.066	0.055	0.057

Table C8a. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 3,500 to 6,300 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
46	5	38.69	1.83	0.00245	-45	-9.91	4000	4000	4000	4000
46	6	39.53	1.91	0.00245	-45	-9.91	4600	4600	4600	4600
46	7	39.52	1.91	0.00245	-45	-9.91	5100	5100	5100	5100
46	8	39.46	1.91	0.00245	-45	-9.91	5700	5700	5700	5700
46	9	39.56	1.92	0.00245	-45	-9.91	6300	6300	6300	6300
46	10	39.25	1.89	0.00245	-45	-4.99	4000	4000	4000	4000
46	11	39.33	1.89	0.00245	-45	-4.98	4600	4600	4600	4600
46	12	39.39	1.90	0.00245	-45	-4.99	5100	5100	5100	5100
46	13	39.30	1.89	0.00245	-45	-4.98	5700	5700	5700	5700
46	14	39.15	1.88	0.00245	-45	-4.99	6300	6300	6300	6300
46	15	39.48	1.91	0.00245	-45	-1.99	4000	4000	4000	4000
46	16	39.63	1.92	0.00245	-45	-1.98	4600	4600	4600	4600
46	17	39.48	1.91	0.00245	-45	-1.99	5100	5100	5100	5100
46	18	39.31	1.89	0.00245	-45	-1.99	5700	5700	5700	5700
46	19	39.19	1.88	0.00245	-45	-1.99	6300	6300	6300	6300
46	20	39.15	1.87	0.00245	-45	0.11	3500	3500	3500	3500
46	21	39.09	1.87	0.00245	-45	0.12	4000	4000	4000	4000
46	22	39.10	1.87	0.00245	-45	0.10	4600	4600	4600	4600
46	23	39.65	1.92	0.00244	-45	0.12	5100	5100	5100	5100
46	24	39.51	1.91	0.00244	-45	0.12	5700	5700	5700	5700
46	25	39.75	1.93	0.00244	-45	2.03	3500	3500	3500	3500
46	26	39.75	1.93	0.00244	-45	2.03	4000	4000	4000	4000
46	27	39.66	1.92	0.00244	-45	2.03	4600	4600	4600	4600
46	28	39.62	1.92	0.00244	-45	2.03	5100	5100	5100	5100
46	29	39.49	1.90	0.00244	-45	2.03	5700	5700	5700	5700
46	30	39.63	1.92	0.00244	-45	5.03	3500	3500	3500	3500
46	31	39.56	1.91	0.00244	-45	5.03	4000	4000	4000	4000
46	32	39.43	1.90	0.00244	-45	5.02	4600	4600	4600	4600
46	33	39.23	1.88	0.00244	-45	5.03	5100	5100	5100	5100
46	34	38.86	1.84	0.00244	-45	5.03	5700	5700	5700	5700
46	35	39.50	1.90	0.00244	-45	9.95	3500	3500	3500	3500
46	36	39.50	1.90	0.00244	-45	9.95	4000	4000	4000	4000
46	37	38.84	1.84	0.00244	-45	9.95	4600	4600	4600	4600
46	38	39.36	1.89	0.00244	-45	9.95	5100	5100	5100	5100
46	39	39.03	1.86	0.00244	-45	9.95	5700	5700	5700	5700

Table C8b. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 3,500 to 6,300 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
46	5	0.581	-0.595	2.299	-0.705	1.727	-0.326	16.813	1.060	1.266	1.158	1.090
46	6	0.660	-0.655	2.935	-1.170	2.384	-0.301	16.785	1.510	1.821	1.632	1.658
46	7	0.702	-0.681	3.505	-1.652	2.954	-0.324	16.760	1.901	2.438	2.211	2.057
46	8	0.769	-0.704	4.190	-2.290	3.675	-0.326	16.722	2.712	3.144	2.984	2.725
46	9	0.840	-0.758	4.921	-2.908	4.183	-0.353	16.673	3.640	4.237	3.857	3.601
46	10	0.575	-0.564	2.612	-1.248	1.941	-0.299	16.810	1.129	1.399	1.224	1.169
46	11	0.621	-0.592	3.304	-1.821	2.607	-0.317	16.781	1.703	2.049	1.797	1.571
46	12	0.676	-0.599	3.865	-2.295	3.059	-0.322	16.754	2.140	2.572	2.319	1.992
46	13	0.697	-0.689	4.665	-2.960	4.126	-0.232	16.714	3.051	3.463	3.089	2.725
46	14	0.761	-0.688	5.350	-3.404	4.440	-0.065	16.662	3.908	4.520	4.047	3.572
46	15	0.572	-0.532	2.793	-1.428	1.930	-0.231	16.806	1.257	1.486	1.359	1.158
46	16	0.626	-0.546	3.507	-2.131	2.540	-0.263	16.777	1.798	2.070	1.805	1.619
46	17	0.655	-0.583	4.103	-2.646	3.214	-0.324	16.751	2.282	2.618	2.340	1.954
46	18	0.690	-0.632	4.888	-3.439	4.154	-0.262	16.709	3.143	3.548	3.182	2.720
46	19	0.722	-0.675	5.675	-3.962	4.847	-0.182	16.657	4.100	4.704	4.126	3.632
46	20	0.530	-0.520	2.341	-1.011	1.603	-0.202	16.824	0.952	1.036	0.974	0.859
46	21	0.546	-0.513	2.913	-1.575	2.217	-0.215	16.805	1.263	1.484	1.312	1.171
46	22	0.592	-0.537	3.635	-2.351	2.652	-0.281	16.777	1.834	2.099	1.910	1.577
46	23	0.648	-0.554	4.307	-3.043	3.306	-0.307	16.749	2.342	2.756	2.289	2.114
46	24	0.680	-0.606	5.103	-3.843	4.248	-0.279	16.705	3.228	3.639	3.260	2.772
46	25	0.528	-0.535	2.476	-1.056	1.749	-0.184	16.823	0.926	1.174	0.953	0.840
46	26	0.550	-0.530	3.053	-1.591	2.207	-0.232	16.803	1.313	1.573	1.296	1.180
46	27	0.588	-0.526	3.803	-2.465	2.755	-0.279	16.774	1.864	2.167	1.947	1.558
46	28	0.621	-0.552	4.487	-3.276	3.506	-0.341	16.743	2.389	2.808	2.425	1.965
46	29	0.653	-0.593	5.283	-4.096	4.412	-0.371	16.704	3.348	3.710	3.221	2.701
46	30	0.504	-0.533	2.631	-0.923	1.911	-0.235	16.820	0.891	1.213	1.034	0.843
46	31	0.515	-0.529	3.213	-1.508	2.254	-0.263	16.803	1.366	1.531	1.476	1.132
46	32	0.547	-0.525	3.969	-2.467	3.032	-0.284	16.775	1.964	2.239	1.931	1.617
46	33	0.576	-0.526	4.658	-3.397	3.668	-0.367	16.742	2.554	2.781	2.416	1.999
46	34	0.606	-0.542	5.494	-4.596	4.458	-0.420	16.699	3.486	3.803	3.271	2.752
46	35	0.470	-0.492	2.818	-0.916	1.834	-0.126	16.819	0.942	1.168	1.070	0.748
46	36	0.464	-0.481	3.398	-1.530	2.267	-0.248	16.797	1.419	1.673	1.540	1.217
46	37	0.486	-0.488	4.235	-2.441	2.975	-0.309	16.768	2.016	2.451	2.091	1.702
46	38	0.536	-0.519	4.985	-3.352	3.771	-0.364	16.734	2.600	2.910	2.762	2.095
46	39	0.562	-0.545	5.842	-4.654	4.855	-0.421	16.692	3.613	3.933	3.413	2.859

**Table C8c. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -45 deg, pitch = -10 to 10 deg,
RPM = 3,500 to 6,300 (uniform) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
46	5	0.092	0.063	0.135	0.160	0.277	0.202	0.001	0.022	0.024	0.023	0.022
46	6	0.092	0.062	0.137	0.162	0.301	0.204	0.001	0.029	0.033	0.031	0.030
46	7	0.099	0.063	0.136	0.168	0.298	0.217	0.001	0.036	0.042	0.039	0.036
46	8	0.101	0.066	0.137	0.181	0.305	0.205	0.001	0.046	0.052	0.049	0.046
46	9	0.126	0.097	0.141	0.249	0.362	0.215	0.001	0.058	0.065	0.060	0.056
46	10	0.092	0.062	0.136	0.161	0.279	0.201	0.001	0.023	0.026	0.024	0.023
46	11	0.093	0.061	0.137	0.161	0.303	0.203	0.001	0.032	0.037	0.033	0.030
46	12	0.098	0.066	0.138	0.177	0.310	0.214	0.001	0.039	0.044	0.041	0.036
46	13	0.100	0.070	0.140	0.190	0.317	0.203	0.001	0.050	0.056	0.051	0.047
46	14	0.126	0.098	0.138	0.253	0.356	0.210	0.001	0.060	0.068	0.062	0.057
46	15	0.091	0.061	0.136	0.158	0.278	0.202	0.001	0.025	0.028	0.026	0.023
46	16	0.093	0.065	0.138	0.170	0.307	0.203	0.001	0.034	0.037	0.033	0.031
46	17	0.096	0.064	0.137	0.173	0.301	0.213	0.001	0.041	0.046	0.042	0.036
46	18	0.102	0.071	0.140	0.194	0.321	0.204	0.001	0.052	0.057	0.052	0.047
46	19	0.155	0.122	0.141	0.329	0.424	0.212	0.001	0.063	0.070	0.065	0.057
46	20	0.090	0.085	0.136	0.207	0.281	0.197	0.000	0.020	0.021	0.019	0.018
46	21	0.093	0.064	0.136	0.164	0.280	0.203	0.001	0.025	0.029	0.025	0.023
46	22	0.092	0.062	0.136	0.164	0.294	0.204	0.001	0.034	0.037	0.035	0.030
46	23	0.097	0.066	0.140	0.179	0.310	0.212	0.001	0.042	0.047	0.042	0.038
46	24	0.098	0.069	0.138	0.184	0.309	0.203	0.001	0.052	0.059	0.053	0.047
46	25	0.090	0.088	0.135	0.210	0.279	0.201	0.000	0.019	0.023	0.020	0.018
46	26	0.093	0.066	0.137	0.168	0.278	0.203	0.001	0.026	0.029	0.026	0.023
46	27	0.092	0.064	0.137	0.166	0.294	0.202	0.001	0.035	0.039	0.035	0.030
46	28	0.095	0.066	0.137	0.176	0.286	0.224	0.001	0.043	0.047	0.042	0.038
46	29	0.094	0.068	0.138	0.178	0.297	0.209	0.001	0.055	0.059	0.053	0.047
46	30	0.091	0.079	0.137	0.180	0.283	0.204	0.000	0.019	0.023	0.021	0.018
46	31	0.092	0.064	0.136	0.166	0.279	0.204	0.001	0.027	0.030	0.028	0.023
46	32	0.093	0.063	0.136	0.166	0.296	0.204	0.001	0.036	0.040	0.036	0.031
46	33	0.094	0.065	0.137	0.176	0.292	0.210	0.001	0.044	0.048	0.043	0.038
46	34	0.096	0.066	0.137	0.179	0.297	0.211	0.001	0.057	0.061	0.054	0.047
46	35	0.091	0.075	0.139	0.174	0.280	0.201	0.000	0.021	0.023	0.021	0.017
46	36	0.092	0.062	0.136	0.161	0.278	0.200	0.001	0.027	0.031	0.029	0.025
46	37	0.092	0.062	0.136	0.162	0.290	0.200	0.001	0.037	0.042	0.038	0.032
46	38	0.095	0.065	0.137	0.174	0.292	0.214	0.001	0.047	0.050	0.047	0.038
46	39	0.093	0.066	0.136	0.177	0.293	0.209	0.001	0.059	0.063	0.056	0.048

Table C9a. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -60 deg, pitch = -10 to 10 deg, RPM = 3,500 to 6,300 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
47	6	39.74	1.91	0.00242	-60	-9.91	4000	4000	4000	4000
47	7	39.71	1.91	0.00242	-60	-9.91	4600	4600	4600	4600
47	8	39.47	1.88	0.00242	-60	-9.91	5100	5100	5100	5100
47	9	39.40	1.88	0.00242	-60	-9.91	5700	5700	5700	5700
47	10	39.02	1.84	0.00242	-60	-9.91	6300	6300	6300	6300
47	11	39.59	1.89	0.00242	-60	-4.99	4000	4000	4000	4000
47	12	39.43	1.88	0.00242	-60	-4.99	4600	4600	4600	4600
47	13	39.26	1.86	0.00242	-60	-4.99	5100	5100	5100	5100
47	14	39.44	1.88	0.00241	-60	-4.99	5700	5700	5700	5700
47	15	39.53	1.89	0.00241	-60	-4.98	6300	6300	6300	6300
47	16	39.45	1.88	0.00241	-60	-1.99	4000	4000	4000	4000
47	17	39.78	1.91	0.00241	-60	-1.99	4600	4600	4600	4600
47	18	39.28	1.86	0.00241	-60	-1.98	5100	5100	5100	5100
47	19	40.25	1.95	0.00241	-60	-1.99	5700	5700	5700	5700
47	20	39.76	1.91	0.00241	-60	-1.99	6300	6300	6300	6300
48	5	39.96	1.92	0.00240	-60	-0.05	3500	3500	3500	3500
48	6	39.68	1.89	0.00240	-60	-0.05	4000	4000	4000	4000
48	7	39.62	1.88	0.00240	-60	-0.04	4600	4600	4600	4600
48	8	39.50	1.87	0.00240	-60	-0.05	5100	5100	5100	5100
48	9	39.66	1.89	0.00240	-60	-0.05	5700	5700	5700	5700
48	10	40.22	1.94	0.00240	-60	2.03	3500	3500	3500	3500
48	11	39.82	1.90	0.00240	-60	2.03	4000	4000	4000	4000
48	12	39.61	1.88	0.00240	-60	2.03	4600	4600	4600	4600
48	13	39.73	1.89	0.00240	-60	2.03	5100	5100	5100	5100
48	14	39.75	1.89	0.00239	-60	2.03	5700	5700	5700	5700
48	15	39.83	1.90	0.00239	-60	5.02	3500	3500	3500	3500
48	16	39.98	1.91	0.00239	-60	5.03	4000	4000	4000	4000
48	17	39.23	1.84	0.00239	-60	5.03	4600	4600	4600	4600
48	18	39.39	1.85	0.00239	-60	5.02	5100	5100	5100	5100
48	19	39.62	1.88	0.00239	-60	5.03	5700	5700	5700	5700
48	20	39.73	1.89	0.00239	-60	9.95	3500	3500	3500	3500
48	21	39.55	1.87	0.00239	-60	9.95	4000	4000	4000	4000
48	22	39.54	1.87	0.00239	-60	9.95	4600	4600	4600	4600
48	23	39.25	1.84	0.00239	-60	9.95	5100	5100	5100	5100
48	25	39.79	1.89	0.00238	-60	9.95	5700	5700	5700	5700

Table C9b. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -60 deg, pitch = -10 to 10 deg, RPM = 3,500 to 6,300 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
47	6	0.468	-0.710	2.161	-1.007	1.383	-0.376	16.814	0.990	1.188	1.161	1.095
47	7	0.526	-0.750	2.750	-1.608	1.781	-0.388	16.788	1.526	1.728	1.718	1.487
47	8	0.572	-0.811	3.284	-2.197	2.126	-0.400	16.762	1.919	2.232	2.226	2.065
47	9	0.634	-0.857	3.924	-3.008	2.486	-0.297	16.726	2.651	2.931	2.932	2.620
47	10	0.692	-0.901	4.675	-3.884	2.827	-0.316	16.680	3.535	3.835	3.858	3.400
47	11	0.452	-0.711	2.481	-1.216	1.554	-0.318	16.810	1.235	1.327	1.347	1.080
47	12	0.484	-0.754	3.113	-1.982	1.670	-0.285	16.781	1.655	1.856	1.843	1.600
47	13	0.528	-0.795	3.678	-2.522	1.902	-0.266	16.752	2.225	2.478	2.357	2.246
47	14	0.602	-0.862	4.394	-3.291	2.249	-0.238	16.716	2.899	3.123	3.225	2.735
47	15	0.663	-0.918	5.126	-4.255	2.657	-0.169	16.667	3.865	4.015	4.211	3.529
47	16	0.432	-0.713	2.666	-1.371	1.520	-0.369	16.807	1.200	1.399	1.352	1.098
47	17	0.478	-0.763	3.328	-2.165	1.807	-0.370	16.779	1.742	1.975	1.848	1.665
47	18	0.507	-0.771	3.945	-2.903	1.924	-0.308	16.752	2.280	2.457	2.376	2.252
47	19	0.586	-0.885	4.737	-3.784	2.159	-0.342	16.708	3.105	3.220	3.340	2.821
47	20	0.645	-0.927	5.470	-4.561	2.469	-0.242	16.659	4.003	4.189	4.314	3.706
48	5	0.392	-0.692	2.341	-0.768	1.510	-0.315	16.824	0.864	1.040	0.959	0.793
48	6	0.413	-0.687	2.854	-1.611	1.731	-0.311	16.805	1.303	1.424	1.405	1.131
48	7	0.457	-0.728	3.535	-2.445	1.885	-0.387	16.777	1.851	1.909	1.910	1.666
48	8	0.493	-0.751	4.156	-3.280	2.053	-0.312	16.750	2.323	2.459	2.419	2.095
48	9	0.550	-0.812	4.949	-4.212	2.324	-0.308	16.707	3.170	3.256	3.325	2.894
48	10	0.389	-0.683	2.478	-0.878	1.626	-0.268	16.824	0.972	1.045	1.062	0.843
48	11	0.402	-0.678	2.976	-1.685	1.881	-0.279	16.805	1.334	1.447	1.397	1.148
48	12	0.439	-0.706	3.710	-2.548	2.016	-0.316	16.775	1.852	2.021	1.970	1.607
48	13	0.491	-0.737	4.343	-3.479	2.251	-0.360	16.745	2.503	2.487	2.515	2.126
48	14	0.538	-0.806	5.114	-4.494	2.447	-0.387	16.706	3.268	3.326	3.259	2.885
48	15	0.357	-0.668	2.576	-0.975	1.763	-0.258	16.822	0.890	1.068	1.070	0.735
48	16	0.387	-0.673	3.157	-1.777	1.939	-0.233	16.801	1.378	1.478	1.460	1.025
48	17	0.411	-0.668	3.883	-2.961	2.144	-0.304	16.774	1.988	2.036	2.062	1.652
48	18	0.462	-0.696	4.540	-3.959	2.378	-0.382	16.744	2.667	2.649	2.524	2.238
48	19	0.527	-0.758	5.354	-5.120	2.627	-0.427	16.703	3.433	3.375	3.263	2.837
48	20	0.334	-0.617	2.757	-1.265	1.773	-0.080	16.822	0.991	1.118	1.133	0.766
48	21	0.343	-0.624	3.319	-2.081	2.151	-0.137	16.801	1.447	1.536	1.477	1.111
48	22	0.376	-0.643	4.160	-3.110	2.612	-0.252	16.769	2.109	2.086	1.984	1.575
48	23	0.406	-0.650	4.839	-4.345	2.742	-0.353	16.741	2.589	2.570	2.666	1.984
48	25	0.467	-0.713	5.742	-6.141	2.782	-0.455	16.699	3.646	3.278	3.512	2.756

**Table C9c. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -60 deg, pitch = -10 to 10 deg,
RPM = 3,500 to 6,300 (uniform) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
47	6	0.092	0.059	0.135	0.152	0.278	0.202	0.001	0.021	0.024	0.022	0.021
47	7	0.096	0.062	0.137	0.164	0.309	0.209	0.001	0.029	0.032	0.031	0.029
47	8	0.096	0.068	0.136	0.183	0.288	0.204	0.001	0.036	0.039	0.039	0.037
47	9	0.093	0.066	0.137	0.175	0.286	0.202	0.001	0.045	0.048	0.048	0.044
47	10	0.107	0.098	0.139	0.252	0.314	0.209	0.001	0.056	0.060	0.059	0.054
47	11	0.092	0.059	0.136	0.154	0.278	0.203	0.001	0.025	0.025	0.024	0.022
47	12	0.098	0.064	0.139	0.167	0.319	0.211	0.001	0.031	0.033	0.033	0.031
47	13	0.108	0.068	0.142	0.180	0.302	0.218	0.001	0.039	0.042	0.041	0.039
47	14	0.093	0.075	0.140	0.197	0.297	0.203	0.001	0.049	0.051	0.052	0.046
47	15	0.107	0.102	0.142	0.258	0.325	0.220	0.001	0.061	0.062	0.063	0.056
47	16	0.093	0.059	0.137	0.155	0.280	0.201	0.001	0.024	0.026	0.026	0.022
47	17	0.097	0.066	0.138	0.174	0.321	0.215	0.001	0.033	0.035	0.034	0.031
47	18	0.098	0.066	0.138	0.178	0.291	0.207	0.001	0.040	0.042	0.041	0.039
47	19	0.093	0.074	0.140	0.200	0.293	0.203	0.001	0.051	0.053	0.054	0.048
47	20	0.110	0.108	0.141	0.269	0.323	0.226	0.001	0.062	0.064	0.065	0.058
48	5	0.089	0.075	0.136	0.184	0.278	0.202	0.000	0.019	0.020	0.019	0.017
48	6	0.093	0.059	0.137	0.155	0.279	0.202	0.001	0.025	0.027	0.026	0.023
48	7	0.098	0.065	0.140	0.171	0.331	0.220	0.001	0.034	0.035	0.034	0.031
48	8	0.098	0.068	0.137	0.185	0.286	0.209	0.001	0.040	0.043	0.042	0.038
48	9	0.097	0.074	0.138	0.202	0.293	0.205	0.001	0.052	0.054	0.053	0.048
48	10	0.089	0.081	0.136	0.189	0.278	0.204	0.000	0.019	0.021	0.020	0.017
48	11	0.093	0.059	0.137	0.156	0.281	0.204	0.001	0.026	0.027	0.026	0.023
48	12	0.096	0.066	0.138	0.175	0.310	0.208	0.001	0.035	0.036	0.034	0.031
48	13	0.102	0.068	0.138	0.183	0.288	0.217	0.001	0.043	0.043	0.043	0.038
48	14	0.097	0.073	0.139	0.198	0.296	0.205	0.001	0.054	0.055	0.052	0.048
48	15	0.089	0.081	0.136	0.192	0.277	0.202	0.000	0.019	0.021	0.020	0.016
48	16	0.094	0.060	0.136	0.155	0.282	0.207	0.001	0.027	0.028	0.027	0.023
48	17	0.095	0.065	0.138	0.172	0.303	0.206	0.001	0.036	0.037	0.036	0.031
48	18	0.102	0.069	0.140	0.183	0.290	0.219	0.001	0.046	0.045	0.043	0.040
48	19	0.096	0.070	0.138	0.191	0.288	0.207	0.001	0.056	0.056	0.053	0.047
48	20	0.089	0.077	0.136	0.183	0.277	0.201	0.000	0.021	0.022	0.021	0.017
48	21	0.092	0.059	0.136	0.155	0.278	0.205	0.001	0.027	0.028	0.028	0.023
48	22	0.093	0.065	0.137	0.173	0.290	0.202	0.001	0.037	0.038	0.036	0.030
48	23	0.097	0.068	0.139	0.179	0.285	0.211	0.001	0.045	0.045	0.045	0.038
48	25	0.094	0.071	0.137	0.196	0.287	0.207	0.001	0.058	0.054	0.056	0.047

Table C10a. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 4,000 to 6,300 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
51	5	20.08	0.47	0.00235	-90	-9.90	4000	4000	4000	4000
51	6	19.53	0.45	0.00235	-90	-9.91	4600	4600	4600	4600
51	7	19.46	0.44	0.00235	-90	-9.91	5100	5100	5100	5100
51	8	20.49	0.49	0.00235	-90	-9.90	5700	5700	5700	5700
51	9	20.11	0.47	0.00235	-90	-9.90	6300	6300	6300	6300
51	14	20.11	0.47	0.00235	-90	-4.98	4000	4000	4000	4000
51	15	19.96	0.47	0.00235	-90	-4.98	4600	4600	4600	4600
51	16	20.01	0.47	0.00235	-90	-4.98	5100	5100	5100	5100
51	17	19.84	0.46	0.00235	-90	-4.98	5700	5700	5700	5700
51	18	19.98	0.47	0.00235	-90	-4.98	6300	6300	6300	6300
51	23	20.16	0.48	0.00235	-90	-1.98	4000	4000	4000	4000
51	24	20.10	0.47	0.00235	-90	-1.98	4600	4600	4600	4600
51	25	19.93	0.47	0.00235	-90	-1.98	5100	5100	5100	5100
51	26	19.85	0.46	0.00235	-90	-1.98	5700	5700	5700	5700
51	27	19.76	0.46	0.00235	-90	-1.98	6300	6300	6300	6300
51	32	20.54	0.50	0.00235	-90	0.12	4000	4000	4000	4000
51	33	19.59	0.45	0.00235	-90	0.12	4600	4600	4600	4600
51	34	19.55	0.45	0.00235	-90	0.12	5100	5100	5100	5100
51	35	20.28	0.48	0.00235	-90	0.12	5700	5700	5700	5700
51	36	20.35	0.49	0.00235	-90	0.12	6300	6300	6300	6300
51	41	20.68	0.50	0.00235	-90	2.03	4000	4000	4000	4000
51	42	20.11	0.48	0.00235	-90	2.03	4600	4600	4600	4600
51	43	19.91	0.47	0.00235	-90	2.03	5100	5100	5100	5100
51	44	19.71	0.46	0.00235	-90	2.03	5700	5700	5700	5700
51	45	19.78	0.46	0.00235	-90	2.03	6300	6300	6300	6300
51	50	20.28	0.48	0.00235	-90	5.03	4000	4000	4000	4000
51	51	20.00	0.47	0.00235	-90	5.03	4600	4600	4600	4600
51	52	20.02	0.47	0.00235	-90	5.03	5100	5100	5100	5100
51	53	19.74	0.46	0.00235	-90	5.03	5700	5700	5700	5700
51	54	19.74	0.46	0.00235	-90	5.03	6300	6300	6300	6300
53	5	20.16	0.50	0.00244	-90	9.95	4000	4000	4000	4000
53	6	19.64	0.47	0.00244	-90	9.95	4600	4600	4600	4600
53	7	20.06	0.49	0.00244	-90	9.95	5100	5100	5100	5100
53	8	19.96	0.49	0.00244	-90	9.95	5700	5700	5700	5700
53	9	19.69	0.47	0.00244	-90	9.95	6300	6300	6300	6300

**Table C10b. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg,
RPM = 4,000 to 6,300 (uniform) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
51	5	0.025	-0.309	1.675	-1.414	-0.158	0.110	16.818	1.001	1.119	1.094	1.112
51	6	0.037	-0.316	2.226	-1.761	-0.180	0.115	16.795	1.439	1.554	1.503	1.527
51	7	0.049	-0.334	2.732	-2.053	-0.357	0.105	16.770	1.786	2.115	1.908	1.927
51	8	0.064	-0.384	3.398	-2.637	-0.432	0.138	16.733	2.476	2.818	2.566	2.677
51	9	0.089	-0.400	4.125	-3.088	-0.620	0.117	16.689	3.254	3.681	3.390	3.474
51	14	0.016	-0.295	1.727	-1.638	-0.174	0.115	16.815	1.053	1.191	1.142	1.073
51	15	0.028	-0.325	2.309	-1.995	-0.225	0.120	16.790	1.495	1.701	1.586	1.581
51	16	0.033	-0.343	2.832	-2.355	-0.279	0.141	16.765	1.990	2.133	2.113	2.087
51	17	0.049	-0.384	3.508	-2.806	-0.359	0.102	16.728	2.602	2.870	2.769	2.700
51	18	0.070	-0.403	4.239	-3.418	-0.495	0.132	16.683	3.455	3.728	3.559	3.534
51	23	0.015	-0.296	1.777	-1.955	-0.156	0.118	16.814	1.048	1.186	1.200	1.102
51	24	0.027	-0.328	2.358	-2.287	-0.258	0.136	16.788	1.527	1.668	1.642	1.578
51	25	0.037	-0.344	2.876	-2.589	-0.391	0.128	16.764	2.000	2.155	2.068	2.079
51	26	0.057	-0.376	3.564	-3.100	-0.466	0.120	16.727	2.657	2.851	2.802	2.740
51	27	0.076	-0.409	4.303	-3.791	-0.500	0.052	16.681	3.495	3.690	3.656	3.509
51	32	0.016	-0.293	1.820	-2.291	-0.126	0.144	16.815	1.024	1.145	1.165	1.061
51	33	0.031	-0.316	2.415	-2.444	-0.234	0.125	16.790	1.508	1.562	1.606	1.532
51	34	0.037	-0.339	2.907	-2.715	-0.384	0.088	16.765	1.944	2.108	2.139	2.043
51	35	0.059	-0.379	3.602	-3.380	-0.409	0.144	16.725	2.693	2.917	2.838	2.759
51	36	0.078	-0.413	4.355	-4.085	-0.490	0.100	16.680	3.531	3.736	3.688	3.582
51	41	0.016	-0.290	1.858	-2.454	-0.156	0.138	16.814	1.061	1.148	1.192	1.120
51	42	0.026	-0.321	2.470	-2.720	-0.198	0.128	16.787	1.433	1.679	1.664	1.554
51	43	0.038	-0.333	2.987	-2.960	-0.220	0.134	16.764	1.984	2.189	2.168	2.011
51	44	0.056	-0.354	3.632	-3.583	-0.340	0.164	16.726	2.696	2.890	2.802	2.723
51	45	0.072	-0.386	4.368	-4.292	-0.502	0.098	16.680	3.523	3.762	3.692	3.558
51	50	0.011	-0.272	1.924	-2.776	-0.112	0.138	16.813	1.079	1.202	1.250	1.170
51	51	0.024	-0.304	2.529	-2.913	-0.204	0.107	16.790	1.585	1.620	1.675	1.538
51	52	0.038	-0.322	3.051	-3.095	-0.253	0.094	16.762	2.035	2.165	2.119	2.045
51	53	0.051	-0.349	3.672	-3.558	-0.398	0.146	16.726	2.623	2.906	2.793	2.774
51	54	0.061	-0.382	4.383	-4.328	-0.390	0.084	16.680	3.529	3.810	3.611	3.614
53	5	0.008	-0.304	2.115	-2.853	-0.283	0.078	16.811	1.115	1.237	1.266	1.111
53	6	0.021	-0.334	2.695	-3.104	-0.309	0.092	16.786	1.546	1.741	1.695	1.618
53	7	0.031	-0.369	3.241	-3.323	-0.502	0.089	16.760	2.113	2.285	2.192	2.210
53	8	0.043	-0.396	3.933	-3.736	-0.636	0.100	16.723	2.745	3.120	2.854	2.837
53	9	0.051	-0.447	4.655	-4.218	-0.624	0.025	16.675	3.658	4.038	3.724	3.729

Table C10c. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 4,000 to 6,300 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
51	5	0.089	0.058	0.134	0.152	0.273	0.197	0.000	0.020	0.022	0.021	0.021
51	6	0.092	0.064	0.134	0.169	0.281	0.211	0.001	0.027	0.030	0.028	0.029
51	7	0.094	0.059	0.135	0.158	0.274	0.195	0.001	0.034	0.038	0.035	0.035
51	8	0.089	0.066	0.135	0.179	0.272	0.197	0.001	0.043	0.048	0.044	0.045
51	9	0.089	0.078	0.135	0.203	0.274	0.201	0.001	0.053	0.059	0.054	0.055
51	14	0.089	0.059	0.134	0.154	0.272	0.198	0.001	0.022	0.023	0.022	0.021
51	15	0.093	0.063	0.134	0.168	0.282	0.208	0.001	0.029	0.032	0.029	0.029
51	16	0.094	0.062	0.135	0.165	0.275	0.197	0.001	0.037	0.038	0.037	0.036
51	17	0.089	0.067	0.135	0.180	0.273	0.198	0.001	0.045	0.048	0.046	0.045
51	18	0.089	0.087	0.136	0.224	0.275	0.204	0.001	0.056	0.059	0.057	0.056
51	23	0.089	0.059	0.134	0.154	0.273	0.200	0.001	0.022	0.023	0.023	0.022
51	24	0.097	0.062	0.135	0.165	0.293	0.203	0.001	0.029	0.031	0.030	0.029
51	25	0.094	0.061	0.135	0.163	0.274	0.197	0.001	0.037	0.039	0.037	0.036
51	26	0.089	0.067	0.135	0.181	0.273	0.198	0.001	0.045	0.048	0.046	0.046
51	27	0.089	0.088	0.136	0.229	0.276	0.204	0.001	0.055	0.059	0.057	0.056
51	32	0.090	0.059	0.135	0.155	0.274	0.198	0.001	0.022	0.023	0.022	0.021
51	33	0.095	0.063	0.135	0.167	0.287	0.208	0.001	0.030	0.030	0.030	0.029
51	34	0.092	0.062	0.135	0.166	0.273	0.200	0.001	0.036	0.039	0.038	0.036
51	35	0.089	0.068	0.135	0.184	0.272	0.200	0.001	0.046	0.049	0.047	0.046
51	36	0.089	0.079	0.137	0.200	0.275	0.200	0.001	0.056	0.059	0.057	0.056
51	41	0.089	0.060	0.135	0.156	0.274	0.199	0.001	0.022	0.023	0.022	0.022
51	42	0.093	0.063	0.135	0.167	0.285	0.206	0.001	0.029	0.031	0.030	0.029
51	43	0.094	0.063	0.136	0.167	0.275	0.200	0.001	0.036	0.040	0.037	0.036
51	44	0.089	0.066	0.135	0.180	0.273	0.198	0.001	0.046	0.048	0.047	0.046
51	45	0.090	0.095	0.136	0.244	0.276	0.207	0.001	0.056	0.059	0.057	0.056
51	50	0.089	0.059	0.135	0.154	0.274	0.198	0.001	0.022	0.023	0.024	0.022
51	51	0.095	0.062	0.135	0.166	0.287	0.206	0.001	0.030	0.031	0.031	0.029
51	52	0.096	0.061	0.136	0.162	0.275	0.198	0.001	0.037	0.039	0.038	0.037
51	53	0.090	0.066	0.136	0.179	0.273	0.199	0.001	0.045	0.049	0.047	0.047
51	54	0.089	0.079	0.137	0.204	0.276	0.201	0.001	0.056	0.059	0.057	0.056
53	5	0.089	0.061	0.136	0.162	0.275	0.201	0.001	0.023	0.024	0.024	0.022
53	6	0.092	0.069	0.135	0.180	0.286	0.224	0.001	0.031	0.033	0.031	0.030
53	7	0.100	0.063	0.137	0.167	0.276	0.201	0.001	0.038	0.040	0.038	0.038
53	8	0.090	0.072	0.136	0.198	0.274	0.198	0.001	0.048	0.052	0.047	0.047
53	9	0.089	0.093	0.136	0.251	0.276	0.209	0.001	0.058	0.063	0.057	0.058

Table C11a. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 3,500 to 6,300 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
49	6	39.70	1.87	0.00237	-90	-9.91	4000	4000	4000	4000
49	7	40.53	1.95	0.00237	-90	-9.91	4600	4600	4600	4600
49	8	39.72	1.87	0.00237	-90	-9.91	5100	5100	5100	5100
49	9	40.60	1.95	0.00237	-90	-9.91	5700	5700	5700	5700
49	10	39.84	1.88	0.00237	-90	-9.91	6300	6300	6300	6300
49	11	39.61	1.86	0.00237	-90	-4.99	4000	4000	4000	4000
49	12	39.54	1.85	0.00237	-90	-4.98	4600	4600	4600	4600
49	13	40.39	1.93	0.00236	-90	-4.98	5100	5100	5100	5100
49	14	39.80	1.87	0.00236	-90	-4.98	5700	5700	5700	5700
49	15	40.39	1.93	0.00236	-90	-4.98	6300	6300	6300	6300
50	5	40.63	1.94	0.00235	-90	-1.98	4000	4000	4000	4000
50	6	40.26	1.91	0.00235	-90	-1.98	4600	4600	4600	4600
50	7	40.24	1.90	0.00235	-90	-1.98	5100	5100	5100	5100
50	8	39.99	1.88	0.00235	-90	-1.98	5700	5700	5700	5700
50	9	39.79	1.86	0.00235	-90	-1.99	6300	6300	6300	6300
50	10	40.32	1.91	0.00235	-90	-0.05	3500	3500	3500	3500
50	11	40.33	1.91	0.00235	-90	-0.05	4000	4000	4000	4000
50	12	40.16	1.89	0.00235	-90	-0.05	4600	4600	4600	4600
50	13	40.44	1.92	0.00235	-90	-0.05	5100	5100	5100	5100
50	14	40.16	1.89	0.00235	-90	-0.05	5700	5700	5700	5700
50	15	40.41	1.92	0.00235	-90	-0.04	6300	6300	6300	6300
50	16	40.24	1.90	0.00235	-90	2.03	3500	3500	3500	3500
50	17	40.03	1.88	0.00235	-90	2.03	4000	4000	4000	4000
50	18	40.34	1.91	0.00235	-90	2.03	4600	4600	4600	4600
50	19	39.87	1.86	0.00235	-90	2.04	5100	5100	5100	5100
50	20	39.99	1.87	0.00234	-90	2.03	5700	5700	5700	5700
50	21	40.02	1.88	0.00234	-90	2.03	6300	6300	6300	6300
50	22	40.24	1.90	0.00234	-90	5.03	3500	3500	3500	3500
50	23	40.06	1.88	0.00234	-90	5.03	4000	4000	4000	4000
50	24	40.50	1.92	0.00234	-90	5.03	4600	4600	4600	4600
50	25	40.45	1.92	0.00234	-90	5.03	5100	5100	5100	5100
50	26	40.06	1.88	0.00234	-90	5.03	5700	5700	5700	5700
50	27	40.05	1.88	0.00234	-90	5.03	6300	6300	6300	6300
50	28	40.35	1.91	0.00234	-90	9.95	3500	3500	3500	3500
50	29	40.55	1.93	0.00234	-90	9.95	4000	4000	4000	4000
50	30	40.35	1.91	0.00234	-90	9.95	4600	4600	4600	4600
50	31	40.19	1.89	0.00234	-90	9.95	5100	5100	5100	5100
50	32	40.42	1.91	0.00234	-90	9.95	5700	5700	5700	5700
50	33	39.91	1.87	0.00234	-90	9.95	6300	6300	6300	6300

Table C11b. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 3,500 to 6,300 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
49	6	-0.029	-0.917	1.825	-1.196	-0.028	-0.055	16.814	1.017	1.172	1.144	1.111
49	7	-0.025	-1.021	2.329	-1.928	-0.029	-0.048	16.789	1.395	1.677	1.591	1.596
49	8	-0.017	-1.030	2.812	-2.730	-0.185	0.070	16.766	1.854	2.135	2.054	2.080
49	9	-0.008	-1.131	3.463	-3.683	-0.274	0.116	16.730	2.581	2.812	2.755	2.683
49	10	0.026	-1.161	4.205	-4.483	-0.356	0.171	16.685	3.450	3.647	3.575	3.499
49	11	-0.024	-0.901	2.116	-1.773	-0.107	-0.002	16.811	1.198	1.164	1.284	1.121
49	12	-0.011	-0.964	2.614	-2.793	-0.210	-0.023	16.784	1.660	1.691	1.806	1.551
49	13	-0.006	-1.025	3.107	-3.681	-0.240	0.066	16.759	2.165	2.175	2.264	2.137
49	14	0.011	-1.060	3.764	-4.748	-0.440	0.167	16.718	2.944	2.829	3.085	2.702
49	15	0.027	-1.156	4.503	-5.679	-0.627	0.197	16.670	3.912	3.772	4.058	3.573
50	5	-0.011	-0.910	2.329	-2.339	-0.418	0.042	16.808	1.239	1.226	1.363	1.139
50	6	0.007	-0.960	2.832	-3.705	-0.393	0.068	16.783	1.776	1.756	1.921	1.571
50	7	0.014	-1.016	3.297	-4.586	-0.604	0.090	16.756	2.305	2.084	2.423	2.112
50	8	0.026	-1.058	3.915	-5.741	-0.794	0.150	16.714	3.128	2.839	3.253	2.719
50	9	0.049	-1.115	4.646	-6.629	-1.160	0.164	16.666	4.047	3.760	4.174	3.613
50	10	0.008	-0.886	1.914	-1.343	-0.399	0.068	16.827	0.860	0.905	0.987	0.829
50	11	0.008	-0.880	2.482	-2.545	-0.601	0.094	16.809	1.221	1.130	1.349	1.135
50	12	0.013	-0.944	2.978	-3.965	-0.683	0.085	16.779	1.768	1.679	1.956	1.556
50	13	0.016	-1.000	3.472	-5.153	-0.786	0.150	16.754	2.400	2.194	2.474	2.003
50	14	0.025	-1.052	4.090	-6.416	-0.829	0.156	16.712	3.213	2.901	3.389	2.771
50	15	0.045	-1.115	4.785	-7.536	-1.130	0.247	16.663	4.136	3.754	4.329	3.559
50	16	0.011	-0.869	2.014	-1.425	-0.509	0.063	16.826	0.884	0.844	1.072	0.876
50	17	0.022	-0.838	2.592	-2.757	-0.711	0.102	16.807	1.221	1.154	1.432	1.136
50	18	0.007	-0.920	3.150	-4.312	-0.803	0.109	16.779	1.899	1.653	2.011	1.559
50	19	0.020	-0.956	3.639	-5.511	-0.764	0.179	16.750	2.358	2.221	2.621	2.169
50	20	0.028	-1.024	4.288	-7.012	-0.964	0.190	16.709	3.263	2.914	3.502	2.735
50	21	0.051	-1.094	4.942	-8.285	-1.094	0.179	16.659	4.235	3.767	4.457	3.565
50	22	0.030	-0.850	2.208	-1.400	-0.542	0.010	16.825	0.934	0.908	0.986	0.970
50	23	0.035	-0.873	2.677	-2.760	-0.694	0.054	16.806	1.306	1.214	1.468	1.167
50	24	0.047	-0.879	3.405	-4.660	-0.943	0.144	16.778	1.900	1.673	2.062	1.644
50	25	0.027	-0.934	3.942	-5.932	-1.119	0.191	16.750	2.493	2.137	2.666	2.074
50	26	0.034	-1.004	4.572	-7.629	-1.293	0.242	16.706	3.318	2.872	3.537	2.765
50	27	0.058	-1.047	5.268	-9.240	-1.345	0.269	16.652	4.418	3.839	4.661	3.659
50	28	0.049	-0.798	2.513	-1.485	-0.529	0.101	16.823	0.833	0.869	1.044	0.897
50	29	0.052	-0.834	2.991	-2.754	-0.653	0.146	16.805	1.374	1.189	1.427	1.155
50	30	0.053	-0.869	3.643	-4.813	-0.841	0.170	16.775	1.955	1.720	2.144	1.635
50	31	0.058	-0.849	4.340	-6.502	-1.131	0.235	16.746	2.558	2.189	2.704	2.227
50	32	0.071	-0.927	5.132	-8.302	-1.340	0.386	16.703	3.470	2.885	3.618	2.818
50	33	0.064	-0.979	5.894	-10.050	-1.546	0.278	16.646	4.559	3.883	4.780	3.858

Table C11c. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 3,500 to 6,300 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
49	6	0.092	0.061	0.136	0.156	0.278	0.201	0.001	0.021	0.023	0.022	0.021
49	7	0.100	0.069	0.136	0.177	0.303	0.224	0.001	0.028	0.031	0.029	0.029
49	8	0.105	0.071	0.138	0.187	0.275	0.206	0.001	0.035	0.038	0.036	0.036
49	9	0.090	0.071	0.137	0.195	0.274	0.203	0.001	0.044	0.047	0.045	0.045
49	10	0.090	0.093	0.138	0.236	0.277	0.205	0.001	0.055	0.058	0.055	0.055
49	11	0.092	0.064	0.136	0.163	0.280	0.212	0.001	0.023	0.023	0.024	0.022
49	12	0.101	0.078	0.136	0.205	0.301	0.247	0.001	0.031	0.031	0.032	0.029
49	13	0.108	0.069	0.140	0.185	0.277	0.206	0.001	0.039	0.039	0.039	0.037
49	14	0.091	0.074	0.137	0.203	0.274	0.203	0.001	0.049	0.048	0.049	0.045
49	15	0.091	0.107	0.139	0.266	0.280	0.214	0.001	0.060	0.060	0.062	0.056
50	5	0.093	0.062	0.136	0.160	0.278	0.204	0.001	0.024	0.024	0.025	0.023
50	6	0.107	0.079	0.138	0.207	0.325	0.238	0.001	0.033	0.033	0.034	0.030
50	7	0.115	0.073	0.141	0.194	0.278	0.206	0.001	0.041	0.039	0.041	0.037
50	8	0.092	0.072	0.138	0.195	0.275	0.203	0.001	0.052	0.048	0.051	0.046
50	9	0.091	0.110	0.140	0.278	0.282	0.209	0.001	0.062	0.060	0.063	0.056
50	10	0.089	0.070	0.136	0.172	0.276	0.207	0.000	0.018	0.018	0.019	0.017
50	11	0.092	0.066	0.137	0.168	0.280	0.219	0.001	0.025	0.023	0.025	0.022
50	12	0.111	0.072	0.136	0.193	0.323	0.229	0.001	0.033	0.032	0.034	0.029
50	13	0.127	0.068	0.145	0.178	0.285	0.205	0.001	0.043	0.039	0.042	0.036
50	14	0.092	0.074	0.138	0.204	0.276	0.202	0.001	0.053	0.049	0.053	0.047
50	15	0.091	0.114	0.141	0.292	0.283	0.209	0.001	0.063	0.059	0.065	0.057
50	16	0.089	0.074	0.135	0.180	0.276	0.202	0.000	0.019	0.017	0.020	0.017
50	17	0.093	0.063	0.137	0.163	0.279	0.210	0.001	0.025	0.023	0.026	0.023
50	18	0.105	0.081	0.136	0.214	0.312	0.248	0.001	0.035	0.031	0.035	0.030
50	19	0.115	0.068	0.143	0.183	0.281	0.206	0.001	0.042	0.039	0.044	0.038
50	20	0.091	0.073	0.138	0.198	0.275	0.208	0.001	0.053	0.049	0.055	0.047
50	21	0.091	0.106	0.141	0.260	0.283	0.210	0.001	0.065	0.060	0.066	0.056
50	22	0.089	0.074	0.135	0.183	0.276	0.203	0.000	0.019	0.018	0.019	0.018
50	23	0.093	0.062	0.137	0.159	0.282	0.204	0.001	0.026	0.024	0.027	0.023
50	24	0.109	0.072	0.138	0.191	0.325	0.223	0.001	0.035	0.032	0.037	0.031
50	25	0.112	0.068	0.141	0.180	0.282	0.206	0.001	0.044	0.039	0.044	0.037
50	26	0.095	0.071	0.138	0.198	0.276	0.201	0.001	0.055	0.050	0.056	0.046
50	27	0.091	0.112	0.142	0.279	0.284	0.215	0.001	0.067	0.060	0.068	0.057
50	28	0.089	0.078	0.135	0.187	0.274	0.206	0.000	0.019	0.018	0.020	0.018
50	29	0.092	0.064	0.137	0.163	0.279	0.215	0.001	0.027	0.024	0.027	0.023
50	30	0.101	0.076	0.137	0.200	0.302	0.234	0.001	0.036	0.033	0.037	0.031
50	31	0.113	0.069	0.142	0.184	0.281	0.202	0.001	0.044	0.040	0.046	0.039
50	32	0.096	0.072	0.140	0.195	0.276	0.201	0.001	0.057	0.050	0.057	0.048
50	33	0.091	0.101	0.143	0.251	0.285	0.203	0.001	0.068	0.062	0.070	0.060

Table C12a. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = 0 deg, pitch = -10 to 10 deg, RPM = 4,600 - 6,800 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
25	20	18.83	0.43	0.00245	0	-9.90	6800	4600	6800	4600
25	21	19.95	0.49	0.00245	0	-9.90	6300	5100	6300	5100
25	22	20.33	0.51	0.00245	0	-9.90	6800	6800	4600	4600
25	23	20.45	0.51	0.00245	0	-9.90	6300	6300	5100	5100
25	24	20.29	0.50	0.00245	0	-9.90	5100	5100	6300	6300
25	25	20.12	0.50	0.00245	0	-9.90	4600	4600	6800	6800
26	11	19.39	0.46	0.00243	0	-4.98	6800	4600	6800	4600
26	12	20.14	0.49	0.00243	0	-4.98	6300	5100	6300	5100
26	13	19.84	0.48	0.00243	0	-4.98	6800	6800	4600	4600
26	14	20.35	0.50	0.00243	0	-4.98	6300	6300	5100	5100
26	15	20.56	0.51	0.00243	0	-4.98	5100	5100	6300	6300
26	16	20.50	0.51	0.00242	0	-4.98	4600	4600	6800	6800
26	22	19.91	0.48	0.00242	0	-1.98	6800	4600	6800	4600
26	23	19.80	0.47	0.00242	0	-1.98	6300	5100	6300	5100
26	24	19.96	0.48	0.00242	0	-1.98	6800	6800	4600	4600
26	25	19.95	0.48	0.00242	0	-1.98	6300	6300	6100	6100
26	26	19.97	0.48	0.00242	0	-1.98	5100	5100	6300	6300
26	27	20.03	0.48	0.00242	0	-1.98	4600	4600	6800	6800
26	34	20.48	0.51	0.00241	0	-0.04	6800	4600	6800	4600
26	35	19.79	0.47	0.00241	0	-0.04	6300	5100	6300	5100
26	36	19.92	0.48	0.00241	0	-0.04	5100	6300	5100	6300
26	37	20.02	0.48	0.00241	0	-0.04	6800	4600	6800	4600
26	38	19.84	0.47	0.00241	0	-0.04	6800	6800	4600	4600
26	39	19.86	0.47	0.00241	0	-0.04	6300	6300	5100	5100
26	40	19.89	0.48	0.00241	0	-0.04	5100	5100	6300	6300
26	41	19.86	0.47	0.00240	0	-0.04	4600	4600	6800	6800
27	11	20.08	0.48	0.00239	0	2.04	6800	4600	6800	4600
27	12	20.11	0.48	0.00239	0	2.03	6300	5100	6300	5100
27	13	20.09	0.48	0.00239	0	2.03	6800	6800	4600	4600
27	14	20.16	0.48	0.00239	0	2.04	6300	6300	5100	5100
27	15	20.07	0.48	0.00238	0	2.03	5100	5100	6300	6300
27	16	20.12	0.48	0.00238	0	2.04	4600	4600	6800	6800
27	22	20.02	0.48	0.00238	0	5.03	6800	4600	6800	4600
27	23	20.05	0.48	0.00238	0	5.03	6300	5100	6300	5100
27	24	20.01	0.48	0.00238	0	5.03	6800	6800	4600	4600
27	25	19.89	0.47	0.00238	0	5.03	6300	6300	5100	5100
27	26	20.03	0.48	0.00238	0	5.03	5100	5100	6300	6300
27	27	20.07	0.48	0.00238	0	5.03	4600	4600	6800	6800
28	10	19.76	0.46	0.00234	0	9.95	6800	4600	6800	4600
28	11	19.89	0.46	0.00234	0	9.95	6300	5100	6300	5100
28	12	19.80	0.46	0.00234	0	9.95	6800	6800	4600	4600
28	13	19.91	0.46	0.00234	0	9.95	6300	6300	5100	5100
28	14	20.02	0.47	0.00234	0	9.95	5100	5100	6300	6300
28	15	20.07	0.47	0.00234	0	9.95	4600	4600	6800	6800

**Table C12b. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = 0 deg, pitch = -10 to 10 deg,
RPM = 4,600 - 6,800 (differential) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
25	20	0.389	0.134	3.711	-7.876	3.012	0.383	16.745	4.380	1.675	4.485	1.575
25	21	0.428	0.052	3.608	-4.349	3.286	0.260	16.755	3.518	2.101	3.583	2.041
25	22	0.432	0.008	3.671	0.080	11.753	0.027	16.743	4.471	4.684	1.571	1.508
25	23	0.444	0.003	3.612	0.228	7.740	0.056	16.755	3.543	3.715	2.022	1.927
25	24	0.455	-0.023	3.720	0.032	-1.063	-0.026	16.753	2.082	2.213	3.625	3.548
25	25	0.465	-0.026	3.812	0.085	-5.338	-0.101	16.744	1.528	1.678	4.535	4.436
26	11	0.394	0.130	3.891	-7.829	3.786	0.390	16.739	4.617	1.795	4.480	1.544
26	12	0.424	0.058	3.793	-4.262	3.881	0.260	16.752	3.714	2.234	3.628	1.942
26	13	0.425	0.004	3.826	-0.074	12.239	0.111	16.739	4.633	4.877	1.597	1.509
26	14	0.444	0.002	3.756	0.009	8.437	0.069	16.750	3.733	3.952	1.996	2.016
26	15	0.452	-0.012	3.816	0.030	-0.715	-0.027	16.754	2.127	2.257	3.611	3.411
26	16	0.461	-0.007	3.966	-0.045	-4.559	-0.051	16.746	1.617	1.756	4.459	4.269
26	22	0.401	0.116	3.930	-7.664	4.131	0.373	16.740	4.609	1.868	4.319	1.608
26	23	0.406	0.049	3.793	-4.114	4.204	0.242	16.751	3.707	2.263	3.480	2.058
26	24	0.414	-0.007	3.850	-0.033	12.530	0.080	16.736	4.701	4.949	1.605	1.541
26	25	0.429	-0.008	3.787	0.025	8.729	0.035	16.749	3.812	3.994	2.015	2.017
26	26	0.421	-0.021	3.810	0.091	-0.369	-0.047	16.753	2.044	2.352	3.526	3.427
26	27	0.434	-0.015	3.939	0.085	-4.049	-0.107	16.745	1.619	1.782	4.352	4.227
26	34	0.406	0.100	3.944	-7.524	4.527	0.384	16.740	4.590	1.832	4.358	1.566
26	35	0.396	0.028	3.799	-4.035	4.470	0.233	16.752	3.699	2.336	3.491	2.005
26	36	0.411	-0.092	3.821	4.121	4.400	-0.302	16.752	2.120	3.908	2.080	3.393
26	37	0.405	-0.164	3.936	7.681	4.245	-0.435	16.742	1.692	4.824	1.640	4.236
26	38	0.403	-0.030	3.843	-0.054	12.649	0.062	16.737	4.646	4.995	1.528	1.478
26	39	0.412	-0.030	3.756	-0.047	8.823	0.019	16.751	3.665	4.002	1.989	1.805
26	40	0.405	-0.030	3.802	0.008	-0.033	-0.075	16.755	2.131	2.272	3.545	3.342
26	41	0.411	-0.026	3.900	0.013	-3.610	-0.098	16.746	1.634	1.785	4.327	4.108
27	11	0.438	0.113	3.993	-7.511	4.624	0.436	16.739	4.594	1.897	4.295	1.580
27	12	0.444	0.042	3.867	-4.134	4.683	0.325	16.751	3.738	2.288	3.423	1.967
27	13	0.455	-0.004	3.908	-0.177	12.656	0.130	16.737	4.643	4.920	1.594	1.576
27	14	0.465	-0.004	3.831	-0.162	8.913	0.090	16.748	3.756	4.005	1.966	1.955
27	15	0.465	-0.022	3.870	-0.017	0.330	0.006	16.750	2.167	2.371	3.557	3.451
27	16	0.458	-0.006	3.932	-0.084	-3.122	-0.066	16.747	1.646	1.865	4.312	4.136
27	22	0.422	0.122	3.998	-7.506	5.091	0.438	16.739	4.631	1.920	4.253	1.544
27	23	0.434	0.037	3.890	-4.029	5.304	0.341	16.749	3.779	2.377	3.377	1.939
27	24	0.450	-0.000	3.959	-0.138	13.089	0.139	16.733	4.741	5.032	1.562	1.459
27	25	0.463	-0.003	3.866	-0.106	9.373	0.097	16.747	3.852	4.126	1.992	1.847
27	26	0.458	-0.014	3.817	-0.058	1.240	0.016	16.752	2.151	2.391	3.449	3.362
27	27	0.456	-0.003	3.930	0.056	-2.274	-0.043	16.743	1.692	1.881	4.299	4.187
28	10	0.449	0.128	3.944	-7.292	5.799	0.485	16.740	4.675	1.979	4.131	1.488
28	11	0.470	0.045	3.835	-4.055	6.156	0.458	16.749	3.845	2.457	3.367	1.909
28	12	0.475	0.017	3.947	-0.194	13.414	0.223	16.733	4.811	5.001	1.471	1.451
28	13	0.485	0.020	3.829	-0.182	9.821	0.193	16.747	3.872	4.105	2.036	1.858
28	14	0.484	0.017	3.751	-0.108	2.390	0.073	16.752	2.324	2.486	3.406	3.295
28	15	0.472	0.023	3.844	-0.049	-0.840	0.048	16.744	1.778	1.981	4.136	4.072

**Table C12c. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = 0 deg, pitch = -10 to 10 deg,
RPM = 4,600 - 6,800 (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
25	20	0.110	0.058	0.137	0.156	0.314	0.196	0.001	0.064	0.037	0.065	0.034
25	21	0.094	0.059	0.136	0.156	0.296	0.210	0.001	0.055	0.042	0.056	0.040
25	22	0.107	0.058	0.138	0.154	0.306	0.197	0.001	0.065	0.068	0.035	0.034
25	23	0.096	0.059	0.137	0.155	0.300	0.213	0.001	0.055	0.058	0.039	0.039
25	24	0.095	0.058	0.135	0.154	0.292	0.208	0.001	0.039	0.042	0.056	0.055
25	25	0.127	0.057	0.135	0.153	0.356	0.195	0.001	0.034	0.037	0.066	0.064
26	11	0.109	0.058	0.137	0.156	0.312	0.196	0.001	0.065	0.038	0.064	0.035
26	12	0.094	0.059	0.137	0.157	0.298	0.210	0.001	0.057	0.043	0.056	0.039
26	13	0.112	0.058	0.139	0.153	0.314	0.197	0.001	0.067	0.070	0.036	0.034
26	14	0.093	0.060	0.136	0.157	0.289	0.219	0.001	0.057	0.061	0.039	0.039
26	15	0.098	0.058	0.135	0.157	0.298	0.213	0.001	0.040	0.043	0.056	0.053
26	16	0.134	0.057	0.135	0.154	0.372	0.196	0.001	0.036	0.039	0.065	0.062
26	22	0.114	0.058	0.137	0.156	0.321	0.197	0.001	0.067	0.039	0.064	0.034
26	23	0.093	0.058	0.137	0.155	0.293	0.205	0.001	0.057	0.043	0.054	0.039
26	24	0.106	0.058	0.137	0.153	0.305	0.198	0.001	0.067	0.071	0.036	0.034
26	25	0.097	0.060	0.136	0.157	0.293	0.220	0.001	0.058	0.061	0.039	0.039
26	26	0.103	0.058	0.135	0.157	0.311	0.208	0.001	0.039	0.043	0.055	0.053
26	27	0.141	0.057	0.135	0.155	0.388	0.196	0.001	0.034	0.040	0.064	0.062
26	34	0.115	0.058	0.137	0.155	0.324	0.197	0.001	0.067	0.040	0.064	0.034
26	35	0.094	0.059	0.136	0.156	0.295	0.213	0.001	0.058	0.043	0.055	0.038
26	36	0.097	0.058	0.136	0.156	0.300	0.208	0.001	0.040	0.060	0.040	0.053
26	37	0.102	0.057	0.136	0.155	0.297	0.196	0.001	0.036	0.069	0.036	0.062
26	38	0.120	0.058	0.139	0.153	0.329	0.197	0.001	0.067	0.072	0.035	0.034
26	39	0.097	0.059	0.136	0.156	0.295	0.218	0.001	0.057	0.061	0.039	0.037
26	40	0.099	0.058	0.135	0.156	0.302	0.209	0.001	0.040	0.043	0.055	0.052
26	41	0.139	0.057	0.135	0.155	0.385	0.196	0.001	0.035	0.038	0.063	0.061
27	11	0.116	0.058	0.137	0.156	0.325	0.199	0.001	0.067	0.039	0.064	0.035
27	12	0.095	0.059	0.137	0.156	0.297	0.213	0.001	0.058	0.043	0.054	0.038
27	13	0.127	0.058	0.140	0.153	0.340	0.198	0.001	0.067	0.071	0.035	0.035
27	14	0.096	0.059	0.136	0.155	0.295	0.214	0.001	0.058	0.061	0.039	0.038
27	15	0.099	0.059	0.135	0.156	0.303	0.209	0.001	0.041	0.044	0.055	0.054
27	16	0.121	0.057	0.135	0.157	0.342	0.199	0.001	0.036	0.039	0.064	0.061
27	22	0.109	0.058	0.137	0.156	0.309	0.199	0.001	0.067	0.039	0.063	0.035
27	23	0.095	0.059	0.137	0.156	0.298	0.215	0.001	0.058	0.044	0.054	0.038
27	24	0.135	0.058	0.141	0.154	0.357	0.198	0.001	0.068	0.072	0.035	0.034
27	25	0.099	0.059	0.137	0.155	0.299	0.216	0.001	0.059	0.063	0.039	0.037
27	26	0.099	0.060	0.135	0.158	0.302	0.218	0.001	0.041	0.044	0.054	0.052
27	27	0.132	0.057	0.135	0.158	0.369	0.198	0.001	0.038	0.040	0.063	0.061
28	10	0.112	0.058	0.137	0.156	0.315	0.200	0.001	0.067	0.039	0.062	0.034
28	11	0.099	0.059	0.137	0.156	0.306	0.216	0.001	0.059	0.045	0.054	0.038
28	12	0.128	0.059	0.139	0.156	0.345	0.203	0.001	0.069	0.071	0.035	0.034
28	13	0.102	0.058	0.137	0.153	0.306	0.211	0.001	0.059	0.063	0.039	0.037
28	14	0.104	0.058	0.136	0.155	0.320	0.208	0.001	0.042	0.045	0.054	0.052
28	15	0.137	0.057	0.135	0.159	0.376	0.201	0.001	0.036	0.042	0.062	0.060

**Table C13a. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = 0 deg, pitch = -10 to 10 deg,
RPM = 4,600 - 6,800 (differential) - Conditions**

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
29	19	40.23	1.89	0.00233	0	-9.99	6800	4600	6800	4600
29	20	40.18	1.88	0.00233	0	-9.91	6300	5100	6300	5100
29	21	40.27	1.89	0.00233	0	-9.99	6800	6800	4600	4600
29	22	40.34	1.90	0.00233	0	-9.96	6300	6300	5100	5100
29	23	40.09	1.87	0.00233	0	-10.01	5100	5100	6300	6300
29	24	40.36	1.90	0.00233	0	-10.01	4600	4600	6800	6800
29	30	40.61	1.92	0.00233	0	-4.98	6800	4600	6800	4600
29	31	40.65	1.93	0.00233	0	-4.98	6300	5100	6300	5100
29	32	40.52	1.91	0.00233	0	-4.98	6800	6800	4600	4600
29	33	40.58	1.92	0.00233	0	-4.98	6300	6300	5100	5100
29	34	40.69	1.93	0.00233	0	-4.98	5100	5100	6300	6300
29	35	40.77	1.94	0.00233	0	-4.98	4600	4600	6800	6800
29	41	40.61	1.92	0.00233	0	-1.98	6800	4600	6800	4600
29	42	40.42	1.91	0.00233	0	-1.98	6300	5100	6300	5100
29	43	40.48	1.91	0.00233	0	-1.98	6800	6800	4600	4600
29	44	40.51	1.91	0.00233	0	-1.98	6300	6300	5100	5100
29	45	40.63	1.92	0.00233	0	-1.98	5100	5100	6300	6300
29	46	40.49	1.91	0.00233	0	-1.98	4600	4600	6800	6800
31	10	39.26	1.88	0.00245	0	-0.04	6800	4600	6800	4600
31	11	39.40	1.90	0.00245	0	-0.05	6300	5100	6300	5100
31	12	39.42	1.90	0.00245	0	-0.04	5100	6300	5100	6300
31	13	39.36	1.89	0.00245	0	-0.04	4600	6800	4600	6800
31	14	39.19	1.88	0.00245	0	-0.04	6800	6800	4600	4600
31	15	39.31	1.89	0.00245	0	-0.04	6300	6300	5100	5100
31	16	39.39	1.90	0.00245	0	-0.04	5100	5100	6300	6300
31	17	39.62	1.92	0.00245	0	-0.04	4600	4600	6800	6800
31	22	39.49	1.91	0.00245	0	2.03	6300	5100	6300	5100
31	23	39.40	1.90	0.00245	0	2.03	6300	6300	5100	5100
31	24	39.36	1.89	0.00245	0	2.03	5100	5100	6300	6300
31	30	38.95	1.86	0.00245	0	5.03	6300	6300	6300	6300
31	31	39.07	1.87	0.00245	0	5.03	6300	5100	6300	5100
31	32	39.08	1.87	0.00245	0	5.03	6300	6300	5100	5100
32	10	39.59	1.91	0.00244	0	9.95	6300	5100	6300	5100
32	11	39.61	1.91	0.00244	0	9.95	6300	6300	5100	5100
32	12	39.58	1.91	0.00244	0	9.95	5100	5100	6300	6300

**Table C13b. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = 0 deg, pitch = -10 to 10 deg,
RPM = 4,600 - 6,800 (differential) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
29	19	1.001	0.031	3.907	-7.233	4.807	0.869	16.743	4.332	1.762	4.284	1.611
29	20	0.993	0.014	3.840	-3.935	5.060	0.555	16.752	3.555	2.210	3.527	2.086
29	21	1.020	-0.050	3.850	0.040	13.342	0.252	16.741	4.380	4.601	1.558	1.576
29	22	1.017	-0.046	3.793	0.039	9.589	0.196	16.750	3.508	3.767	2.072	2.063
29	23	0.974	-0.028	3.833	0.035	0.406	0.026	16.756	2.116	2.190	3.527	3.468
29	24	0.956	-0.025	3.961	0.053	-3.618	-0.012	16.748	1.532	1.742	4.246	4.154
29	30	0.947	0.009	4.185	-7.110	6.284	0.916	16.736	4.678	1.889	4.324	1.508
29	31	0.939	0.007	4.145	-3.860	6.581	0.671	16.745	3.824	2.440	3.508	2.106
29	32	0.966	-0.033	4.186	0.008	15.072	0.194	16.731	4.830	5.006	1.631	1.568
29	33	0.963	-0.022	4.148	-0.003	11.147	0.193	16.744	3.808	3.979	2.115	1.919
29	34	0.914	-0.009	4.171	0.012	1.833	0.086	16.749	2.243	2.373	3.497	3.421
29	35	0.918	0.001	4.309	0.006	-2.286	0.045	16.744	1.833	1.901	4.247	4.233
29	41	0.913	0.000	4.391	-7.143	7.236	0.945	16.731	4.842	1.967	4.343	1.492
29	42	0.900	-0.002	4.358	-3.863	7.666	0.673	16.741	4.009	2.537	3.544	2.056
29	43	0.932	-0.031	4.433	-0.164	16.397	0.204	16.724	5.062	5.213	1.601	1.624
29	44	0.906	-0.020	4.359	-0.088	12.336	0.179	16.737	4.093	4.262	2.103	2.081
29	45	0.884	-0.006	4.379	0.002	2.800	0.103	16.746	2.405	2.509	3.478	3.478
29	46	0.876	-0.004	4.464	0.011	-1.651	0.027	16.740	1.809	1.980	4.219	4.219
31	10	0.917	0.037	4.807	-7.662	7.970	0.863	16.724	5.327	2.211	4.735	1.649
31	11	0.880	0.010	4.711	-4.190	8.535	0.498	16.736	4.324	2.684	3.753	2.085
31	12	0.880	-0.024	4.692	4.436	8.427	-0.540	16.735	2.532	4.526	2.206	3.662
31	13	0.907	-0.026	4.795	8.026	7.881	-0.814	16.724	1.989	5.587	1.666	4.671
31	14	0.941	0.013	4.810	0.138	18.030	0.103	16.717	5.293	5.653	1.665	1.608
31	15	0.892	0.010	4.762	0.062	13.632	0.067	16.730	4.443	4.576	2.160	2.232
31	16	0.862	0.003	4.666	0.211	3.530	-0.057	16.740	2.582	2.639	3.707	3.623
31	17	0.865	-0.013	4.751	0.180	-1.397	-0.106	16.735	1.990	2.137	4.527	4.504
31	22	0.852	-0.016	4.792	-4.060	9.393	0.433	16.731	4.537	2.817	3.729	2.199
31	23	0.853	-0.014	4.872	0.142	14.750	0.004	16.726	4.535	4.770	2.122	2.088
31	24	0.831	-0.015	4.729	0.144	4.235	-0.072	16.738	2.773	2.772	3.732	3.617
31	30	0.852	-0.016	5.718	0.096	13.104	0.014	16.681	4.778	4.972	3.667	3.666
31	31	0.800	-0.019	4.869	-4.113	10.594	0.494	16.729	4.623	2.985	3.830	2.140
31	32	0.795	0.002	5.013	0.061	16.177	0.089	16.722	4.705	4.982	2.215	2.144
32	10	0.775	-0.009	5.180	-3.467	11.794	0.658	16.725	4.962	3.021	3.544	1.933
32	11	0.768	0.011	5.332	-0.104	17.936	0.134	16.713	5.024	5.309	2.126	2.121
32	12	0.766	0.009	5.047	-0.124	5.556	-0.001	16.737	2.733	2.869	3.431	3.725

**Table C13c. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = 0 deg, pitch = -10 to 10 deg,
RPM = 4,600 - 6,800 (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
29	19	0.165	0.060	0.141	0.160	0.424	0.208	0.001	0.064	0.038	0.064	0.034
29	20	0.109	0.061	0.139	0.160	0.334	0.226	0.001	0.056	0.042	0.056	0.039
29	21	0.172	0.061	0.148	0.161	0.434	0.205	0.001	0.064	0.067	0.035	0.034
29	22	0.115	0.062	0.143	0.161	0.345	0.232	0.001	0.055	0.058	0.040	0.039
29	23	0.152	0.059	0.139	0.159	0.444	0.208	0.001	0.040	0.042	0.055	0.053
29	24	0.205	0.058	0.137	0.163	0.532	0.200	0.001	0.034	0.038	0.063	0.061
29	30	0.107	0.061	0.140	0.161	0.313	0.209	0.001	0.068	0.039	0.064	0.034
29	31	0.119	0.062	0.141	0.161	0.358	0.226	0.001	0.059	0.045	0.056	0.040
29	32	0.114	0.063	0.141	0.164	0.335	0.217	0.001	0.069	0.072	0.037	0.034
29	33	0.110	0.064	0.141	0.164	0.338	0.245	0.001	0.059	0.061	0.041	0.039
29	34	0.160	0.060	0.140	0.161	0.467	0.212	0.001	0.042	0.044	0.055	0.053
29	35	0.140	0.059	0.135	0.167	0.379	0.206	0.001	0.037	0.039	0.063	0.061
29	41	0.191	0.062	0.146	0.164	0.496	0.206	0.001	0.069	0.041	0.064	0.034
29	42	0.124	0.063	0.141	0.164	0.373	0.233	0.001	0.061	0.046	0.057	0.040
29	43	0.149	0.065	0.145	0.166	0.394	0.219	0.001	0.071	0.074	0.037	0.036
29	44	0.118	0.063	0.144	0.163	0.365	0.239	0.001	0.062	0.064	0.041	0.040
29	45	0.160	0.060	0.140	0.162	0.469	0.216	0.001	0.044	0.046	0.055	0.054
29	46	0.108	0.059	0.134	0.172	0.309	0.208	0.001	0.037	0.040	0.063	0.062
31	10	0.177	0.064	0.144	0.168	0.451	0.216	0.001	0.074	0.043	0.069	0.036
31	11	0.106	0.063	0.140	0.167	0.341	0.239	0.001	0.064	0.048	0.058	0.040
31	12	0.116	0.065	0.138	0.171	0.345	0.260	0.001	0.045	0.067	0.043	0.056
31	13	0.170	0.062	0.145	0.172	0.457	0.205	0.001	0.040	0.078	0.037	0.066
31	14	0.133	0.067	0.146	0.170	0.362	0.217	0.001	0.073	0.078	0.038	0.037
31	15	0.120	0.064	0.143	0.168	0.372	0.243	0.001	0.065	0.068	0.042	0.042
31	16	0.141	0.062	0.137	0.166	0.398	0.224	0.001	0.045	0.048	0.057	0.056
31	17	0.250	0.060	0.141	0.169	0.636	0.200	0.001	0.039	0.042	0.065	0.064
31	22	0.112	0.062	0.140	0.166	0.344	0.229	0.001	0.066	0.050	0.059	0.041
31	23	0.127	0.064	0.144	0.168	0.384	0.241	0.001	0.066	0.070	0.043	0.041
31	24	0.130	0.061	0.137	0.161	0.376	0.233	0.001	0.047	0.049	0.058	0.056
31	30	0.147	0.059	0.139	0.160	0.407	0.232	0.001	0.070	0.074	0.060	0.058
31	31	0.120	0.063	0.140	0.167	0.367	0.244	0.001	0.068	0.052	0.059	0.041
31	32	0.114	0.064	0.143	0.167	0.378	0.254	0.001	0.069	0.072	0.043	0.041
32	10	0.114	0.066	0.140	0.170	0.360	0.248	0.001	0.072	0.053	0.057	0.040
32	11	0.119	0.064	0.146	0.166	0.407	0.252	0.001	0.072	0.076	0.043	0.042
32	12	0.127	0.062	0.137	0.165	0.376	0.235	0.001	0.048	0.051	0.056	0.056

Table C14a. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -5 deg, pitch = -10 to 10 deg, RPM = 4,600 - 6,800 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
33	21	19.86	0.47	0.00240	-5	-9.91	6800	4600	6800	4600
33	22	19.74	0.47	0.00240	-5	-9.91	6300	5100	6300	5100
33	23	19.69	0.47	0.00240	-5	-9.90	6800	6800	4600	4600
33	24	19.77	0.47	0.00240	-5	-9.91	6300	6300	5100	5100
33	25	19.80	0.47	0.00240	-5	-9.91	5100	5100	6300	6300
33	26	19.85	0.47	0.00240	-5	-9.90	4600	4600	6800	6800
33	32	19.60	0.46	0.00239	-5	-4.98	6800	4600	6800	4600
33	33	19.64	0.46	0.00239	-5	-4.98	6300	5100	6300	5100
33	34	19.63	0.46	0.00239	-5	-4.98	6800	6800	4600	4600
33	35	19.72	0.46	0.00239	-5	-4.98	6300	6300	5100	5100
33	36	19.80	0.47	0.00239	-5	-4.98	5100	5100	6300	6300
33	37	19.90	0.47	0.00239	-5	-4.98	4600	4600	6800	6800
33	43	19.69	0.46	0.00238	-5	-1.99	6800	4600	6800	4600
33	44	19.68	0.46	0.00238	-5	-1.98	6300	5100	6300	5100
33	45	19.95	0.47	0.00238	-5	-1.98	6800	6800	4600	4600
33	46	20.14	0.48	0.00238	-5	-1.98	6300	6300	5100	5100
33	47	20.08	0.48	0.00238	-5	-1.98	5100	5100	6300	6300
33	48	20.12	0.48	0.00238	-5	-1.98	4600	4600	6800	6800
33	55	20.64	0.50	0.00237	-5	-0.05	6800	4600	6800	4600
33	56	20.71	0.51	0.00237	-5	-0.04	6300	5100	6300	5100
33	57	19.97	0.47	0.00237	-5	-0.04	5100	6300	5100	6300
33	58	20.16	0.48	0.00236	-5	-0.04	4600	6800	4600	6800
33	59	19.93	0.47	0.00236	-5	-0.04	6800	6800	4600	4600
33	60	19.96	0.47	0.00236	-5	-0.05	6300	6300	5100	5100
33	61	19.98	0.47	0.00236	-5	-0.05	5100	5100	6300	6300
33	62	19.99	0.47	0.00236	-5	-0.05	4600	4600	6800	6800
34	11	20.36	0.48	0.00232	-5	2.03	6800	4600	6800	4600
34	12	20.30	0.48	0.00232	-5	2.04	6300	5100	6300	5100
34	13	20.39	0.48	0.00232	-5	2.03	6800	6800	4600	4600
34	14	20.27	0.48	0.00232	-5	2.04	6300	6300	5100	5100
34	15	20.29	0.48	0.00232	-5	2.03	5100	5100	6300	6300
34	16	20.53	0.49	0.00232	-5	2.04	4600	4600	6800	6800
34	22	20.08	0.47	0.00232	-5	5.03	6800	4600	6800	4600
34	23	20.16	0.47	0.00232	-5	5.03	6300	5100	6300	5100
34	24	20.13	0.47	0.00232	-5	5.04	6800	6800	4600	4600
34	25	20.01	0.46	0.00232	-5	5.03	6300	6300	5100	5100
34	26	20.11	0.47	0.00232	-5	5.03	5100	5100	6300	6300
34	27	20.16	0.47	0.00232	-5	5.03	4600	4600	6800	6800
34	33	20.67	0.49	0.00232	-5	9.95	6800	4600	6800	4600
34	34	20.79	0.50	0.00232	-5	9.95	6300	5100	6300	5100
34	35	20.68	0.50	0.00232	-5	9.95	6800	6800	4600	4600
34	36	20.68	0.49	0.00232	-5	9.95	6300	6300	5100	5100
34	37	20.74	0.50	0.00232	-5	9.95	5100	5100	6300	6300
34	38	20.64	0.49	0.00232	-5	9.95	4600	4600	6800	6800

Table C14b. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -5 deg, pitch = -10 to 10 deg, RPM = 4,600 - 6,800 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
33	21	0.407	0.090	3.784	-7.938	3.168	0.478	16.743	4.337	1.567	4.508	1.457
33	22	0.406	0.033	3.677	-4.517	3.262	0.274	16.756	3.499	2.188	3.600	1.968
33	23	0.428	-0.031	3.720	-0.384	11.401	0.133	16.742	4.344	4.650	1.607	1.503
33	24	0.415	-0.027	3.627	-0.366	7.695	0.037	16.756	3.475	3.762	2.048	1.778
33	25	0.407	-0.011	3.724	-0.380	-1.056	-0.075	16.756	1.916	2.134	3.559	3.484
33	26	0.424	-0.050	3.906	-0.109	-4.929	-0.065	16.745	1.533	1.695	4.511	4.431
33	32	0.396	0.062	3.861	-7.785	3.655	0.378	16.743	4.451	1.808	4.498	1.571
33	33	0.396	0.010	3.776	-4.344	3.920	0.268	16.755	3.584	2.291	3.500	2.013
33	34	0.420	-0.056	3.795	-0.396	11.900	0.111	16.741	4.527	4.792	1.555	1.514
33	35	0.413	-0.043	3.725	-0.495	8.214	0.078	16.752	3.653	3.891	2.023	1.940
33	36	0.417	-0.036	3.820	-0.281	-0.585	-0.073	16.754	2.012	2.224	3.584	3.423
33	37	0.451	-0.053	3.999	-0.148	-4.534	-0.011	16.746	1.588	1.685	4.340	4.473
33	43	0.400	0.057	3.892	-7.765	4.079	0.401	16.743	4.449	1.817	4.276	1.556
33	44	0.398	-0.001	3.795	-4.298	4.167	0.244	16.754	3.571	2.251	3.478	1.855
33	45	0.424	-0.049	3.861	-0.523	12.303	0.169	16.740	4.566	4.886	1.543	1.379
33	46	0.425	-0.049	3.786	-0.494	8.662	0.055	16.752	3.701	3.895	2.099	1.923
33	47	0.439	-0.049	3.901	-0.185	-0.196	-0.051	16.753	2.014	2.227	3.495	3.543
33	48	0.462	-0.063	4.063	-0.070	-4.025	0.005	16.743	1.562	1.753	4.266	4.450
33	55	0.421	0.066	3.974	-7.722	4.638	0.503	16.744	4.492	1.788	4.215	1.576
33	56	0.420	0.000	3.876	-4.297	4.782	0.329	16.754	3.640	2.258	3.417	1.895
33	57	0.428	-0.110	3.887	3.644	4.605	-0.284	16.754	2.049	3.919	2.003	3.336
33	58	0.413	-0.178	3.960	7.058	4.479	-0.376	16.744	1.661	4.703	1.668	4.110
33	59	0.419	-0.043	3.896	-0.530	12.567	0.192	16.741	4.432	4.861	1.563	1.389
33	60	0.414	-0.033	3.809	-0.629	8.929	0.119	16.752	3.662	3.901	2.037	1.780
33	61	0.431	-0.038	3.941	-0.226	0.168	-0.006	16.753	2.038	2.251	3.490	3.533
33	62	0.452	-0.050	4.084	-0.104	-3.526	0.041	16.743	1.587	1.808	4.272	4.464
34	11	0.453	0.119	3.828	-7.709	4.272	0.585	16.746	4.411	1.857	4.145	1.507
34	12	0.451	0.054	3.722	-4.330	4.352	0.428	16.756	3.650	2.315	3.376	1.917
34	13	0.469	-0.000	3.754	-0.650	11.964	0.229	16.742	4.562	4.804	1.608	1.405
34	14	0.465	0.021	3.668	-0.801	8.404	0.207	16.756	3.634	3.890	1.988	1.710
34	15	0.488	0.012	3.811	-0.356	-0.245	0.129	16.754	2.036	2.302	3.409	3.544
34	16	0.503	0.003	3.929	-0.280	-3.613	0.166	16.746	1.643	1.785	4.158	4.421
34	22	0.436	0.134	3.845	-7.755	4.754	0.617	16.745	4.483	1.927	4.138	1.502
34	23	0.448	0.066	3.752	-4.416	4.849	0.504	16.756	3.630	2.354	3.295	1.902
34	24	0.462	0.020	3.814	-0.829	12.519	0.338	16.740	4.567	4.916	1.564	1.380
34	25	0.457	0.034	3.714	-0.886	8.862	0.284	16.754	3.681	3.969	2.017	1.851
34	26	0.472	0.020	3.838	-0.432	0.451	0.181	16.753	2.075	2.392	3.399	3.548
34	27	0.484	0.012	3.932	-0.314	-2.726	0.212	16.746	1.698	1.854	4.147	4.368
34	33	0.430	0.122	3.927	-7.804	6.172	0.672	16.745	4.548	1.989	4.051	1.392
34	34	0.447	0.069	3.814	-4.731	6.427	0.612	16.754	3.787	2.418	3.350	1.854
34	35	0.458	0.023	3.913	-0.977	13.646	0.413	16.738	4.715	5.020	1.547	1.378
34	36	0.451	0.037	3.811	-1.027	10.217	0.345	16.751	3.779	4.066	1.971	1.738
34	37	0.454	0.038	3.792	-0.791	2.521	0.239	16.755	2.225	2.476	3.321	3.253
34	38	0.460	0.013	3.899	-0.543	-0.599	0.198	16.746	1.771	1.926	4.024	4.231

**Table C14c. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -5 deg, pitch = -10 to 10 deg,
RPM = 4,600 - 6,800 (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
33	21	0.099	0.058	0.137	0.156	0.293	0.197	0.001	0.063	0.036	0.066	0.033
33	22	0.094	0.060	0.136	0.158	0.289	0.213	0.001	0.055	0.042	0.056	0.038
33	23	0.113	0.058	0.139	0.152	0.315	0.198	0.001	0.063	0.067	0.036	0.034
33	24	0.096	0.059	0.136	0.155	0.291	0.212	0.001	0.054	0.058	0.040	0.036
33	25	0.105	0.058	0.135	0.154	0.314	0.206	0.001	0.038	0.042	0.056	0.054
33	26	0.157	0.058	0.135	0.152	0.418	0.196	0.001	0.035	0.037	0.066	0.064
33	32	0.100	0.058	0.136	0.157	0.289	0.198	0.001	0.065	0.038	0.066	0.034
33	33	0.092	0.058	0.136	0.155	0.283	0.207	0.001	0.056	0.042	0.056	0.038
33	34	0.105	0.058	0.138	0.152	0.300	0.200	0.001	0.065	0.069	0.035	0.034
33	35	0.092	0.059	0.135	0.156	0.281	0.220	0.001	0.056	0.060	0.040	0.038
33	36	0.107	0.059	0.135	0.155	0.321	0.209	0.001	0.039	0.042	0.056	0.053
33	37	0.158	0.058	0.135	0.153	0.419	0.196	0.001	0.034	0.039	0.065	0.064
33	43	0.125	0.059	0.138	0.157	0.338	0.198	0.001	0.065	0.040	0.063	0.033
33	44	0.094	0.059	0.136	0.156	0.288	0.209	0.001	0.056	0.043	0.055	0.037
33	45	0.105	0.059	0.137	0.153	0.304	0.201	0.001	0.066	0.071	0.035	0.033
33	46	0.095	0.058	0.136	0.154	0.289	0.211	0.001	0.057	0.060	0.040	0.038
33	47	0.117	0.059	0.136	0.156	0.348	0.207	0.001	0.039	0.043	0.055	0.054
33	48	0.164	0.058	0.135	0.155	0.433	0.197	0.001	0.036	0.039	0.064	0.064
33	55	0.097	0.058	0.137	0.157	0.287	0.198	0.001	0.066	0.038	0.063	0.034
33	56	0.096	0.060	0.136	0.157	0.293	0.214	0.001	0.057	0.043	0.055	0.038
33	57	0.098	0.058	0.136	0.154	0.295	0.210	0.001	0.040	0.060	0.040	0.052
33	58	0.101	0.058	0.136	0.156	0.293	0.198	0.001	0.036	0.068	0.035	0.061
33	59	0.130	0.058	0.141	0.152	0.348	0.199	0.001	0.065	0.070	0.035	0.033
33	60	0.092	0.059	0.135	0.154	0.283	0.215	0.001	0.056	0.060	0.040	0.036
33	61	0.114	0.059	0.136	0.156	0.340	0.208	0.001	0.040	0.043	0.055	0.055
33	62	0.163	0.059	0.135	0.157	0.431	0.198	0.001	0.036	0.040	0.063	0.064
34	11	0.124	0.059	0.138	0.157	0.339	0.198	0.001	0.065	0.040	0.062	0.033
34	12	0.093	0.059	0.136	0.155	0.287	0.209	0.001	0.056	0.044	0.054	0.038
34	13	0.092	0.060	0.135	0.157	0.283	0.207	0.001	0.066	0.069	0.036	0.033
34	14	0.097	0.058	0.137	0.153	0.293	0.210	0.001	0.056	0.060	0.040	0.036
34	15	0.116	0.059	0.136	0.154	0.347	0.206	0.001	0.040	0.043	0.055	0.055
34	16	0.188	0.059	0.135	0.156	0.486	0.198	0.001	0.036	0.039	0.063	0.064
34	22	0.127	0.059	0.138	0.160	0.338	0.201	0.001	0.065	0.039	0.062	0.033
34	23	0.093	0.058	0.136	0.155	0.286	0.208	0.001	0.057	0.044	0.053	0.037
34	24	0.118	0.059	0.138	0.157	0.326	0.206	0.001	0.066	0.071	0.035	0.033
34	25	0.092	0.058	0.135	0.153	0.283	0.212	0.001	0.057	0.061	0.040	0.037
34	26	0.110	0.059	0.136	0.154	0.330	0.206	0.001	0.040	0.044	0.055	0.055
34	27	0.175	0.059	0.135	0.159	0.458	0.200	0.001	0.037	0.040	0.063	0.064
34	33	0.146	0.059	0.139	0.160	0.373	0.205	0.001	0.066	0.041	0.062	0.032
34	34	0.097	0.059	0.136	0.157	0.295	0.213	0.001	0.058	0.044	0.054	0.037
34	35	0.151	0.060	0.142	0.156	0.386	0.207	0.001	0.068	0.072	0.035	0.033
34	36	0.103	0.058	0.138	0.153	0.306	0.211	0.001	0.058	0.062	0.039	0.036
34	37	0.110	0.059	0.136	0.155	0.331	0.209	0.001	0.041	0.045	0.053	0.051
34	38	0.191	0.059	0.136	0.159	0.494	0.202	0.001	0.037	0.040	0.060	0.061

Table C15a. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -5 deg, pitch = -10 to 10 deg, RPM = 5,100 - 6,300 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
36	19	39.27	1.89	0.00245	-5	-9.90	6300	5100	6300	5100
36	20	39.12	1.87	0.00245	-5	-9.90	6300	6300	5100	5100
36	21	39.18	1.88	0.00245	-5	-9.90	5100	5100	6300	6300
37	9	39.62	1.92	0.00244	-5	-4.98	6300	5100	6300	5100
37	10	39.55	1.91	0.00244	-5	-4.98	6300	6300	5100	5100
37	11	39.61	1.92	0.00244	-5	-4.98	5100	5100	6300	6300
37	16	39.28	1.88	0.00244	-5	-1.99	6300	5100	6300	5100
37	17	39.01	1.86	0.00244	-5	-1.99	6300	6300	5100	5100
37	18	39.11	1.87	0.00244	-5	-1.98	5100	5100	6300	6300
37	26	39.11	1.86	0.00243	-5	0.12	6300	5100	6300	5100
37	27	38.80	1.83	0.00243	-5	0.12	5100	6300	5100	6300
37	28	39.47	1.89	0.00243	-5	0.12	6300	6300	5100	5100
37	29	39.25	1.87	0.00243	-5	0.11	5100	5100	6300	6300
38	10	39.45	1.89	0.00242	-5	2.03	6300	5100	6300	5100
38	11	39.87	1.93	0.00242	-5	2.03	6300	6300	5100	5100
38	12	39.58	1.90	0.00242	-5	2.03	5100	5100	6300	6300
38	18	39.79	1.91	0.00242	-5	5.03	6300	5100	6300	5100
38	19	39.16	1.85	0.00242	-5	5.03	6300	6300	5100	5100
38	20	39.82	1.92	0.00242	-5	5.03	5100	5100	6300	6300
39	10	39.41	1.87	0.00241	-5	9.95	6300	5100	6300	5100
39	11	39.02	1.83	0.00241	-5	9.95	6300	6300	5100	5100
39	12	39.33	1.86	0.00241	-5	9.95	5100	5100	6300	6300

Table C15b. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -5 deg, pitch = -10 to 10 deg, RPM = 5,100 - 6,300 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
36	19	1.007	-0.057	4.126	-4.364	4.924	0.391	16.754	3.712	2.196	3.708	2.030
36	20	1.016	-0.117	4.168	-0.165	9.421	0.057	16.754	3.643	3.915	2.270	1.981
36	21	0.998	-0.124	4.148	-0.005	0.102	-0.052	16.757	2.053	2.231	3.641	3.607
37	9	0.964	-0.070	4.414	-4.479	6.421	0.517	16.745	4.024	2.535	3.599	2.299
37	10	0.987	-0.096	4.485	-0.396	10.773	0.108	16.744	4.009	4.136	2.180	2.126
37	11	0.917	-0.102	4.419	-0.260	1.718	0.054	16.749	2.406	2.470	3.708	3.668
37	16	0.914	-0.079	4.580	-4.577	7.393	0.517	16.743	4.206	2.529	3.690	2.117
37	17	0.930	-0.103	4.683	-0.443	11.908	0.034	16.741	4.164	4.315	2.204	2.043
37	18	0.870	-0.109	4.598	-0.337	2.451	0.005	16.743	2.389	2.519	3.655	3.659
37	26	0.882	-0.091	4.657	-4.624	8.050	0.495	16.739	4.321	2.702	3.616	2.218
37	27	0.857	-0.120	4.727	3.966	7.703	-0.559	16.739	2.558	4.481	2.209	3.725
37	28	0.909	-0.097	4.785	-0.401	12.880	0.011	16.735	4.324	4.569	2.122	2.138
37	29	0.848	-0.119	4.702	-0.277	2.999	-0.040	16.745	2.652	2.602	3.705	3.695
38	10	0.875	-0.077	4.799	-4.745	8.875	0.534	16.737	4.432	2.779	3.672	2.129
38	11	0.902	-0.083	4.966	-0.625	13.753	0.026	16.728	4.421	4.758	2.182	2.267
38	12	0.857	-0.086	4.784	-0.505	3.539	-0.024	16.742	2.495	2.754	3.728	3.518
38	18	0.847	-0.101	4.922	-4.763	9.945	0.422	16.732	4.680	2.821	3.671	2.037
38	19	0.837	-0.079	5.079	-0.701	15.116	-0.017	16.724	4.721	4.935	2.118	2.237
38	20	0.840	-0.062	4.828	-0.666	4.580	-0.056	16.741	2.750	2.756	3.756	3.567
39	10	0.777	-0.087	5.190	-4.741	11.078	0.389	16.725	4.850	3.022	3.759	2.036
39	11	0.781	-0.093	5.312	-1.064	16.706	-0.195	16.718	4.903	5.160	2.248	2.050
39	12	0.767	-0.063	5.029	-1.146	5.072	-0.259	16.736	2.952	3.050	3.879	3.217

**Table C15c. Full Vehicle: 3DR SOLO, nominal speed 40 ft/s, yaw = -5 deg, pitch = -10 to 10 deg,
RPM = 5,100 - 6,300 (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
36	19	0.102	0.061	0.138	0.163	0.313	0.217	0.001	0.057	0.043	0.057	0.039
36	20	0.114	0.065	0.140	0.168	0.342	0.252	0.001	0.057	0.060	0.042	0.039
36	21	0.110	0.060	0.135	0.160	0.321	0.241	0.001	0.039	0.042	0.057	0.055
37	9	0.100	0.066	0.138	0.172	0.313	0.255	0.001	0.060	0.046	0.057	0.041
37	10	0.112	0.069	0.140	0.176	0.342	0.272	0.001	0.061	0.063	0.042	0.041
37	11	0.144	0.063	0.137	0.163	0.407	0.227	0.001	0.043	0.045	0.057	0.056
37	16	0.105	0.067	0.139	0.175	0.330	0.249	0.001	0.063	0.046	0.057	0.041
37	17	0.115	0.069	0.141	0.176	0.354	0.259	0.001	0.062	0.065	0.042	0.040
37	18	0.151	0.064	0.138	0.166	0.425	0.229	0.001	0.044	0.047	0.057	0.056
37	26	0.108	0.066	0.138	0.172	0.333	0.251	0.001	0.064	0.048	0.057	0.041
37	27	0.124	0.063	0.138	0.167	0.359	0.251	0.001	0.045	0.067	0.042	0.057
37	28	0.123	0.068	0.143	0.175	0.368	0.258	0.001	0.064	0.068	0.042	0.041
37	29	0.132	0.062	0.137	0.162	0.380	0.233	0.001	0.046	0.047	0.058	0.056
38	10	0.117	0.069	0.139	0.177	0.354	0.263	0.001	0.065	0.050	0.058	0.041
38	11	0.120	0.066	0.145	0.170	0.382	0.241	0.001	0.066	0.070	0.043	0.042
38	12	0.130	0.063	0.137	0.163	0.374	0.240	0.001	0.046	0.049	0.058	0.055
38	18	0.118	0.067	0.139	0.173	0.355	0.258	0.001	0.068	0.050	0.058	0.041
38	19	0.127	0.062	0.146	0.164	0.400	0.222	0.001	0.069	0.072	0.042	0.042
38	20	0.160	0.063	0.139	0.161	0.459	0.227	0.001	0.048	0.050	0.059	0.055
39	10	0.120	0.063	0.140	0.166	0.356	0.241	0.001	0.070	0.053	0.059	0.041
39	11	0.123	0.069	0.144	0.176	0.377	0.271	0.001	0.071	0.075	0.044	0.041
39	12	0.127	0.061	0.137	0.158	0.374	0.221	0.001	0.050	0.053	0.060	0.052

Table C16a. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 5,100 - 6,300 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
42	11	20.27	0.49	0.00237	-45	-9.90	6300	5100	6300	5100
42	12	20.12	0.48	0.00237	-45	-9.90	5100	6300	5100	6300
42	13	19.93	0.47	0.00237	-45	-9.90	6300	6300	5100	5100
42	14	20.16	0.48	0.00237	-45	-9.91	5100	5100	6300	6300
42	20	20.04	0.48	0.00237	-45	-4.98	6300	5100	6300	5100
42	21	19.84	0.47	0.00237	-45	-4.98	5100	6300	5100	6300
42	22	20.25	0.48	0.00237	-45	-4.98	6300	6300	5100	5100
42	23	20.28	0.49	0.00237	-45	-4.98	5100	5100	6300	6300
42	29	20.15	0.48	0.00237	-45	-1.98	6300	5100	6300	5100
42	30	20.11	0.48	0.00237	-45	-1.98	5100	6300	5100	6300
42	31	20.13	0.48	0.00237	-45	-1.98	6300	6300	5100	5100
42	32	20.21	0.48	0.00237	-45	-1.98	5100	5100	6300	6300
43	10	20.09	0.48	0.00237	-45	-0.05	6300	5100	6300	5100
43	11	19.77	0.46	0.00237	-45	-0.04	5100	6300	5100	6300
43	12	19.70	0.46	0.00237	-45	-0.04	6300	6300	5100	5100
43	13	20.05	0.48	0.00237	-45	-0.05	5100	5100	6300	6300
43	19	19.92	0.47	0.00237	-45	2.03	6300	5100	6300	5100
43	20	19.90	0.47	0.00237	-45	2.03	5100	6300	5100	6300
43	21	19.76	0.46	0.00237	-45	2.03	6300	6300	5100	5100
43	22	19.80	0.46	0.00237	-45	2.03	5100	5100	6300	6300
45	10	19.11	0.45	0.00245	-45	5.03	6300	5100	6300	5100
45	11	19.71	0.48	0.00245	-45	5.03	5100	6300	5100	6300
45	12	19.74	0.48	0.00245	-45	5.02	6300	6300	5100	5100
45	13	19.41	0.46	0.00245	-45	5.03	5100	5100	6300	6300
45	19	19.45	0.46	0.00245	-45	9.95	6300	5100	6300	5100
45	20	19.43	0.46	0.00245	-45	9.95	5100	6300	5100	6300
45	21	19.25	0.45	0.00245	-45	9.95	6300	6300	5100	5100
45	22	19.38	0.46	0.00245	-45	9.94	5100	5100	6300	6300

Table C16b. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 5,100 - 6,300 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
42	11	0.317	-0.220	3.551	-6.386	2.688	0.128	16.622	3.450	2.123	3.469	1.947
42	12	0.312	-0.310	3.616	2.249	2.614	-0.254	16.623	1.891	3.718	2.081	3.334
42	13	0.301	-0.280	3.582	-2.273	6.724	-0.169	16.621	3.366	3.744	2.027	1.928
42	14	0.315	-0.245	3.588	-1.884	-1.562	0.074	16.622	1.892	2.225	3.532	3.415
42	20	0.284	-0.205	3.655	-6.444	2.787	0.074	16.619	3.384	2.264	3.542	1.995
42	21	0.296	-0.300	3.753	1.996	2.863	-0.215	16.620	2.007	3.830	2.085	3.421
42	22	0.281	-0.259	3.640	-2.362	6.712	-0.187	16.619	3.446	3.740	2.081	2.025
42	23	0.307	-0.238	3.714	-2.107	-1.327	0.077	16.619	1.912	2.282	3.536	3.405
42	29	0.272	-0.191	3.706	-6.598	3.083	0.085	16.619	3.509	2.315	3.548	2.014
42	30	0.288	-0.297	3.834	1.852	3.078	-0.235	16.620	2.058	3.872	2.059	3.394
42	31	0.263	-0.273	3.716	-2.309	7.056	-0.281	16.619	3.465	3.839	2.060	1.924
42	32	0.298	-0.239	3.800	-2.100	-1.061	0.047	16.620	2.015	2.333	3.505	3.387
43	10	0.266	-0.203	3.683	-6.572	3.084	0.078	16.619	3.557	2.363	3.449	2.052
43	11	0.279	-0.295	3.826	1.949	3.137	-0.270	16.618	2.067	3.989	2.006	3.436
43	12	0.257	-0.270	3.715	-2.322	7.125	-0.301	16.618	3.491	3.893	2.031	2.013
43	13	0.298	-0.240	3.791	-2.072	-0.965	0.023	16.619	2.018	2.334	3.433	3.414
43	19	0.250	-0.203	3.731	-6.495	3.440	0.042	16.620	3.588	2.362	3.327	1.949
43	20	0.277	-0.282	3.912	1.781	3.399	-0.288	16.617	2.060	4.048	1.969	3.473
43	21	0.250	-0.282	3.797	-2.422	7.392	-0.371	16.616	3.583	3.991	2.040	2.064
43	22	0.287	-0.215	3.823	-2.072	-0.672	0.070	16.621	1.993	2.456	3.267	3.408
45	10	0.252	-0.222	3.930	-6.569	3.687	-0.034	16.721	3.671	2.434	3.424	2.067
45	11	0.294	-0.312	4.131	2.054	3.720	-0.373	16.718	2.200	4.180	2.075	3.596
45	12	0.278	-0.306	4.039	-2.496	7.924	-0.413	16.718	3.714	4.176	2.046	2.082
45	13	0.302	-0.249	4.034	-2.021	-0.592	-0.002	16.724	2.159	2.435	3.443	3.596
45	19	0.242	-0.221	4.049	-6.651	4.293	-0.113	16.722	3.741	2.501	3.253	2.065
45	20	0.272	-0.276	4.326	1.653	4.059	-0.520	16.715	2.159	4.298	2.058	3.540
45	21	0.262	-0.294	4.112	-2.692	8.225	-0.504	16.716	3.723	4.295	2.026	2.086
45	22	0.279	-0.231	4.160	-2.059	-0.010	0.029	16.723	2.291	2.431	3.349	3.540

Table C16c. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 5,100 - 6,300 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
42	11	0.095	0.064	0.135	0.176	0.283	0.200	0.001	0.054	0.041	0.054	0.037
42	12	0.099	0.065	0.136	0.167	0.297	0.212	0.001	0.037	0.058	0.039	0.052
42	13	0.094	0.063	0.137	0.167	0.288	0.203	0.001	0.054	0.058	0.039	0.037
42	14	0.099	0.070	0.135	0.179	0.302	0.201	0.001	0.037	0.042	0.055	0.053
42	20	0.095	0.067	0.136	0.181	0.287	0.201	0.001	0.054	0.042	0.055	0.038
42	21	0.098	0.065	0.136	0.168	0.296	0.211	0.001	0.039	0.059	0.040	0.053
42	22	0.096	0.064	0.137	0.169	0.289	0.207	0.001	0.054	0.058	0.040	0.039
42	23	0.100	0.071	0.135	0.183	0.305	0.201	0.001	0.038	0.043	0.056	0.054
42	29	0.095	0.065	0.136	0.177	0.284	0.202	0.001	0.055	0.043	0.055	0.038
42	30	0.098	0.065	0.137	0.170	0.296	0.210	0.001	0.039	0.060	0.039	0.053
42	31	0.098	0.066	0.138	0.175	0.293	0.208	0.001	0.054	0.059	0.039	0.038
42	32	0.101	0.070	0.135	0.187	0.302	0.199	0.001	0.039	0.044	0.055	0.053
43	10	0.091	0.062	0.136	0.166	0.279	0.202	0.001	0.055	0.044	0.054	0.038
43	11	0.098	0.066	0.137	0.172	0.296	0.210	0.001	0.039	0.061	0.039	0.053
43	12	0.097	0.067	0.138	0.176	0.297	0.202	0.001	0.055	0.060	0.039	0.038
43	13	0.096	0.065	0.135	0.173	0.289	0.202	0.001	0.039	0.044	0.054	0.053
43	19	0.096	0.066	0.136	0.178	0.286	0.201	0.001	0.056	0.044	0.053	0.038
43	20	0.099	0.067	0.137	0.175	0.300	0.213	0.001	0.039	0.062	0.039	0.054
43	21	0.096	0.066	0.136	0.172	0.291	0.210	0.001	0.056	0.061	0.040	0.039
43	22	0.097	0.067	0.135	0.172	0.295	0.203	0.001	0.039	0.045	0.052	0.053
45	10	0.094	0.064	0.136	0.174	0.281	0.205	0.001	0.057	0.044	0.054	0.039
45	11	0.101	0.069	0.136	0.179	0.302	0.219	0.001	0.041	0.064	0.040	0.056
45	12	0.099	0.068	0.137	0.179	0.297	0.215	0.001	0.057	0.063	0.040	0.040
45	13	0.095	0.065	0.135	0.174	0.288	0.206	0.001	0.040	0.044	0.055	0.055
45	19	0.094	0.066	0.136	0.178	0.284	0.207	0.001	0.058	0.046	0.052	0.039
45	20	0.103	0.070	0.136	0.182	0.306	0.224	0.001	0.041	0.065	0.040	0.055
45	21	0.101	0.070	0.137	0.184	0.304	0.217	0.001	0.058	0.065	0.040	0.040
45	22	0.095	0.065	0.135	0.174	0.287	0.207	0.001	0.042	0.045	0.053	0.055

Table C17a. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 5,100 - 6,300 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
51	10	20.25	0.48	0.00235	-90	-9.91	6300	5100	6300	5100
51	11	20.15	0.48	0.00235	-90	-9.91	5100	6300	5100	6300
51	12	20.02	0.47	0.00235	-90	-9.90	6300	6300	5100	5100
51	13	20.18	0.48	0.00235	-90	-9.91	5100	5100	6300	6300
51	19	20.02	0.47	0.00235	-90	-4.98	6300	5100	6300	5100
51	20	19.98	0.47	0.00235	-90	-4.98	5100	6300	5100	6300
51	21	19.89	0.46	0.00235	-90	-4.98	6300	6300	5100	5100
51	22	19.94	0.47	0.00235	-90	-4.98	5100	5100	6300	6300
51	28	19.97	0.47	0.00235	-90	-1.98	6300	5100	6300	5100
51	29	19.91	0.47	0.00235	-90	-1.98	5100	6300	5100	6300
51	30	19.92	0.47	0.00235	-90	-1.98	6300	6300	5100	5100
51	31	19.78	0.46	0.00235	-90	-1.98	5100	5100	6300	6300
51	37	20.36	0.49	0.00235	-90	0.12	6300	5100	6300	5100
51	38	20.41	0.49	0.00235	-90	0.12	5100	6300	5100	6300
51	39	20.45	0.49	0.00235	-90	0.12	6300	6300	5100	5100
51	40	20.39	0.49	0.00235	-90	0.12	5100	5100	6300	6300
51	46	19.91	0.47	0.00235	-90	2.03	6300	5100	6300	5100
51	47	19.88	0.46	0.00235	-90	2.03	5100	6300	5100	6300
51	48	19.87	0.46	0.00235	-90	2.03	6300	6300	5100	5100
51	49	20.00	0.47	0.00235	-90	2.03	5100	5100	6300	6300
51	55	19.71	0.46	0.00235	-90	5.03	6300	5100	6300	5100
51	56	19.90	0.47	0.00235	-90	5.03	5100	6300	5100	6300
51	57	19.87	0.46	0.00235	-90	5.03	6300	6300	5100	5100
51	58	19.82	0.46	0.00235	-90	5.03	5100	5100	6300	6300
53	10	19.94	0.49	0.00244	-90	9.95	6300	5100	6300	5100
53	11	19.99	0.49	0.00244	-90	9.94	5100	6300	5100	6300
53	12	19.98	0.49	0.00244	-90	9.94	6300	6300	5100	5100
53	13	19.84	0.48	0.00244	-90	9.95	5100	5100	6300	6300

Table C17b. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 5,100 - 6,300 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
51	10	0.065	-0.320	3.407	-6.873	-0.379	0.214	16.729	3.274	2.232	3.343	2.117
51	11	0.060	-0.429	3.434	1.490	-0.529	0.037	16.727	1.891	3.688	1.955	3.448
51	12	0.012	-0.382	3.425	-2.620	3.796	0.024	16.729	3.216	3.705	1.909	1.950
51	13	0.120	-0.382	3.429	-2.557	-4.721	0.160	16.729	1.882	2.085	3.387	3.538
51	19	0.061	-0.309	3.510	-7.009	-0.359	0.204	16.724	3.394	2.206	3.502	2.063
51	20	0.055	-0.425	3.526	1.128	-0.519	0.046	16.725	1.945	3.650	2.114	3.473
51	21	0.010	-0.396	3.527	-2.902	3.769	0.000	16.724	3.407	3.734	2.120	1.927
51	22	0.108	-0.373	3.532	-2.815	-4.701	0.207	16.724	1.960	2.119	3.579	3.586
51	28	0.060	-0.301	3.584	-7.426	-0.411	0.167	16.722	3.492	2.209	3.614	2.138
51	29	0.056	-0.430	3.605	0.735	-0.454	0.023	16.724	2.002	3.668	2.162	3.486
51	30	0.015	-0.390	3.610	-3.356	3.959	0.053	16.722	3.531	3.766	2.155	1.965
51	31	0.110	-0.374	3.598	-3.180	-4.829	0.211	16.723	2.018	2.109	3.626	3.651
51	37	0.061	-0.307	3.643	-7.634	-0.329	0.177	16.720	3.580	2.193	3.640	2.134
51	38	0.056	-0.428	3.649	0.371	-0.494	0.076	16.723	2.051	3.672	2.162	3.537
51	39	0.022	-0.400	3.675	-3.568	3.899	0.085	16.721	3.514	3.780	2.165	1.910
51	40	0.109	-0.385	3.643	-3.503	-4.732	0.231	16.722	2.016	2.098	3.658	3.634
51	46	0.054	-0.306	3.657	-7.722	-0.347	0.139	16.721	3.475	2.164	3.662	2.053
51	47	0.056	-0.418	3.686	0.310	-0.442	0.041	16.722	2.002	3.708	2.175	3.526
51	48	0.019	-0.391	3.681	-3.678	3.887	0.030	16.721	3.568	3.796	2.191	2.047
51	49	0.102	-0.372	3.679	-3.686	-4.665	0.243	16.721	2.014	2.065	3.731	3.660
51	55	0.053	-0.297	3.665	-7.836	-0.345	0.182	16.724	3.458	2.150	3.602	1.970
51	56	0.054	-0.391	3.724	0.062	-0.406	0.061	16.721	2.047	3.723	2.190	3.496
51	57	0.020	-0.380	3.717	-3.911	3.878	0.013	16.721	3.565	3.827	2.188	1.982
51	58	0.103	-0.354	3.701	-3.891	-4.542	0.294	16.720	1.996	2.044	3.704	3.619
53	10	0.049	-0.359	3.905	-7.748	-0.374	0.097	16.719	3.553	2.380	3.647	2.163
53	11	0.056	-0.450	4.025	0.111	-0.554	-0.020	16.716	2.144	3.958	2.212	3.712
53	12	-0.001	-0.441	3.964	-4.023	3.760	-0.144	16.715	3.778	4.045	2.237	2.112
53	13	0.104	-0.422	3.951	-3.850	-4.948	0.219	16.717	2.131	2.237	3.776	3.887

Table C17c. Full Vehicle: 3DR SOLO, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 5,100 - 6,300 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
51	10	0.090	0.072	0.135	0.191	0.273	0.199	0.001	0.052	0.041	0.052	0.038
51	11	0.091	0.071	0.135	0.187	0.275	0.201	0.001	0.037	0.057	0.038	0.053
51	12	0.095	0.071	0.137	0.184	0.273	0.200	0.001	0.052	0.057	0.037	0.037
51	13	0.090	0.072	0.134	0.193	0.275	0.199	0.001	0.037	0.040	0.053	0.054
51	19	0.091	0.084	0.135	0.222	0.274	0.205	0.001	0.054	0.041	0.054	0.038
51	20	0.091	0.075	0.135	0.197	0.275	0.204	0.001	0.038	0.057	0.040	0.053
51	21	0.092	0.076	0.136	0.197	0.274	0.201	0.001	0.054	0.058	0.039	0.038
51	22	0.091	0.079	0.135	0.212	0.276	0.204	0.001	0.038	0.040	0.055	0.055
51	28	0.091	0.080	0.136	0.209	0.274	0.203	0.001	0.054	0.041	0.056	0.039
51	29	0.092	0.069	0.136	0.181	0.275	0.201	0.001	0.039	0.057	0.040	0.054
51	30	0.094	0.079	0.137	0.204	0.274	0.205	0.001	0.055	0.058	0.040	0.038
51	31	0.091	0.064	0.135	0.167	0.277	0.197	0.001	0.039	0.040	0.056	0.056
51	37	0.091	0.077	0.136	0.211	0.275	0.203	0.001	0.055	0.042	0.056	0.040
51	38	0.091	0.074	0.136	0.198	0.276	0.203	0.001	0.039	0.057	0.040	0.054
51	39	0.092	0.076	0.137	0.199	0.273	0.205	0.001	0.055	0.059	0.040	0.038
51	40	0.091	0.065	0.135	0.171	0.276	0.198	0.001	0.039	0.041	0.056	0.055
51	46	0.091	0.087	0.135	0.232	0.275	0.207	0.001	0.055	0.041	0.056	0.039
51	47	0.091	0.074	0.136	0.198	0.276	0.204	0.001	0.039	0.058	0.040	0.054
51	48	0.097	0.075	0.139	0.192	0.276	0.201	0.001	0.055	0.058	0.040	0.039
51	49	0.091	0.064	0.135	0.166	0.276	0.197	0.001	0.039	0.040	0.057	0.056
51	55	0.091	0.084	0.136	0.221	0.275	0.205	0.001	0.054	0.042	0.055	0.038
51	56	0.092	0.077	0.136	0.206	0.276	0.203	0.001	0.040	0.058	0.040	0.054
51	57	0.093	0.077	0.137	0.200	0.274	0.204	0.001	0.056	0.059	0.041	0.038
51	58	0.091	0.063	0.135	0.163	0.276	0.197	0.001	0.039	0.040	0.056	0.055
53	10	0.091	0.083	0.136	0.224	0.275	0.207	0.001	0.055	0.044	0.056	0.040
53	11	0.094	0.070	0.137	0.191	0.276	0.202	0.001	0.041	0.061	0.041	0.057
53	12	0.100	0.077	0.139	0.202	0.276	0.204	0.001	0.058	0.061	0.041	0.040
53	13	0.091	0.078	0.135	0.211	0.276	0.203	0.001	0.041	0.042	0.057	0.058

Wind Tunnel Data - DJI Phantom 3 Full Vehicle

Table C18a. Full Vehicle: DJI Phantom 3, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,200 to 6,400 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
16	7	21.48	0.50	0.00217	0	-39.95	4200	4200	4200	4200
16	8	21.70	0.51	0.00217	0	-39.95	4800	4800	4800	4800
16	6	20.75	0.47	0.00217	0	-39.95	5300	5300	5300	5300
16	9	21.10	0.48	0.00217	0	-39.95	5800	5800	5800	5800
16	10	21.19	0.49	0.00217	0	-39.95	6400	6400	6400	6400
16	19	20.74	0.47	0.00217	0	-29.94	4200	4200	4200	4200
16	20	20.98	0.48	0.00217	0	-29.94	4800	4800	4800	4800
16	18	21.13	0.48	0.00217	0	-29.94	5300	5300	5300	5300
16	21	21.16	0.49	0.00217	0	-29.94	5800	5800	5800	5800
16	22	21.23	0.49	0.00217	0	-29.94	6400	6400	6400	6400
16	28	21.36	0.50	0.00217	0	-19.92	4300	4300	4300	4300
16	29	21.44	0.50	0.00217	0	-19.91	4800	4800	4800	4800
16	27	21.43	0.50	0.00217	0	-19.92	5300	5300	5300	5300
16	30	21.59	0.51	0.00217	0	-19.91	5800	5800	5800	5800
16	31	21.64	0.51	0.00217	0	-19.92	6400	6400	6400	6400
16	37	20.70	0.47	0.00217	0	-9.91	4200	4200	4200	4200
16	42	20.17	0.44	0.00217	0	-9.90	4800	4800	4800	4800
16	36	20.88	0.47	0.00217	0	-9.90	5300	5300	5300	5300
16	43	21.16	0.49	0.00217	0	-9.90	5800	5800	5800	5800
16	44	20.99	0.48	0.00217	0	-9.90	6400	6400	6400	6400
16	53	20.83	0.47	0.00217	0	-4.98	4200	4200	4200	4200
16	54	20.96	0.48	0.00217	0	-4.98	4800	4800	4800	4800
16	52	20.92	0.48	0.00217	0	-4.98	5300	5300	5300	5300
16	55	20.87	0.47	0.00217	0	-4.98	5800	5800	5800	5800
16	56	20.77	0.47	0.00217	0	-4.98	6400	6400	6400	6400
16	62	21.02	0.48	0.00217	0	-1.98	4200	4200	4200	4200
16	63	21.10	0.48	0.00217	0	-1.98	4800	4800	4800	4800
16	66	20.95	0.48	0.00217	0	-1.98	5300	5300	5300	5300
16	64	20.91	0.47	0.00217	0	-1.98	5800	5800	5800	5800
16	65	20.93	0.48	0.00217	0	-1.98	6400	6400	6400	6400
16	68	20.99	0.48	0.00217	0	0.12	4200	4200	4200	4200
16	69	21.09	0.48	0.00217	0	0.12	4800	4800	4800	4800
16	67	20.87	0.47	0.00217	0	0.12	5300	5300	5300	5300
16	70	20.82	0.47	0.00217	0	0.12	5800	5800	5800	5800
16	71	20.62	0.46	0.00217	0	0.12	6400	6400	6400	6400

Table C18b. Full Vehicle: DJI Phantom 3, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,200 to 6,400 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
16	7	0.252	0.008	1.411	-0.007	0.913	-0.044	16.677	1.489	1.638	1.448	1.407
16	8	0.289	0.008	1.966	-0.036	1.319	-0.050	16.641	2.169	2.386	2.138	2.083
16	6	0.292	0.013	2.582	-0.021	1.700	-0.067	16.596	2.925	3.340	2.956	2.928
16	9	0.325	0.019	3.165	-0.066	2.100	-0.073	16.548	3.839	4.337	3.893	3.774
16	10	0.369	0.020	3.991	-0.095	2.549	-0.093	16.475	5.124	5.757	5.283	5.123
16	19	0.313	0.010	1.674	-0.024	1.147	-0.034	16.676	1.507	1.642	1.502	1.465
16	20	0.358	0.008	2.274	-0.065	1.652	-0.055	16.638	2.197	2.423	2.199	2.159
16	18	0.395	0.006	2.844	-0.097	1.915	-0.055	16.595	2.885	3.274	3.049	2.961
16	21	0.442	0.013	3.448	-0.105	2.431	-0.067	16.549	3.792	4.307	3.880	3.780
16	22	0.498	0.026	4.294	-0.113	2.852	-0.076	16.475	5.083	5.679	5.253	5.155
16	28	0.372	0.014	1.975	-0.075	1.491	-0.031	16.670	1.571	1.738	1.639	1.597
16	29	0.411	0.017	2.478	-0.106	1.825	-0.045	16.638	2.114	2.341	2.228	2.193
16	27	0.454	0.020	3.079	-0.202	2.285	-0.054	16.596	2.873	3.226	3.034	2.945
16	30	0.512	0.030	3.726	-0.093	2.726	-0.041	16.550	3.695	4.119	3.917	3.854
16	31	0.576	0.025	4.597	-0.220	3.437	-0.060	16.480	4.939	5.501	5.325	5.154
16	37	0.357	0.017	2.050	-0.106	1.718	-0.042	16.677	1.418	1.562	1.544	1.498
16	42	0.403	0.013	2.655	-0.143	2.214	-0.052	16.640	2.059	2.255	2.277	2.188
16	36	0.460	0.015	3.285	-0.277	2.814	-0.083	16.601	2.732	3.028	3.015	2.915
16	43	0.550	0.030	3.947	-0.143	3.423	-0.056	16.554	3.583	4.014	3.898	3.851
16	44	0.625	0.037	4.776	-0.207	3.987	-0.088	16.488	4.779	5.335	5.234	5.105
16	53	0.365	0.022	2.169	-0.151	2.007	-0.046	16.678	1.359	1.501	1.565	1.506
16	54	0.422	0.030	2.765	-0.286	2.519	-0.054	16.643	2.030	2.163	2.244	2.146
16	52	0.476	0.023	3.413	-0.292	3.129	-0.050	16.601	2.759	3.040	3.000	2.959
16	55	0.538	0.028	4.007	-0.176	3.638	-0.087	16.556	3.578	4.009	3.887	3.775
16	56	0.618	0.037	4.857	-0.160	4.304	-0.130	16.486	4.819	5.439	5.191	5.073
16	62	0.369	0.025	2.186	-0.085	2.263	-0.043	16.679	1.346	1.476	1.519	1.479
16	63	0.427	0.029	2.829	-0.256	2.840	-0.063	16.643	2.022	2.169	2.223	2.151
16	66	0.479	0.022	3.459	-0.240	3.456	-0.089	16.597	2.847	3.196	3.049	2.970
16	64	0.545	0.026	4.077	-0.196	3.960	-0.084	16.554	3.608	4.046	3.875	3.781
16	65	0.600	0.038	4.972	-0.251	4.677	-0.132	16.482	4.871	5.513	5.322	5.117
16	68	0.374	0.021	2.237	-0.179	2.464	-0.055	16.679	1.354	1.476	1.548	1.474
16	69	0.431	0.028	2.867	-0.300	3.101	-0.075	16.643	2.035	2.208	2.213	2.135
16	67	0.483	0.021	3.491	-0.194	3.666	-0.073	16.600	2.762	3.165	2.998	2.911
16	70	0.548	0.028	4.123	-0.124	4.190	-0.085	16.555	3.574	4.054	3.812	3.765
16	71	0.602	0.039	5.023	-0.252	4.956	-0.086	16.481	4.906	5.500	5.230	5.156

Table C18c. Full Vehicle: DJI Phantom 3, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,200 to 6,400 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
16	7	0.088	0.058	0.134	0.154	0.273	0.193	0.001	0.032	0.036	0.033	0.032
16	8	0.088	0.061	0.134	0.163	0.272	0.196	0.002	0.043	0.049	0.045	0.044
16	6	0.088	0.057	0.134	0.151	0.272	0.195	0.002	0.054	0.064	0.058	0.057
16	9	0.088	0.057	0.134	0.149	0.273	0.194	0.002	0.065	0.077	0.070	0.068
16	10	0.089	0.056	0.134	0.150	0.274	0.194	0.003	0.081	0.091	0.086	0.083
16	19	0.089	0.060	0.134	0.160	0.273	0.193	0.001	0.032	0.037	0.035	0.033
16	20	0.089	0.060	0.134	0.161	0.273	0.197	0.002	0.044	0.049	0.047	0.045
16	18	0.089	0.058	0.134	0.153	0.273	0.199	0.002	0.054	0.063	0.060	0.057
16	21	0.089	0.058	0.134	0.150	0.274	0.196	0.002	0.066	0.076	0.070	0.069
16	22	0.090	0.057	0.134	0.151	0.275	0.194	0.003	0.080	0.090	0.086	0.083
16	28	0.089	0.061	0.134	0.163	0.273	0.194	0.001	0.034	0.038	0.037	0.036
16	29	0.089	0.062	0.134	0.168	0.274	0.201	0.002	0.043	0.048	0.047	0.045
16	27	0.089	0.057	0.134	0.151	0.276	0.198	0.002	0.054	0.062	0.059	0.057
16	30	0.090	0.058	0.134	0.151	0.276	0.194	0.002	0.064	0.074	0.071	0.069
16	31	0.091	0.057	0.134	0.151	0.276	0.194	0.003	0.077	0.090	0.087	0.083
16	37	0.090	0.061	0.134	0.163	0.276	0.194	0.001	0.031	0.035	0.035	0.034
16	42	0.089	0.060	0.134	0.162	0.274	0.202	0.002	0.042	0.047	0.048	0.046
16	36	0.089	0.058	0.135	0.154	0.276	0.197	0.002	0.051	0.059	0.059	0.056
16	43	0.090	0.058	0.134	0.151	0.277	0.194	0.002	0.063	0.072	0.070	0.069
16	44	0.092	0.057	0.134	0.152	0.278	0.194	0.003	0.075	0.087	0.085	0.082
16	53	0.090	0.060	0.134	0.161	0.276	0.194	0.001	0.030	0.035	0.035	0.034
16	54	0.089	0.062	0.134	0.171	0.275	0.203	0.002	0.041	0.046	0.047	0.044
16	52	0.090	0.057	0.135	0.152	0.278	0.197	0.002	0.052	0.060	0.058	0.057
16	55	0.091	0.058	0.134	0.151	0.278	0.194	0.002	0.063	0.072	0.070	0.068
16	56	0.092	0.057	0.134	0.151	0.279	0.194	0.003	0.076	0.088	0.085	0.081
16	62	0.090	0.060	0.134	0.157	0.278	0.194	0.001	0.030	0.034	0.035	0.033
16	63	0.089	0.060	0.134	0.163	0.275	0.202	0.002	0.041	0.045	0.046	0.045
16	66	0.091	0.057	0.136	0.151	0.282	0.199	0.002	0.053	0.062	0.060	0.058
16	64	0.090	0.057	0.134	0.150	0.277	0.195	0.002	0.063	0.073	0.070	0.068
16	65	0.092	0.057	0.134	0.151	0.279	0.195	0.003	0.077	0.089	0.086	0.082
16	68	0.090	0.060	0.134	0.158	0.275	0.194	0.001	0.030	0.034	0.035	0.033
16	69	0.089	0.061	0.134	0.161	0.275	0.202	0.002	0.041	0.046	0.046	0.044
16	67	0.090	0.057	0.136	0.154	0.280	0.205	0.002	0.052	0.062	0.058	0.057
16	70	0.090	0.058	0.134	0.151	0.276	0.197	0.002	0.063	0.073	0.069	0.068
16	71	0.092	0.057	0.134	0.151	0.279	0.194	0.003	0.077	0.089	0.086	0.083

Table C19a. Full Vehicle: DJI Phantom 3, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,200 to 6,400 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
18	6	42.03	1.90	0.00215	0	-39.95	4200	4200	4200	4200
18	7	42.14	1.91	0.00215	0	-39.95	4800	4800	4800	4800
18	5	42.39	1.94	0.00215	0	-39.94	5300	5300	5300	5300
18	8	42.32	1.93	0.00215	0	-39.95	5800	5800	5800	5800
18	9	42.42	1.94	0.00215	0	-39.95	6400	6400	6400	6400
18	17	42.17	1.91	0.00215	0	-29.94	4200	4200	4200	4200
18	18	42.23	1.92	0.00215	0	-29.94	4800	4800	4800	4800
18	16	42.40	1.93	0.00215	0	-29.95	5300	5300	5300	5300
18	19	42.43	1.93	0.00215	0	-29.94	5800	5800	5800	5800
18	20	42.30	1.92	0.00215	0	-29.94	6400	6400	6400	6400
18	25	42.16	1.91	0.00215	0	-19.91	4200	4200	4200	4200
18	26	41.97	1.89	0.00214	0	-19.91	4800	4800	4800	4800
18	24	42.47	1.93	0.00215	0	-19.91	5300	5300	5300	5300
18	27	41.86	1.88	0.00214	0	-19.91	5800	5800	5800	5800
18	28	41.64	1.86	0.00214	0	-19.91	6400	6400	6400	6400
19	5	42.57	1.94	0.00214	0	-9.90	4200	4200	4200	4200
19	6	42.92	1.97	0.00214	0	-9.90	4800	4800	4800	4800
19	7	42.69	1.95	0.00214	0	-9.90	5300	5300	5300	5300
19	8	43.05	1.98	0.00214	0	-9.90	5800	5800	5800	5800
19	9	42.77	1.96	0.00214	0	-9.90	6400	6400	6400	6400
19	13	42.79	1.96	0.00214	0	-4.98	4200	4200	4200	4200
19	14	42.74	1.96	0.00214	0	-4.98	4800	4800	4800	4800
19	15	42.68	1.95	0.00214	0	-4.98	5300	5300	5300	5300
19	16	42.57	1.94	0.00214	0	-4.98	5800	5800	5800	5800
19	17	42.57	1.94	0.00214	0	-4.98	6400	6400	6400	6400
19	24	42.77	1.96	0.00214	0	-1.98	4200	4200	4200	4200
19	25	42.24	1.91	0.00214	0	-1.98	4800	4800	4800	4800
19	26	42.09	1.90	0.00215	0	-1.98	5300	5300	5300	5300
19	27	42.07	1.90	0.00215	0	-1.98	5800	5800	5800	5800
19	28	41.94	1.89	0.00215	0	-1.98	6400	6400	6400	6400
19	32	42.26	1.91	0.00214	0	-0.04	4200	4200	4200	4200
19	33	42.11	1.90	0.00214	0	-0.04	4800	4800	4800	4800
19	34	42.24	1.91	0.00214	0	-0.04	5300	5300	5300	5300
19	35	42.19	1.91	0.00214	0	-0.04	5800	5800	5800	5800
19	36	41.95	1.89	0.00214	0	-0.04	6400	6400	6400	6400

Table C19b. Full Vehicle: DJI Phantom 3, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,200 to 6,400 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
18	6	0.530	-0.005	0.594	0.184	0.246	-0.044	16.695	1.157	1.285	1.102	1.089
18	7	0.588	-0.014	1.110	0.124	0.532	-0.073	16.660	1.789	1.990	1.736	1.700
18	5	0.653	-0.020	1.630	0.191	1.030	-0.104	16.622	2.512	2.863	2.392	2.358
18	8	0.720	-0.006	2.208	0.207	1.645	-0.128	16.576	3.377	3.827	3.146	3.128
18	9	0.802	-0.018	2.959	0.222	2.469	-0.126	16.512	4.642	5.249	4.319	4.258
18	17	0.646	-0.015	1.188	0.156	0.667	-0.070	16.682	1.416	1.581	1.314	1.293
18	18	0.719	-0.031	1.747	0.035	1.117	-0.072	16.645	2.117	2.332	1.980	1.933
18	16	0.814	0.005	2.362	0.046	1.779	-0.072	16.605	2.852	3.205	2.704	2.644
18	19	0.892	-0.018	2.971	0.145	2.458	-0.124	16.558	3.706	4.143	3.527	3.480
18	20	0.976	-0.016	3.761	0.104	3.318	-0.181	16.493	4.877	5.480	4.714	4.649
18	25	0.701	-0.013	1.787	0.192	1.333	-0.093	16.674	1.528	1.696	1.485	1.484
18	26	0.782	-0.018	2.483	-0.081	2.057	-0.058	16.637	2.219	2.440	2.182	2.141
18	24	0.867	-0.005	3.079	0.072	2.717	-0.116	16.597	2.897	3.198	2.930	2.914
18	27	0.926	-0.009	3.714	0.066	3.452	-0.165	16.553	3.652	4.074	3.746	3.698
18	28	1.035	-0.012	4.540	0.130	4.253	-0.214	16.490	4.764	5.358	4.964	4.910
19	5	0.720	-0.007	2.371	-0.052	2.593	-0.061	16.674	1.474	1.617	1.584	1.551
19	6	0.798	-0.001	3.041	-0.285	3.355	-0.101	16.639	2.036	2.220	2.318	2.216
19	7	0.867	0.010	3.725	-0.110	4.163	-0.114	16.602	2.624	2.937	3.054	2.942
19	8	0.960	0.015	4.447	-0.079	5.107	-0.162	16.558	3.333	3.772	3.948	3.832
19	9	1.067	0.018	5.270	-0.053	6.056	-0.236	16.498	4.301	4.902	5.142	4.976
19	13	0.708	-0.010	2.587	0.021	2.856	-0.081	16.677	1.356	1.493	1.587	1.545
19	14	0.764	-0.009	3.338	-0.124	3.853	-0.076	16.638	2.046	2.237	2.337	2.305
19	15	0.832	0.004	4.025	-0.135	4.836	-0.170	16.599	2.687	3.011	3.106	2.992
19	16	0.927	0.012	4.752	-0.093	6.039	-0.216	16.557	3.454	3.875	3.888	3.776
19	17	1.039	0.010	5.616	-0.112	7.112	-0.201	16.495	4.489	5.027	5.055	4.984
19	24	0.698	-0.016	2.750	0.030	3.102	-0.102	16.677	1.388	1.547	1.591	1.516
19	25	0.759	-0.007	3.480	-0.140	4.469	-0.136	16.638	2.019	2.364	2.285	2.215
19	26	0.822	0.004	4.184	-0.083	5.398	-0.182	16.601	2.660	2.985	3.044	2.965
19	27	0.911	0.019	4.885	-0.017	6.542	-0.231	16.558	3.388	3.858	3.846	3.741
19	28	1.020	0.027	5.788	-0.063	7.708	-0.283	16.497	4.464	5.001	5.049	4.889
19	32	0.669	-0.008	2.842	0.007	3.414	-0.102	16.676	1.417	1.607	1.565	1.487
19	33	0.730	-0.002	3.571	-0.137	4.922	-0.179	16.639	1.995	2.305	2.284	2.208
19	34	0.805	0.011	4.312	-0.105	5.851	-0.179	16.603	2.638	2.965	2.995	2.942
19	35	0.899	0.021	5.008	-0.069	7.005	-0.229	16.560	3.373	3.773	3.833	3.740
19	36	1.023	0.027	5.900	-0.100	8.242	-0.261	16.501	4.375	4.908	4.975	4.846

Table C19c. Full Vehicle: DJI Phantom 3, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,200 to 6,400 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
18	6	0.089	0.060	0.134	0.158	0.273	0.194	0.001	0.026	0.029	0.027	0.026
18	7	0.089	0.062	0.134	0.167	0.273	0.197	0.001	0.036	0.041	0.038	0.037
18	5	0.090	0.058	0.134	0.151	0.274	0.194	0.002	0.048	0.056	0.049	0.048
18	8	0.091	0.058	0.134	0.150	0.278	0.193	0.002	0.059	0.068	0.060	0.059
18	9	0.093	0.057	0.134	0.152	0.280	0.193	0.002	0.073	0.085	0.073	0.072
18	17	0.090	0.061	0.134	0.162	0.274	0.197	0.001	0.030	0.035	0.031	0.030
18	18	0.090	0.067	0.135	0.184	0.275	0.202	0.001	0.042	0.048	0.043	0.041
18	16	0.090	0.061	0.134	0.156	0.275	0.195	0.002	0.053	0.061	0.054	0.052
18	19	0.092	0.060	0.134	0.152	0.279	0.195	0.002	0.064	0.073	0.065	0.063
18	20	0.096	0.057	0.134	0.153	0.285	0.194	0.003	0.076	0.089	0.079	0.077
18	25	0.090	0.066	0.134	0.179	0.276	0.199	0.001	0.033	0.037	0.034	0.034
18	26	0.090	0.074	0.136	0.209	0.281	0.213	0.002	0.044	0.050	0.046	0.045
18	24	0.094	0.059	0.135	0.155	0.287	0.198	0.002	0.054	0.061	0.058	0.056
18	27	0.098	0.059	0.134	0.152	0.294	0.194	0.002	0.063	0.074	0.069	0.067
18	28	0.099	0.057	0.134	0.156	0.292	0.195	0.003	0.075	0.088	0.083	0.081
19	5	0.092	0.066	0.135	0.174	0.277	0.205	0.001	0.032	0.037	0.036	0.035
19	6	0.091	0.074	0.137	0.205	0.280	0.208	0.002	0.041	0.047	0.048	0.046
19	7	0.097	0.059	0.135	0.156	0.294	0.195	0.002	0.050	0.058	0.059	0.056
19	8	0.100	0.062	0.134	0.155	0.299	0.199	0.002	0.059	0.070	0.070	0.068
19	9	0.103	0.057	0.134	0.158	0.301	0.196	0.002	0.069	0.082	0.084	0.081
19	13	0.093	0.064	0.134	0.174	0.281	0.198	0.001	0.030	0.034	0.036	0.034
19	14	0.090	0.075	0.138	0.209	0.281	0.214	0.002	0.042	0.047	0.048	0.047
19	15	0.105	0.060	0.141	0.158	0.330	0.199	0.002	0.051	0.059	0.060	0.056
19	16	0.101	0.062	0.135	0.153	0.303	0.196	0.002	0.061	0.071	0.070	0.068
19	17	0.106	0.057	0.134	0.154	0.307	0.196	0.002	0.072	0.085	0.084	0.082
19	24	0.094	0.064	0.135	0.173	0.285	0.201	0.001	0.031	0.035	0.036	0.034
19	25	0.094	0.069	0.144	0.193	0.299	0.211	0.002	0.041	0.049	0.048	0.046
19	26	0.100	0.059	0.137	0.157	0.311	0.202	0.002	0.051	0.059	0.059	0.057
19	27	0.101	0.062	0.135	0.153	0.302	0.198	0.002	0.060	0.070	0.070	0.067
19	28	0.105	0.057	0.135	0.157	0.305	0.196	0.002	0.072	0.084	0.083	0.081
19	32	0.093	0.070	0.135	0.186	0.284	0.210	0.001	0.031	0.036	0.036	0.034
19	33	0.092	0.059	0.143	0.160	0.279	0.198	0.002	0.041	0.048	0.048	0.046
19	34	0.101	0.060	0.137	0.158	0.313	0.204	0.002	0.050	0.058	0.058	0.056
19	35	0.097	0.061	0.135	0.151	0.293	0.199	0.002	0.060	0.069	0.069	0.067
19	36	0.100	0.057	0.135	0.157	0.295	0.198	0.002	0.071	0.082	0.082	0.080

Table C20a. Full Vehicle: DJI Phantom 3, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,200 to 6,400 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
16	11	20.81	0.47	0.00217	0	-39.95	5800	4800	5800	4800
16	12	20.99	0.48	0.00217	0	-39.95	6400	4200	6400	4200
16	13	20.98	0.48	0.00217	0	-39.95	6400	6400	4200	4200
16	14	20.81	0.47	0.00217	0	-39.94	5800	5800	4800	4800
16	15	20.95	0.48	0.00217	0	-39.95	4800	4800	5800	5800
16	16	20.88	0.47	0.00217	0	-39.95	4200	4200	6400	6400
16	23	20.77	0.47	0.00217	0	-29.94	5800	4800	5800	4800
16	24	20.71	0.47	0.00217	0	-29.94	5800	5800	4800	4800
16	25	20.73	0.47	0.00217	0	-29.94	4800	4800	5800	5800
16	32	21.19	0.49	0.00217	0	-19.91	5800	4800	5800	4800
16	33	20.95	0.48	0.00217	0	-19.92	5800	5800	4800	4800
16	34	21.19	0.49	0.00217	0	-19.91	4800	4800	5800	5800
16	45	20.81	0.47	0.00217	0	-9.90	6400	4200	6400	4200
16	46	20.92	0.48	0.00217	0	-9.90	5800	4800	5800	4800
16	47	20.88	0.47	0.00217	0	-9.90	6400	6400	4200	4200
16	48	20.75	0.47	0.00217	0	-9.90	5800	5800	4800	4800
16	49	21.11	0.48	0.00217	0	-9.90	4800	4800	5800	5800
16	50	21.16	0.49	0.00217	0	-9.90	4200	4200	6400	6400
16	57	20.94	0.48	0.00217	0	-4.98	5800	4800	5800	4800
16	58	20.96	0.48	0.00217	0	-4.98	5800	5800	4800	4800
16	59	21.03	0.48	0.00217	0	-4.98	4800	4800	5800	5800
16	72	20.70	0.47	0.00217	0	0.12	6400	4200	6400	4200
16	73	20.76	0.47	0.00217	0	0.12	5800	4800	5800	4800
16	74	20.80	0.47	0.00217	0	0.12	4800	5800	4800	5800
16	75	20.72	0.47	0.00217	0	0.12	4200	6400	4200	6400
16	77	20.26	0.45	0.00217	0	0.12	6400	6400	4200	4200
16	78	20.51	0.46	0.00217	0	0.12	5800	5800	4800	4800
16	79	20.58	0.46	0.00217	0	0.12	4800	4800	5800	5800
16	80	20.84	0.47	0.00217	0	0.12	4200	4200	6400	6400

Table C20b. Full Vehicle: DJI Phantom 3, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,200 to 6,400 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
16	11	0.302	0.066	2.615	-3.246	1.640	-0.034	16.591	3.941	2.435	4.054	2.091
16	12	0.306	0.145	2.727	-6.818	1.581	0.080	16.576	5.183	1.653	5.348	1.438
16	13	0.444	0.020	2.873	-0.103	7.091	-0.094	16.577	5.143	5.546	1.459	1.391
16	14	0.360	0.015	2.686	-0.130	4.346	-0.073	16.589	3.990	4.471	2.190	2.067
16	15	0.250	0.006	2.519	-0.085	-0.733	-0.058	16.592	2.264	2.524	3.897	3.800
16	16	0.189	-0.002	2.539	-0.015	-3.796	-0.023	16.577	1.533	1.671	5.252	5.132
16	23	0.400	0.071	2.898	-3.248	1.849	0.004	16.590	3.854	2.477	4.039	2.223
16	24	0.472	0.018	2.968	-0.104	4.444	-0.061	16.589	3.875	4.336	2.265	2.172
16	25	0.340	0.008	2.791	-0.165	-0.635	-0.036	16.591	2.234	2.436	3.954	3.828
16	32	0.452	0.057	3.107	-3.323	2.196	0.048	16.593	3.737	2.378	3.979	2.243
16	33	0.526	0.027	3.186	-0.060	4.888	-0.042	16.592	3.737	4.155	2.281	2.243
16	34	0.386	0.016	3.022	-0.216	-0.253	-0.042	16.594	2.187	2.394	3.924	3.814
16	45	0.448	0.165	3.475	-7.008	2.691	0.179	16.581	4.698	1.571	5.317	1.569
16	46	0.479	0.084	3.328	-3.369	2.695	0.104	16.597	3.582	2.212	4.013	2.241
16	47	0.670	0.034	3.609	-0.222	8.751	-0.095	16.582	4.812	5.294	1.553	1.514
16	48	0.562	0.034	3.404	-0.145	5.619	-0.052	16.597	3.594	4.085	2.240	2.186
16	49	0.404	0.022	3.233	-0.279	0.146	-0.050	16.599	2.048	2.238	3.892	3.769
16	50	0.340	0.024	3.264	-0.163	-3.008	-0.040	16.583	1.409	1.546	5.166	5.013
16	57	0.487	0.087	3.431	-3.298	3.053	0.073	16.597	3.586	2.267	3.945	2.256
16	58	0.568	0.032	3.486	-0.132	5.780	-0.070	16.597	3.616	4.025	2.241	2.197
16	59	0.413	0.026	3.313	-0.257	0.448	-0.058	16.599	2.047	2.208	3.872	3.759
16	72	0.463	0.160	3.653	-6.946	3.577	0.169	16.583	4.735	1.523	5.222	1.556
16	73	0.480	0.083	3.523	-3.317	3.631	0.053	16.598	3.634	2.239	3.921	2.202
16	74	0.466	-0.028	3.491	2.827	3.753	-0.198	16.597	2.083	4.018	2.284	3.735
16	75	0.452	-0.100	3.578	6.646	3.839	-0.342	16.582	1.365	5.303	1.550	5.045
16	77	0.655	0.038	3.782	-0.214	9.532	-0.101	16.579	4.918	5.433	1.586	1.525
16	78	0.532	0.031	3.594	-0.194	6.610	-0.099	16.591	3.746	4.285	2.297	2.203
16	79	0.412	0.018	3.362	-0.275	1.072	-0.075	16.600	2.082	2.258	3.821	3.678
16	80	0.339	0.015	3.373	-0.121	-1.890	-0.041	16.588	1.356	1.462	5.057	4.927

**Table C20c. Full Vehicle: DJI Phantom 3, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 0 deg,
RPM = 4,200 to 6,400 (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
16	11	0.088	0.057	0.134	0.153	0.273	0.194	0.002	0.066	0.053	0.070	0.047
16	12	0.089	0.057	0.134	0.153	0.274	0.193	0.002	0.077	0.044	0.083	0.041
16	13	0.089	0.057	0.134	0.151	0.275	0.193	0.002	0.077	0.087	0.042	0.040
16	14	0.089	0.059	0.134	0.155	0.274	0.194	0.002	0.066	0.076	0.049	0.047
16	15	0.088	0.057	0.134	0.151	0.272	0.196	0.002	0.047	0.054	0.069	0.066
16	16	0.089	0.057	0.134	0.150	0.274	0.193	0.002	0.040	0.045	0.083	0.081
16	23	0.089	0.058	0.134	0.153	0.274	0.195	0.002	0.064	0.054	0.071	0.050
16	24	0.089	0.059	0.134	0.157	0.274	0.194	0.002	0.065	0.074	0.051	0.049
16	25	0.089	0.057	0.134	0.152	0.274	0.199	0.002	0.047	0.054	0.070	0.068
16	32	0.089	0.058	0.134	0.155	0.274	0.196	0.002	0.063	0.052	0.070	0.049
16	33	0.089	0.060	0.134	0.160	0.274	0.195	0.002	0.063	0.072	0.051	0.049
16	34	0.089	0.058	0.134	0.153	0.275	0.202	0.002	0.046	0.053	0.069	0.066
16	45	0.090	0.058	0.134	0.158	0.276	0.194	0.002	0.072	0.043	0.083	0.042
16	46	0.089	0.059	0.134	0.157	0.275	0.197	0.002	0.061	0.049	0.069	0.049
16	47	0.091	0.058	0.134	0.154	0.277	0.195	0.002	0.073	0.083	0.043	0.041
16	48	0.090	0.061	0.134	0.162	0.275	0.196	0.002	0.061	0.070	0.050	0.048
16	49	0.090	0.058	0.134	0.153	0.277	0.201	0.002	0.044	0.050	0.068	0.066
16	50	0.091	0.057	0.134	0.154	0.278	0.194	0.002	0.038	0.043	0.081	0.079
16	57	0.090	0.059	0.134	0.157	0.276	0.196	0.002	0.061	0.050	0.069	0.051
16	58	0.090	0.061	0.134	0.161	0.275	0.196	0.002	0.061	0.071	0.050	0.049
16	59	0.090	0.057	0.134	0.151	0.277	0.196	0.002	0.044	0.049	0.068	0.066
16	72	0.090	0.057	0.134	0.157	0.276	0.194	0.002	0.073	0.042	0.081	0.042
16	73	0.090	0.058	0.134	0.157	0.277	0.198	0.002	0.062	0.050	0.068	0.048
16	74	0.089	0.060	0.134	0.161	0.274	0.209	0.002	0.045	0.071	0.050	0.066
16	75	0.089	0.058	0.134	0.155	0.274	0.195	0.002	0.037	0.085	0.042	0.080
16	77	0.090	0.058	0.134	0.155	0.277	0.195	0.002	0.075	0.085	0.043	0.041
16	78	0.089	0.060	0.134	0.160	0.275	0.195	0.002	0.063	0.073	0.051	0.049
16	79	0.090	0.057	0.134	0.151	0.277	0.195	0.002	0.045	0.051	0.067	0.065
16	80	0.091	0.057	0.134	0.153	0.279	0.194	0.002	0.037	0.041	0.080	0.078

Table C21a. Full Vehicle: DJI Phantom 3, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,200 to 6,400 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
18	10	42.27	1.92	0.00215	0	-39.95	6400	4200	6400	4200
18	11	42.17	1.91	0.00215	0	-39.95	5800	4800	5800	4800
18	12	42.20	1.92	0.00215	0	-39.95	6400	6400	4200	4200
18	13	42.30	1.92	0.00215	0	-39.95	5800	5800	4800	4800
18	14	42.38	1.93	0.00215	0	-39.95	4800	4800	5800	5800
18	15	42.34	1.93	0.00215	0	-39.94	4200	4200	6400	6400
18	21	42.17	1.91	0.00215	0	-29.94	5800	4800	5800	4800
18	22	42.39	1.93	0.00215	0	-29.94	5800	5800	4800	4800
18	23	42.43	1.93	0.00215	0	-29.94	4800	4800	5800	5800
18	29	42.15	1.90	0.00214	0	-19.91	6400	4200	6400	4200
18	30	42.13	1.90	0.00214	0	-19.91	5800	4800	5800	4800
18	31	41.96	1.89	0.00214	0	-19.91	6400	6400	4200	4200
18	32	42.12	1.90	0.00214	0	-19.91	5800	5800	4800	4800
18	33	41.90	1.88	0.00214	0	-19.91	4800	4800	5800	5800
18	34	42.18	1.91	0.00214	0	-19.91	4200	4200	6400	6400
19	10	42.93	1.97	0.00214	0	-9.90	5800	4800	5800	4800
19	11	42.86	1.96	0.00214	0	-9.90	5800	5800	4800	4800
19	12	43.09	1.99	0.00214	0	-9.90	4800	4800	5800	5800
19	18	42.95	1.98	0.00214	0	-4.98	6400	4200	6400	4200
19	19	42.87	1.97	0.00214	0	-4.98	5800	4800	5800	4800
19	20	42.56	1.94	0.00214	0	-4.98	6400	6400	4200	4200
19	21	42.73	1.95	0.00214	0	-4.98	5800	5800	4800	4800
19	22	42.90	1.97	0.00214	0	-4.98	4800	4800	5800	5800
19	23	43.03	1.98	0.00214	0	-4.98	4200	4200	6400	6400
19	29	42.12	1.90	0.00215	0	-1.98	5800	4800	5800	4800
19	30	42.05	1.90	0.00215	0	-1.98	5800	5800	4800	4800
19	31	42.34	1.92	0.00214	0	-1.98	4800	4800	5800	5800
19	37	42.23	1.91	0.00215	0	-0.04	6400	4200	6400	4200
19	38	42.27	1.92	0.00215	0	-0.04	5800	4800	5800	4800
19	39	42.30	1.92	0.00215	0	-0.04	4800	5800	4800	5800
19	40	42.31	1.92	0.00215	0	-0.04	4200	6400	4200	6400
19	41	42.20	1.91	0.00215	0	-0.04	6400	6400	4200	4200
19	42	42.30	1.92	0.00215	0	-0.04	5800	5800	4800	4800
19	43	42.33	1.92	0.00215	0	-0.04	4800	4800	5800	5800
19	44	42.38	1.93	0.00215	0	-0.04	4200	4200	6400	6400

Table C21b. Full Vehicle: DJI Phantom 3, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,200 to 6,400 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
18	10	0.666	0.096	1.797	-5.537	1.209	0.496	16.604	4.612	1.363	4.284	1.134
18	11	0.662	0.037	1.679	-2.564	1.058	0.193	16.618	3.425	2.045	3.209	1.704
18	12	0.776	-0.026	1.931	0.178	6.653	-0.156	16.598	4.580	5.169	1.091	1.065
18	13	0.702	-0.020	1.709	0.203	3.659	-0.121	16.615	3.403	3.863	1.700	1.668
18	14	0.597	-0.016	1.576	0.145	-1.292	-0.067	16.620	1.832	2.046	3.205	3.179
18	15	0.546	-0.005	1.645	0.150	-3.977	-0.049	16.607	1.192	1.316	4.408	4.325
18	21	0.802	0.051	2.378	-2.764	1.783	0.186	16.600	3.724	2.423	3.557	1.964
18	22	0.886	-0.010	2.413	0.072	4.488	-0.113	16.600	3.707	4.117	1.944	1.917
18	23	0.735	-0.025	2.304	0.058	-0.767	-0.085	16.600	2.199	2.454	3.557	3.490
18	29	0.864	0.076	3.226	-6.396	2.640	0.509	16.581	4.819	1.714	5.051	1.512
18	30	0.851	0.021	3.099	-2.990	2.599	0.152	16.594	3.713	2.430	3.841	2.171
18	31	1.028	-0.019	3.260	0.067	8.916	-0.155	16.585	4.746	5.271	1.425	1.398
18	32	0.933	-0.019	3.109	0.050	5.655	-0.153	16.596	3.668	4.133	2.141	2.079
18	33	0.772	-0.015	3.027	-0.050	-0.070	-0.118	16.593	2.260	2.459	3.810	3.756
18	34	0.713	-0.013	3.081	0.179	-3.477	-0.095	16.578	1.568	1.732	5.075	5.001
19	10	0.877	0.028	3.763	-3.248	3.935	0.131	16.597	3.349	2.280	3.993	2.279
19	11	0.970	0.008	3.854	-0.143	7.345	-0.130	16.602	3.330	3.722	2.309	2.235
19	12	0.799	0.003	3.662	-0.180	1.031	-0.145	16.594	2.063	2.284	3.923	3.826
19	18	0.854	0.014	4.073	-6.920	4.570	0.391	16.590	4.408	1.522	5.084	1.539
19	19	0.838	-0.002	4.027	-3.273	4.861	0.040	16.596	3.443	2.244	3.945	2.239
19	20	1.032	0.004	4.323	-0.118	12.080	-0.176	16.589	4.464	5.009	1.554	1.532
19	21	0.932	0.013	4.161	-0.154	8.441	-0.174	16.599	3.464	3.925	2.297	2.218
19	22	0.771	0.002	3.948	-0.116	1.520	-0.171	16.596	2.059	2.261	3.909	3.804
19	23	0.719	-0.001	3.935	0.031	-2.288	-0.123	16.586	1.386	1.532	5.020	4.841
19	29	0.827	-0.005	4.187	-3.110	5.300	0.003	16.597	3.428	2.355	3.913	2.247
19	30	0.915	0.009	4.294	-0.107	8.796	-0.190	16.600	3.410	3.857	2.305	2.203
19	31	0.752	0.006	4.127	-0.105	1.996	-0.198	16.596	2.034	2.346	3.901	3.761
19	37	0.842	0.005	4.365	-6.717	5.552	0.420	16.589	4.403	1.646	4.951	1.494
19	38	0.826	-0.000	4.310	-3.153	5.718	-0.001	16.599	3.397	2.332	3.853	2.207
19	39	0.818	0.022	4.313	2.830	5.904	-0.406	16.598	2.031	3.831	2.325	3.715
19	40	0.865	0.019	4.367	6.532	5.804	-0.785	16.587	1.491	4.938	1.513	4.829
19	41	1.016	0.023	4.558	-0.121	13.064	-0.208	16.592	4.353	4.905	1.522	1.497
19	42	0.912	0.017	4.393	-0.132	9.312	-0.184	16.601	3.379	3.818	2.267	2.202
19	43	0.739	0.010	4.256	-0.149	2.494	-0.197	16.597	2.042	2.405	3.819	3.722
19	44	0.665	0.013	4.104	-0.056	-1.454	-0.150	16.595	1.451	1.614	4.680	4.397

**Table C21c. Full Vehicle: DJI Phantom 3, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 0 deg,
RPM = 4,200 to 6,400 (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
18	10	0.091	0.058	0.134	0.155	0.276	0.193	0.002	0.070	0.038	0.069	0.034
18	11	0.090	0.058	0.134	0.154	0.275	0.194	0.002	0.058	0.045	0.058	0.041
18	12	0.091	0.059	0.134	0.156	0.277	0.194	0.002	0.070	0.081	0.035	0.034
18	13	0.090	0.061	0.134	0.160	0.274	0.194	0.002	0.058	0.066	0.041	0.040
18	14	0.091	0.058	0.134	0.154	0.279	0.196	0.002	0.040	0.046	0.059	0.057
18	15	0.091	0.057	0.134	0.153	0.278	0.194	0.002	0.033	0.038	0.071	0.069
18	21	0.091	0.060	0.134	0.159	0.277	0.196	0.002	0.063	0.052	0.064	0.045
18	22	0.091	0.064	0.134	0.166	0.277	0.195	0.002	0.062	0.071	0.045	0.045
18	23	0.091	0.061	0.134	0.161	0.278	0.201	0.002	0.047	0.052	0.063	0.062
18	29	0.093	0.060	0.134	0.163	0.281	0.196	0.002	0.073	0.045	0.080	0.041
18	30	0.094	0.063	0.135	0.168	0.287	0.200	0.002	0.062	0.053	0.068	0.049
18	31	0.095	0.061	0.134	0.165	0.285	0.198	0.002	0.073	0.083	0.041	0.040
18	32	0.093	0.065	0.135	0.167	0.281	0.196	0.002	0.062	0.071	0.048	0.047
18	33	0.093	0.061	0.134	0.165	0.286	0.204	0.002	0.047	0.054	0.067	0.066
18	34	0.093	0.060	0.135	0.164	0.283	0.197	0.002	0.040	0.045	0.080	0.079
19	10	0.097	0.067	0.135	0.180	0.300	0.203	0.002	0.058	0.050	0.069	0.050
19	11	0.095	0.067	0.135	0.170	0.288	0.196	0.002	0.058	0.066	0.051	0.048
19	12	0.095	0.067	0.135	0.182	0.293	0.218	0.002	0.045	0.051	0.069	0.067
19	18	0.098	0.064	0.135	0.181	0.293	0.196	0.002	0.068	0.042	0.080	0.041
19	19	0.094	0.068	0.136	0.178	0.291	0.207	0.002	0.059	0.050	0.068	0.049
19	20	0.096	0.065	0.135	0.175	0.287	0.201	0.002	0.069	0.080	0.042	0.041
19	21	0.097	0.065	0.136	0.171	0.291	0.195	0.002	0.059	0.069	0.050	0.048
19	22	0.100	0.059	0.136	0.158	0.310	0.196	0.002	0.045	0.050	0.068	0.066
19	23	0.101	0.063	0.135	0.175	0.301	0.203	0.002	0.037	0.043	0.079	0.076
19	29	0.094	0.070	0.137	0.188	0.294	0.209	0.002	0.059	0.052	0.068	0.049
19	30	0.095	0.068	0.136	0.175	0.286	0.197	0.002	0.059	0.068	0.051	0.049
19	31	0.096	0.062	0.136	0.164	0.302	0.199	0.002	0.045	0.052	0.068	0.066
19	37	0.096	0.063	0.135	0.171	0.287	0.202	0.002	0.068	0.044	0.078	0.040
19	38	0.094	0.069	0.137	0.187	0.293	0.210	0.002	0.059	0.051	0.068	0.049
19	39	0.096	0.066	0.136	0.173	0.292	0.222	0.002	0.044	0.069	0.051	0.066
19	40	0.099	0.063	0.135	0.171	0.294	0.208	0.002	0.038	0.080	0.041	0.077
19	41	0.096	0.063	0.135	0.168	0.288	0.199	0.002	0.068	0.078	0.041	0.040
19	42	0.095	0.066	0.136	0.169	0.287	0.197	0.002	0.058	0.067	0.050	0.048
19	43	0.100	0.065	0.136	0.179	0.311	0.208	0.002	0.045	0.053	0.067	0.065
19	44	0.101	0.062	0.135	0.169	0.302	0.200	0.002	0.037	0.043	0.074	0.071

Wind Tunnel Data - 3DR Iris+ Full Vehicle

Table C22a. Full Vehicle: 3DR Iris+, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,300 to 6,500 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
59	6	20.34	0.48	0.00233	0	-39.95	4300	4300	4300	4300
59	7	20.41	0.49	0.00233	0	-39.95	4900	4900	4900	4900
59	8	20.28	0.48	0.00233	0	-39.95	5400	5400	5400	5400
59	9	20.39	0.48	0.00233	0	-39.95	5900	5900	5900	5900
59	10	20.73	0.50	0.00233	0	-39.95	6500	6500	6500	6500
59	11	20.47	0.49	0.00233	0	-19.92	4300	4300	4300	4300
59	12	20.39	0.48	0.00233	0	-19.91	4900	4900	4900	4900
59	13	20.20	0.48	0.00233	0	-19.91	5400	5400	5400	5400
59	14	20.24	0.48	0.00233	0	-19.92	5900	5900	5900	5900
59	15	20.00	0.47	0.00233	0	-19.92	6500	6500	6500	6500
59	16	20.04	0.47	0.00233	0	-9.90	4300	4300	4300	4300
59	17	19.98	0.47	0.00233	0	-9.90	4900	4900	4900	4900
59	18	20.07	0.47	0.00233	0	-9.90	5400	5400	5400	5400
59	19	20.17	0.47	0.00233	0	-9.90	5900	5900	5900	5900
59	20	20.13	0.47	0.00233	0	-9.90	6500	6500	6500	6500
61	5	19.82	0.48	0.00243	0	-4.98	4300	4300	4300	4300
61	6	19.86	0.48	0.00243	0	-4.98	4900	4900	4900	4900
61	7	19.96	0.48	0.00243	0	-4.98	5400	5400	5400	5400
61	8	20.18	0.49	0.00243	0	-4.98	5900	5900	5900	5900
61	9	20.47	0.51	0.00243	0	-4.98	6500	6500	6500	6500
61	16	20.04	0.49	0.00243	0	-1.98	4300	4300	4300	4300
61	17	20.12	0.49	0.00243	0	-1.98	4900	4900	4900	4900
61	18	20.32	0.50	0.00243	0	-1.98	5400	5400	5400	5400
61	19	20.22	0.50	0.00243	0	-1.98	5900	5900	5900	5900
61	20	20.56	0.51	0.00243	0	-1.98	6500	6500	6500	6500
61	27	19.74	0.47	0.00243	0	-0.05	4300	4300	4300	4300
61	28	19.32	0.45	0.00243	0	-0.05	4900	4900	4900	4900
61	29	19.68	0.47	0.00243	0	-0.05	5400	5400	5400	5400
61	30	19.83	0.48	0.00243	0	-0.05	5900	5900	5900	5900
61	31	19.88	0.48	0.00243	0	-0.05	6500	6500	6500	6500

Table C22b. Full Vehicle: 3DR Iris+, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,300 to 6,500 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
59	6	0.163	-0.010	0.974	0.087	0.318	0.072	12.684	1.300	1.479	1.401	1.328
59	7	0.182	-0.008	1.423	0.060	0.616	0.107	12.655	1.842	2.078	1.953	1.873
59	8	0.203	-0.004	1.875	0.066	0.887	0.106	12.623	2.386	2.690	2.572	2.435
59	9	0.226	0.004	2.379	-0.010	1.289	0.151	12.585	3.098	3.448	3.265	3.123
59	10	0.259	-0.001	3.033	0.071	1.573	0.123	12.531	4.059	4.502	4.312	4.096
59	11	0.236	0.001	1.490	0.073	1.075	0.099	12.680	1.393	1.552	1.502	1.446
59	12	0.260	0.003	1.998	0.009	1.443	0.140	12.650	1.918	2.120	2.069	2.006
59	13	0.284	0.006	2.462	-0.045	1.746	0.158	12.619	2.465	2.694	2.658	2.579
59	14	0.313	0.001	2.981	0.044	2.052	0.151	12.581	3.121	3.464	3.362	3.250
59	15	0.343	0.012	3.682	0.160	2.329	0.162	12.528	4.064	4.521	4.427	4.247
59	16	0.241	0.000	1.687	0.112	1.471	0.094	12.681	1.342	1.528	1.477	1.432
59	17	0.278	0.007	2.184	-0.004	1.847	0.166	12.652	1.849	2.098	2.033	1.976
59	18	0.314	0.008	2.649	-0.046	2.209	0.188	12.622	2.359	2.699	2.616	2.511
59	19	0.341	0.004	3.144	-0.032	2.571	0.179	12.586	3.003	3.438	3.286	3.186
59	20	0.384	0.012	3.853	0.116	2.871	0.170	12.533	3.907	4.481	4.326	4.159
61	5	0.246	-0.003	1.891	0.137	1.738	0.070	12.677	1.433	1.626	1.567	1.509
61	6	0.284	0.003	2.388	-0.085	2.116	0.118	12.649	1.951	2.193	2.137	2.047
61	7	0.324	-0.006	2.885	0.045	2.585	0.108	12.617	2.466	2.914	2.700	2.623
61	8	0.366	-0.008	3.442	0.077	2.941	0.088	12.580	3.123	3.704	3.437	3.307
61	9	0.411	-0.001	4.137	-0.184	3.381	0.117	12.527	4.097	4.757	4.466	4.227
61	16	0.252	-0.001	1.936	0.112	2.023	0.053	12.676	1.456	1.694	1.569	1.510
61	17	0.298	-0.019	2.434	0.071	2.369	0.049	12.646	1.979	2.314	2.142	2.050
61	18	0.333	-0.010	2.937	0.059	2.716	0.083	12.615	2.511	2.956	2.740	2.632
61	19	0.372	-0.009	3.482	-0.021	3.096	0.093	12.578	3.206	3.756	3.456	3.309
61	20	0.419	-0.003	4.204	-0.080	3.642	0.117	12.524	4.196	4.904	4.463	4.259
61	27	0.245	-0.009	1.891	0.114	1.954	0.052	12.677	1.444	1.670	1.547	1.501
61	28	0.284	-0.018	2.445	0.013	2.457	0.054	12.645	2.014	2.335	2.141	2.056
61	29	0.323	-0.011	2.938	-0.002	2.837	0.093	12.614	2.576	2.990	2.736	2.639
61	30	0.367	-0.014	3.446	0.106	3.169	0.064	12.577	3.235	3.793	3.411	3.302
61	31	0.407	-0.007	4.193	0.131	3.664	0.074	12.523	4.196	4.946	4.464	4.297

Table C22c. Full Vehicle: 3DR Iris+, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,300 to 6,500 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
59	6	0.089	0.057	0.134	0.151	0.275	0.193	0.001	0.024	0.026	0.026	0.024
59	7	0.089	0.058	0.134	0.152	0.274	0.193	0.001	0.033	0.034	0.036	0.031
59	8	0.089	0.061	0.134	0.160	0.274	0.194	0.001	0.038	0.042	0.041	0.039
59	9	0.093	0.058	0.135	0.153	0.282	0.195	0.001	0.045	0.050	0.048	0.046
59	10	0.096	0.059	0.138	0.156	0.284	0.198	0.001	0.054	0.060	0.058	0.055
59	11	0.090	0.058	0.134	0.152	0.277	0.195	0.001	0.025	0.028	0.027	0.026
59	12	0.091	0.061	0.134	0.154	0.279	0.194	0.001	0.032	0.035	0.035	0.033
59	13	0.091	0.065	0.134	0.159	0.277	0.194	0.001	0.039	0.042	0.042	0.040
59	14	0.096	0.059	0.139	0.162	0.287	0.196	0.001	0.046	0.050	0.049	0.047
59	15	0.091	0.060	0.143	0.164	0.276	0.197	0.001	0.054	0.060	0.059	0.056
59	16	0.090	0.058	0.134	0.153	0.277	0.195	0.001	0.025	0.027	0.027	0.026
59	17	0.092	0.059	0.135	0.152	0.282	0.194	0.001	0.031	0.035	0.034	0.033
59	18	0.091	0.071	0.135	0.166	0.278	0.194	0.001	0.038	0.042	0.041	0.039
59	19	0.104	0.059	0.141	0.159	0.302	0.195	0.001	0.044	0.050	0.049	0.046
59	20	0.094	0.062	0.145	0.167	0.281	0.199	0.001	0.053	0.060	0.058	0.056
61	5	0.090	0.058	0.134	0.152	0.276	0.195	0.001	0.026	0.029	0.028	0.027
61	6	0.090	0.059	0.134	0.151	0.276	0.194	0.001	0.033	0.036	0.036	0.034
61	7	0.090	0.067	0.135	0.156	0.276	0.194	0.001	0.039	0.044	0.043	0.041
61	8	0.103	0.062	0.139	0.154	0.301	0.196	0.001	0.046	0.053	0.050	0.048
61	9	0.106	0.064	0.146	0.173	0.299	0.201	0.001	0.055	0.062	0.060	0.056
61	16	0.090	0.059	0.134	0.152	0.277	0.195	0.001	0.026	0.030	0.028	0.027
61	17	0.090	0.060	0.134	0.152	0.275	0.194	0.001	0.033	0.038	0.036	0.034
61	18	0.091	0.067	0.135	0.156	0.276	0.194	0.001	0.039	0.045	0.043	0.041
61	19	0.104	0.061	0.140	0.154	0.302	0.197	0.001	0.047	0.053	0.051	0.048
61	20	0.106	0.065	0.148	0.173	0.299	0.201	0.001	0.056	0.064	0.060	0.057
61	27	0.090	0.059	0.134	0.153	0.278	0.195	0.001	0.026	0.029	0.028	0.027
61	28	0.090	0.060	0.134	0.151	0.275	0.194	0.001	0.033	0.038	0.036	0.034
61	29	0.091	0.070	0.135	0.157	0.277	0.194	0.001	0.040	0.045	0.043	0.041
61	30	0.104	0.062	0.140	0.154	0.302	0.195	0.001	0.047	0.053	0.050	0.048
61	31	0.100	0.065	0.140	0.175	0.289	0.202	0.001	0.056	0.064	0.060	0.057

Table C23a. Full Vehicle: 3DR Iris+, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,300 to 6,500 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
62	5	39.64	1.90	0.00242	0	-39.95	4300	4300	4300	4300
62	6	39.79	1.92	0.00242	0	-39.95	4900	4900	4900	4900
62	7	39.69	1.91	0.00242	0	-39.95	5400	5400	5400	5400
62	8	39.66	1.90	0.00242	0	-39.95	5900	5900	5900	5900
62	9	39.82	1.92	0.00242	0	-39.95	6500	6500	6500	6500
62	10	39.97	1.93	0.00242	0	-19.92	4300	4300	4300	4300
62	11	39.84	1.92	0.00242	0	-19.92	4900	4900	4900	4900
62	12	39.48	1.88	0.00241	0	-19.91	5400	5400	5400	5400
62	13	39.34	1.87	0.00241	0	-19.92	5900	5900	5900	5900
62	14	39.87	1.92	0.00241	0	-19.92	6500	6500	6500	6500
62	15	39.76	1.91	0.00241	0	-10.08	4300	4300	4300	4300
62	16	39.55	1.88	0.00241	0	-10.08	4900	4900	4900	4900
62	17	40.12	1.94	0.00241	0	-10.08	5400	5400	5400	5400
62	18	40.22	1.95	0.00241	0	-10.08	5900	5900	5900	5900
62	19	39.99	1.92	0.00241	0	-10.08	6500	6500	6500	6500
63	5	39.90	1.90	0.00239	0	-4.98	4300	4300	4300	4300
63	6	39.81	1.90	0.00239	0	-4.98	4900	4900	4900	4900
63	7	39.57	1.87	0.00239	0	-4.98	5400	5400	5400	5400
63	8	39.55	1.87	0.00239	0	-4.98	5900	5900	5900	5900
63	9	39.32	1.85	0.00239	0	-4.98	6500	6500	6500	6500
63	16	39.95	1.90	0.00238	0	-1.98	4300	4300	4300	4300
63	17	39.84	1.89	0.00238	0	-1.98	4900	4900	4900	4900
63	18	39.72	1.88	0.00238	0	-1.98	5400	5400	5400	5400
63	19	40.45	1.94	0.00238	0	-1.98	5900	5900	5900	5900
63	20	39.98	1.90	0.00238	0	-1.98	6500	6500	6500	6500
63	27	40.16	1.91	0.00237	0	-0.04	4300	4300	4300	4300
63	28	40.03	1.90	0.00237	0	-0.04	4900	4900	4900	4900
63	29	40.04	1.90	0.00237	0	-0.04	5400	5400	5400	5400
63	30	39.77	1.87	0.00237	0	-0.04	5900	5900	5900	5900
63	31	39.69	1.86	0.00237	0	-0.04	6500	6500	6500	6500

**Table C23b. Full Vehicle: 3DR Iris+, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 0 deg,
RPM = 4,300 to 6,500 (uniform) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
62	5	0.377	-0.014	-0.173	-0.033	-0.433	0.021	12.702	0.968	1.085	1.132	1.060
62	6	0.413	-0.002	0.238	-0.162	-0.214	0.075	12.673	1.495	1.633	1.690	1.587
62	7	0.436	-0.002	0.627	-0.121	0.070	0.080	12.644	2.027	2.230	2.250	2.133
62	8	0.468	-0.007	1.082	-0.165	0.479	0.094	12.608	2.708	2.947	2.939	2.798
62	9	0.503	0.005	1.659	-0.235	0.818	0.084	12.558	3.647	3.918	3.892	3.695
62	10	0.598	-0.004	1.188	-0.049	1.286	0.080	12.677	1.454	1.607	1.564	1.479
62	11	0.642	0.005	1.744	-0.103	1.953	0.122	12.647	2.013	2.210	2.142	2.051
62	12	0.674	0.001	2.252	-0.017	2.499	0.111	12.615	2.582	2.823	2.769	2.660
62	13	0.717	0.002	2.783	-0.113	3.155	0.147	12.579	3.253	3.561	3.456	3.336
62	14	0.782	0.001	3.486	0.003	3.689	0.119	12.524	4.227	4.630	4.529	4.330
62	15	0.607	0.003	1.913	-0.059	2.417	0.069	12.675	1.485	1.630	1.568	1.515
62	16	0.643	-0.007	2.462	0.064	2.940	0.088	12.646	1.984	2.204	2.149	2.119
62	17	0.707	0.006	2.952	-0.038	3.684	0.116	12.616	2.527	2.830	2.738	2.676
62	18	0.759	-0.005	3.474	-0.045	4.358	0.086	12.579	3.208	3.573	3.457	3.353
62	19	0.821	0.003	4.209	0.061	5.065	0.089	12.526	4.132	4.669	4.530	4.289
63	5	0.586	0.001	2.250	-0.099	3.003	0.056	12.674	1.525	1.701	1.567	1.540
63	6	0.645	-0.003	2.782	-0.056	3.896	0.071	12.644	2.053	2.348	2.149	2.077
63	7	0.684	0.004	3.274	-0.169	4.619	0.122	12.612	2.608	2.990	2.771	2.664
63	8	0.729	0.002	3.803	-0.133	5.332	0.110	12.575	3.242	3.793	3.470	3.356
63	9	0.796	-0.006	4.535	0.157	5.964	0.068	12.518	4.190	5.040	4.589	4.340
63	16	0.569	0.005	2.393	-0.033	3.521	0.066	12.673	1.585	1.808	1.535	1.495
63	17	0.624	-0.003	2.943	0.030	4.583	0.041	12.640	2.152	2.553	2.139	2.057
63	18	0.667	-0.023	3.428	0.118	5.270	0.041	12.606	2.736	3.278	2.772	2.660
63	19	0.744	-0.010	3.986	-0.038	6.191	0.079	12.567	3.428	4.141	3.499	3.350
63	20	0.797	-0.015	4.721	0.158	7.038	0.045	12.511	4.418	5.356	4.600	4.353
63	27	0.571	-0.020	2.494	0.159	3.812	0.012	12.671	1.619	1.896	1.534	1.472
63	28	0.623	-0.012	3.064	0.114	4.971	0.039	12.638	2.194	2.638	2.139	2.039
63	29	0.677	-0.028	3.538	0.087	5.822	0.049	12.605	2.769	3.368	2.742	2.623
63	30	0.728	-0.021	4.058	0.009	6.729	0.099	12.566	3.462	4.206	3.502	3.316
63	31	0.798	-0.028	4.807	0.146	7.634	0.077	12.509	4.448	5.449	4.629	4.337

Table C23c. Full Vehicle: 3DR Iris+, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 0 deg, RPM = 4,300 to 6,500 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
62	5	0.090	0.057	0.134	0.151	0.276	0.194	0.001	0.019	0.021	0.021	0.020
62	6	0.090	0.058	0.134	0.150	0.275	0.193	0.001	0.026	0.028	0.029	0.028
62	7	0.089	0.063	0.134	0.153	0.274	0.193	0.001	0.033	0.036	0.037	0.035
62	8	0.099	0.060	0.135	0.151	0.295	0.196	0.001	0.041	0.044	0.044	0.042
62	9	0.103	0.060	0.139	0.157	0.295	0.202	0.001	0.050	0.053	0.054	0.051
62	10	0.092	0.059	0.134	0.154	0.279	0.196	0.001	0.026	0.029	0.028	0.027
62	11	0.093	0.063	0.135	0.153	0.281	0.195	0.001	0.033	0.036	0.036	0.034
62	12	0.095	0.077	0.135	0.159	0.284	0.196	0.001	0.040	0.044	0.043	0.041
62	13	0.110	0.062	0.143	0.155	0.315	0.197	0.001	0.047	0.051	0.051	0.048
62	14	0.101	0.067	0.141	0.177	0.292	0.203	0.001	0.056	0.061	0.060	0.057
62	15	0.092	0.061	0.135	0.156	0.280	0.196	0.001	0.027	0.029	0.028	0.027
62	16	0.096	0.065	0.135	0.156	0.289	0.197	0.001	0.033	0.036	0.036	0.035
62	17	0.097	0.079	0.137	0.162	0.286	0.197	0.001	0.040	0.044	0.043	0.041
62	18	0.127	0.068	0.143	0.159	0.348	0.198	0.001	0.047	0.051	0.051	0.048
62	19	0.105	0.069	0.152	0.182	0.294	0.213	0.001	0.055	0.062	0.060	0.057
63	5	0.094	0.061	0.135	0.158	0.284	0.199	0.001	0.027	0.030	0.029	0.028
63	6	0.092	0.069	0.136	0.159	0.279	0.198	0.001	0.034	0.038	0.036	0.035
63	7	0.096	0.078	0.137	0.162	0.288	0.199	0.001	0.040	0.045	0.043	0.041
63	8	0.114	0.068	0.147	0.160	0.323	0.202	0.001	0.047	0.054	0.051	0.048
63	9	0.124	0.069	0.158	0.189	0.325	0.207	0.001	0.056	0.065	0.061	0.057
63	16	0.092	0.061	0.135	0.159	0.278	0.198	0.001	0.028	0.031	0.028	0.027
63	17	0.093	0.066	0.136	0.158	0.280	0.200	0.001	0.035	0.040	0.036	0.034
63	18	0.096	0.081	0.137	0.165	0.288	0.200	0.001	0.042	0.049	0.044	0.042
63	19	0.127	0.069	0.145	0.163	0.349	0.207	0.001	0.048	0.057	0.050	0.049
63	20	0.124	0.073	0.151	0.198	0.327	0.215	0.001	0.058	0.068	0.061	0.058
63	27	0.092	0.061	0.135	0.160	0.278	0.198	0.001	0.028	0.033	0.028	0.027
63	28	0.093	0.068	0.136	0.159	0.280	0.199	0.001	0.035	0.041	0.036	0.034
63	29	0.096	0.080	0.137	0.167	0.287	0.202	0.001	0.043	0.049	0.044	0.041
63	30	0.116	0.070	0.146	0.164	0.328	0.210	0.001	0.049	0.058	0.051	0.048
63	31	0.123	0.072	0.152	0.199	0.324	0.209	0.001	0.058	0.069	0.062	0.057

Table C24a. Full Vehicle: 3DR Iris+, nominal speed 20 ft/s, yaw = 0 deg, pitch = -10 to 0 deg, RPM = 4,300 to 6,500 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
59	21	19.59	0.45	0.00233	0	-9.90	6500	4300	6500	4300
59	22	20.03	0.47	0.00233	0	-9.91	5900	4900	5900	4900
59	23	19.70	0.45	0.00233	0	-9.90	6500	6500	4300	4300
59	24	19.85	0.46	0.00233	0	-9.90	5900	5900	4900	4900
59	25	19.97	0.47	0.00233	0	-9.90	4900	4900	5900	5900
59	26	19.81	0.46	0.00233	0	-9.90	4300	4300	6500	6500
61	10	19.46	0.46	0.00243	0	-4.98	6500	4300	6500	4300
61	11	19.55	0.46	0.00243	0	-4.98	5900	4900	5900	4900
61	12	19.69	0.47	0.00243	0	-4.98	6500	6500	4300	4300
61	13	19.38	0.46	0.00243	0	-4.98	5900	5900	4900	4900
61	14	19.28	0.45	0.00243	0	-4.98	4900	4900	5900	5900
61	15	20.43	0.51	0.00243	0	-4.98	4300	4300	6500	6500
61	21	19.57	0.47	0.00243	0	-1.98	6500	4300	6500	4300
61	22	19.61	0.47	0.00243	0	-1.99	5900	4900	5900	4900
61	23	19.68	0.47	0.00243	0	-1.99	6500	6500	4300	4300
61	24	19.68	0.47	0.00243	0	-1.98	5900	5900	4900	4900
61	25	19.80	0.48	0.00243	0	-1.98	4900	4900	5900	5900
61	26	20.08	0.49	0.00243	0	-1.98	4300	4300	6500	6500
61	32	19.66	0.47	0.00243	0	-0.05	6500	4300	6500	4300
61	33	19.78	0.48	0.00243	0	-0.05	5900	4900	5900	4900
61	34	19.74	0.47	0.00243	0	-0.04	4900	5900	4900	5900
61	35	19.86	0.48	0.00243	0	-0.04	4300	6500	4300	6500
61	36	19.76	0.47	0.00243	0	-0.04	6500	6500	4300	4300
61	37	19.75	0.47	0.00243	0	-0.04	5900	5900	4900	4900
61	38	19.72	0.47	0.00243	0	-0.04	4900	4900	5900	5900
61	39	19.98	0.49	0.00243	0	-0.04	4300	4300	6500	6500

**Table C24b. Full Vehicle: 3DR Iris+, nominal speed 20 ft/s, yaw = 0 deg, pitch = -10 to 0 deg,
RPM = 4,300 to 6,500 (differential) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
59	21	0.303	0.117	2.786	-9.325	2.119	0.627	12.607	3.926	1.585	4.320	1.463
59	22	0.305	0.051	2.675	-4.127	2.164	0.400	12.619	2.985	2.131	3.306	1.995
59	23	0.289	-0.003	2.755	0.020	8.181	0.097	12.607	3.918	4.387	1.438	1.406
59	24	0.298	-0.008	2.639	0.070	4.878	0.143	12.620	2.987	3.381	2.008	1.971
59	25	0.316	0.014	2.714	0.013	-0.409	0.182	12.617	1.867	2.157	3.304	3.200
59	26	0.325	0.018	2.846	0.049	-3.763	0.165	12.604	1.380	1.583	4.375	4.192
61	10	0.318	0.117	3.004	-9.659	2.456	0.591	12.604	4.056	1.659	4.430	1.520
61	11	0.317	0.052	2.901	-4.296	2.524	0.353	12.615	3.099	2.269	3.406	2.082
61	12	0.301	-0.006	2.964	0.034	8.796	0.084	12.604	4.067	4.697	1.494	1.443
61	13	0.307	-0.008	2.863	0.022	5.287	0.089	12.615	3.102	3.630	2.091	2.039
61	14	0.321	-0.001	2.929	-0.017	-0.258	0.114	12.613	1.969	2.277	3.473	3.332
61	15	0.359	-0.001	3.103	0.200	-3.518	0.127	12.598	1.468	1.699	4.614	4.374
61	21	0.326	0.102	3.013	-9.508	2.629	0.537	12.603	4.106	1.716	4.415	1.536
61	22	0.325	0.041	2.940	-4.145	2.670	0.330	12.613	3.146	2.344	3.416	2.104
61	23	0.316	-0.023	2.969	0.145	8.915	0.019	12.603	4.069	4.804	1.491	1.440
61	24	0.318	-0.018	2.913	-0.005	5.520	0.057	12.613	3.177	3.727	2.092	2.010
61	25	0.335	-0.010	2.981	0.146	-0.028	0.066	12.610	1.981	2.374	3.517	3.376
61	26	0.353	-0.027	3.090	0.151	-3.349	0.096	12.597	1.511	1.722	4.613	4.366
61	32	0.320	0.116	3.038	-9.459	2.848	0.514	12.602	4.121	1.728	4.379	1.542
61	33	0.333	0.057	2.910	-4.306	2.829	0.300	12.613	3.208	2.316	3.378	2.079
61	34	0.323	-0.067	2.964	4.264	3.018	-0.155	12.610	2.042	3.769	2.163	3.290
61	35	0.327	-0.127	3.004	9.549	2.779	-0.393	12.601	1.488	4.771	1.588	4.202
61	36	0.303	-0.007	3.008	-0.054	9.143	0.062	12.601	4.151	4.872	1.495	1.444
61	37	0.310	-0.016	2.946	0.047	5.702	0.053	12.611	3.220	3.773	2.095	2.039
61	38	0.335	-0.016	2.979	0.011	0.190	0.050	12.609	2.070	2.402	3.515	3.378
61	39	0.348	-0.001	3.101	-0.027	-3.042	0.025	12.597	1.541	1.735	4.604	4.382

Table C24c. Full Vehicle: 3DR Iris+, nominal speed 20 ft/s, yaw = 0 deg, pitch = -10 to 0 deg, RPM = 4,300 to 6,500 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
59	21	0.091	0.061	0.143	0.163	0.277	0.200	0.001	0.052	0.032	0.057	0.029
59	22	0.100	0.063	0.135	0.157	0.297	0.197	0.001	0.044	0.037	0.048	0.034
59	23	0.102	0.061	0.144	0.161	0.296	0.196	0.001	0.052	0.057	0.029	0.029
59	24	0.095	0.065	0.136	0.158	0.286	0.194	0.001	0.043	0.048	0.035	0.034
59	25	0.094	0.060	0.135	0.157	0.285	0.197	0.001	0.033	0.037	0.048	0.046
59	26	0.096	0.058	0.135	0.154	0.284	0.198	0.001	0.028	0.031	0.058	0.055
61	10	0.107	0.061	0.139	0.162	0.304	0.196	0.001	0.053	0.032	0.058	0.030
61	11	0.100	0.061	0.136	0.153	0.295	0.196	0.001	0.045	0.038	0.049	0.036
61	12	0.107	0.062	0.146	0.167	0.304	0.196	0.001	0.053	0.060	0.030	0.029
61	13	0.095	0.063	0.138	0.154	0.286	0.193	0.001	0.045	0.051	0.036	0.035
61	14	0.097	0.060	0.135	0.152	0.290	0.196	0.001	0.034	0.038	0.050	0.047
61	15	0.098	0.059	0.135	0.153	0.288	0.201	0.001	0.029	0.033	0.060	0.057
61	21	0.105	0.060	0.140	0.162	0.300	0.197	0.001	0.054	0.033	0.058	0.030
61	22	0.099	0.062	0.136	0.154	0.293	0.196	0.001	0.045	0.039	0.049	0.036
61	23	0.104	0.063	0.143	0.169	0.299	0.196	0.001	0.053	0.061	0.030	0.029
61	24	0.096	0.063	0.138	0.154	0.287	0.194	0.001	0.045	0.052	0.036	0.035
61	25	0.096	0.060	0.135	0.152	0.289	0.197	0.001	0.034	0.040	0.051	0.048
61	26	0.099	0.059	0.136	0.154	0.290	0.199	0.001	0.030	0.033	0.060	0.057
61	32	0.104	0.061	0.141	0.163	0.298	0.198	0.001	0.054	0.033	0.058	0.030
61	33	0.098	0.062	0.136	0.155	0.290	0.196	0.001	0.046	0.039	0.049	0.036
61	34	0.092	0.063	0.137	0.155	0.280	0.194	0.001	0.035	0.052	0.037	0.047
61	35	0.103	0.061	0.142	0.167	0.294	0.197	0.001	0.029	0.061	0.031	0.055
61	36	0.103	0.065	0.142	0.173	0.296	0.198	0.001	0.054	0.062	0.030	0.029
61	37	0.098	0.062	0.140	0.154	0.290	0.193	0.001	0.046	0.052	0.036	0.035
61	38	0.096	0.060	0.135	0.152	0.289	0.197	0.001	0.035	0.040	0.051	0.048
61	39	0.098	0.059	0.135	0.154	0.288	0.201	0.001	0.030	0.033	0.060	0.057

Table C25a. Full Vehicle: 3DR Iris+, nominal speed 40 ft/s, yaw = 0 deg, pitch = -10 to 0 deg, RPM = 4,300 to 6,500 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
62	20	39.74	1.90	0.00241	0	-10.08	6500	4300	6500	4300
62	21	39.45	1.87	0.00240	0	-10.08	5900	4900	5900	4900
62	22	39.59	1.88	0.00240	0	-10.08	6500	6500	4300	4300
62	23	39.40	1.86	0.00240	0	-10.08	5900	5900	4900	4900
62	24	39.81	1.90	0.00240	0	-10.08	4900	4900	5900	5900
62	25	39.57	1.88	0.00240	0	-10.08	4300	4300	6500	6500
63	10	39.91	1.90	0.00239	0	-4.98	6500	4300	6500	4300
63	11	39.86	1.90	0.00239	0	-4.98	5900	4900	5900	4900
63	12	39.68	1.88	0.00238	0	-4.98	6500	6500	4300	4300
63	13	39.68	1.88	0.00238	0	-4.98	5900	5900	4900	4900
63	14	39.53	1.86	0.00238	0	-4.98	4900	4900	5900	5900
63	15	39.81	1.89	0.00238	0	-4.98	4300	4300	6500	6500
63	21	40.32	1.93	0.00238	0	-1.98	6500	4300	6500	4300
63	22	40.52	1.95	0.00237	0	-1.98	5900	4900	5900	4900
63	23	39.98	1.90	0.00237	0	-1.98	6500	6500	4300	4300
63	24	39.88	1.89	0.00237	0	-1.98	5900	5900	4900	4900
63	25	40.22	1.92	0.00237	0	-1.98	4900	4900	5900	5900
63	26	39.97	1.89	0.00237	0	-1.98	4300	4300	6500	6500
63	32	40.22	1.91	0.00237	0	-0.04	6500	4300	6500	4300
63	33	40.39	1.93	0.00236	0	-0.04	5900	4900	5900	4900
63	34	40.36	1.93	0.00236	0	-0.04	4900	5900	4900	5900
63	35	40.34	1.92	0.00236	0	-0.04	4300	6500	4300	6500
63	36	39.89	1.88	0.00236	0	-0.04	6500	6500	4300	4300
63	37	40.29	1.92	0.00236	0	-0.04	5900	5900	4900	4900
63	38	40.01	1.89	0.00236	0	-0.04	4900	4900	5900	5900
63	39	39.90	1.88	0.00236	0	-0.04	4300	4300	6500	6500

**Table C25b. Full Vehicle: 3DR Iris+, nominal speed 40 ft/s, yaw = 0 deg, pitch = -10 to 0 deg,
RPM = 4,300 to 6,500 (differential) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
62	20	0.700	0.098	3.050	-9.682	3.595	0.862	12.602	4.099	1.655	4.455	1.535
62	21	0.685	0.033	2.957	-4.318	3.640	0.515	12.613	3.170	2.236	3.432	2.116
62	22	0.692	-0.013	2.975	0.190	10.455	0.092	12.604	4.072	4.587	1.524	1.495
62	23	0.680	-0.010	2.899	-0.058	6.658	0.061	12.615	3.149	3.510	2.134	2.070
62	24	0.688	-0.003	2.976	-0.036	0.708	0.106	12.612	2.021	2.241	3.450	3.337
62	25	0.687	-0.010	3.111	0.041	-3.113	0.035	12.601	1.501	1.662	4.505	4.279
63	10	0.693	0.090	3.403	-9.697	4.443	0.909	12.598	4.168	1.767	4.551	1.548
63	11	0.693	0.024	3.299	-4.254	4.590	0.460	12.609	3.232	2.386	3.487	2.092
63	12	0.690	-0.009	3.303	-0.032	11.281	0.075	12.600	4.152	4.819	1.521	1.466
63	13	0.687	-0.013	3.246	-0.128	7.579	0.074	12.609	3.221	3.753	2.167	2.070
63	14	0.679	-0.006	3.300	-0.089	1.543	0.106	12.609	2.073	2.386	3.466	3.298
63	15	0.684	-0.001	3.434	0.030	-2.381	0.058	12.598	1.551	1.747	4.502	4.269
63	21	0.690	0.081	3.555	-9.606	5.133	0.914	12.595	4.362	1.869	4.564	1.501
63	22	0.694	0.015	3.475	-4.234	5.413	0.459	12.604	3.436	2.587	3.515	2.063
63	23	0.679	-0.013	3.510	0.006	12.081	0.044	12.592	4.357	5.181	1.553	1.481
63	24	0.678	-0.021	3.422	0.037	8.414	0.019	12.603	3.395	4.102	2.171	2.073
63	25	0.684	-0.018	3.471	0.044	2.221	0.071	12.606	2.151	2.556	3.436	3.296
63	26	0.689	-0.017	3.588	0.096	-1.807	0.052	12.597	1.617	1.867	4.493	4.200
63	32	0.687	0.067	3.659	-9.486	5.636	0.945	12.593	4.376	1.936	4.558	1.482
63	33	0.687	0.008	3.564	-4.159	5.909	0.468	12.603	3.442	2.663	3.480	2.037
63	34	0.689	-0.064	3.581	4.360	5.843	-0.350	12.601	2.218	4.179	2.136	3.325
63	35	0.688	-0.099	3.623	9.584	5.699	-0.821	12.588	1.644	5.397	1.547	4.283
63	36	0.676	-0.018	3.577	0.048	12.519	0.027	12.590	4.366	5.279	1.557	1.476
63	37	0.688	-0.026	3.533	-0.003	8.990	0.042	12.601	3.429	4.183	2.156	2.038
63	38	0.679	-0.026	3.566	0.076	2.660	0.089	12.605	2.218	2.638	3.433	3.251
63	39	0.678	-0.015	3.659	0.210	-1.378	0.053	12.597	1.644	1.917	4.455	4.141

Table C25c. Full Vehicle: 3DR Iris+, nominal speed 40 ft/s, yaw = 0 deg, pitch = -10 to 0 deg, RPM = 4,300 to 6,500 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
62	20	0.126	0.066	0.142	0.172	0.334	0.202	0.001	0.054	0.032	0.059	0.030
62	21	0.108	0.066	0.139	0.159	0.310	0.199	0.001	0.046	0.038	0.050	0.036
62	22	0.093	0.069	0.137	0.182	0.284	0.201	0.001	0.053	0.059	0.031	0.030
62	23	0.105	0.070	0.140	0.160	0.305	0.196	0.001	0.045	0.050	0.037	0.035
62	24	0.109	0.064	0.137	0.156	0.315	0.204	0.001	0.035	0.038	0.050	0.047
62	25	0.106	0.061	0.137	0.157	0.300	0.211	0.001	0.030	0.033	0.059	0.056
63	10	0.108	0.067	0.152	0.178	0.302	0.206	0.001	0.052	0.035	0.057	0.031
63	11	0.113	0.067	0.139	0.160	0.320	0.207	0.001	0.044	0.041	0.048	0.037
63	12	0.115	0.068	0.155	0.185	0.314	0.200	0.001	0.054	0.062	0.031	0.029
63	13	0.106	0.070	0.145	0.160	0.304	0.197	0.001	0.046	0.052	0.037	0.036
63	14	0.106	0.068	0.137	0.159	0.308	0.208	0.001	0.035	0.040	0.050	0.047
63	15	0.110	0.062	0.137	0.160	0.306	0.210	0.001	0.032	0.033	0.060	0.055
63	21	0.114	0.066	0.151	0.176	0.310	0.205	0.001	0.056	0.035	0.060	0.030
63	22	0.113	0.068	0.140	0.161	0.319	0.210	0.001	0.048	0.042	0.051	0.036
63	23	0.125	0.067	0.163	0.183	0.329	0.201	0.001	0.056	0.065	0.031	0.030
63	24	0.104	0.074	0.141	0.163	0.302	0.200	0.001	0.048	0.056	0.038	0.036
63	25	0.113	0.067	0.138	0.158	0.324	0.211	0.001	0.037	0.042	0.050	0.047
63	26	0.105	0.062	0.137	0.160	0.295	0.217	0.001	0.031	0.035	0.059	0.055
63	32	0.114	0.066	0.153	0.178	0.310	0.206	0.001	0.057	0.036	0.060	0.030
63	33	0.115	0.068	0.139	0.161	0.324	0.212	0.001	0.048	0.043	0.050	0.035
63	34	0.101	0.071	0.141	0.163	0.299	0.199	0.001	0.036	0.057	0.036	0.048
63	35	0.110	0.064	0.143	0.177	0.308	0.202	0.001	0.031	0.067	0.031	0.056
63	36	0.112	0.069	0.156	0.188	0.311	0.202	0.001	0.056	0.066	0.031	0.030
63	37	0.102	0.075	0.141	0.164	0.298	0.201	0.001	0.048	0.057	0.038	0.035
63	38	0.106	0.068	0.137	0.158	0.310	0.212	0.001	0.037	0.043	0.050	0.047
63	39	0.109	0.062	0.138	0.161	0.306	0.212	0.001	0.031	0.036	0.059	0.054

Wind Tunnel Data - Drone America x8 Full Vehicle

Table C27a. Full Vehicle: Drone America x8, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 20 deg, RPM = 5,000 to 9,200 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
75	6	39.22	1.86	0.00241	0	-39.95	6200	6200	6200	6200	6200	6200	6200	6200
75	7	39.89	1.92	0.00241	0	-39.95	6800	6800	6800	6800	6800	6800	6800	6800
75	8	40.38	1.97	0.00241	0	-39.95	7400	7400	7400	7400	7400	7400	7400	7400
75	9	39.25	1.86	0.00241	0	-39.95	8000	8000	8000	8000	8000	8000	8000	8000
75	10	39.89	1.91	0.00241	0	-39.95	8600	8600	8600	8600	8600	8600	8600	8600
75	11	39.69	1.89	0.00240	0	-39.95	9200	9200	9200	9200	9200	9200	9200	9200
75	12	40.13	1.93	0.00240	0	-19.92	6200	6200	6200	6200	6200	6200	6200	6200
75	13	39.81	1.90	0.00240	0	-19.92	6800	6800	6800	6800	6800	6800	6800	6800
75	14	40.20	1.94	0.00240	0	-19.92	7400	7400	7400	7400	7400	7400	7400	7400
75	15	39.79	1.90	0.00240	0	-19.92	8000	8000	8000	8000	8000	8000	8000	8000
75	17	39.92	1.91	0.00240	0	-19.92	8600	8600	8600	8600	8600	8600	8600	8600
75	18	39.92	1.91	0.00239	0	-19.92	9200	9200	9200	9200	9200	9200	9200	9200
76	5	39.73	1.87	0.00237	0	-9.91	6200	6200	6200	6200	6200	6200	6200	6200
75	19	40.14	1.93	0.00239	0	-9.91	6800	6800	6800	6800	6800	6800	6800	6800
75	20	40.35	1.95	0.00239	0	-9.91	7400	7400	7400	7400	7400	7400	7400	7400
75	21	40.05	1.92	0.00239	0	-9.91	8000	8000	8000	8000	8000	8000	8000	8000
75	22	40.16	1.93	0.00239	0	-9.91	8600	8600	8600	8600	8600	8600	8600	8600
76	9	39.83	1.87	0.00236	0	-4.99	5000	5000	5000	5000	5000	5000	5000	5000
76	10	39.22	1.82	0.00236	0	-4.99	5600	5600	5600	5600	5600	5600	5600	5600
76	11	39.71	1.86	0.00236	0	-4.99	6200	6200	6200	6200	6200	6200	6200	6200
76	12	40.36	1.92	0.00236	0	-4.99	6800	6800	6800	6800	6800	6800	6800	6800
76	13	40.68	1.95	0.00236	0	-4.99	7400	7400	7400	7400	7400	7400	7400	7400
76	17	40.20	1.90	0.00236	0	-1.99	5000	5000	5000	5000	5000	5000	5000	5000
76	18	40.00	1.89	0.00236	0	-1.99	5600	5600	5600	5600	5600	5600	5600	5600
76	19	39.93	1.88	0.00236	0	-1.99	6200	6200	6200	6200	6200	6200	6200	6200
76	20	40.06	1.89	0.00236	0	-1.99	6800	6800	6800	6800	6800	6800	6800	6800
76	21	40.11	1.90	0.00236	0	-1.99	7400	7400	7400	7400	7400	7400	7400	7400
78	5	40.40	1.92	0.00236	0	0.11	5000	5000	5000	5000	5000	5000	5000	5000
78	6	39.84	1.87	0.00236	0	0.11	5600	5600	5600	5600	5600	5600	5600	5600
78	7	39.76	1.86	0.00236	0	0.11	6200	6200	6200	6200	6200	6200	6200	6200
78	8	40.33	1.92	0.00236	0	0.11	6800	6800	6800	6800	6800	6800	6800	6800
78	9	40.36	1.92	0.00236	0	0.11	7400	7400	7400	7400	7400	7400	7400	7400

Table C27b. Full Vehicle: Drone America x8, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 20 deg,
RPM = 5,000 to 9,200 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
75	6	4.512	-0.034	-4.258	0.369	-50.791	-0.560	16.534	3.292	3.404	3.726	3.860	3.634	3.776	3.441	3.377
75	7	4.803	0.036	-2.462	1.314	-50.006	-0.592	16.424	4.522	4.703	4.922	5.122	4.826	4.946	4.753	4.617
75	8	5.087	0.021	-0.424	2.371	-47.737	-0.443	16.289	5.984	6.240	6.325	6.551	6.179	6.445	6.332	6.216
75	9	5.076	0.051	2.737	3.749	-43.788	-0.150	16.120	7.915	8.239	8.114	8.437	7.914	8.335	8.214	8.184
75	10	5.366	0.099	5.040	5.811	-44.694	-0.193	15.921	10.035	10.358	10.309	10.603	9.977	10.509	10.545	10.630
75	11	5.452	0.142	7.974	4.940	-42.977	0.160	15.667	12.829	13.278	12.876	13.216	12.308	13.247	13.151	13.373
75	12	5.597	0.030	4.865	0.404	-19.315	0.033	16.463	4.358	4.405	4.180	4.444	4.080	4.306	4.390	4.461
75	13	5.848	0.050	7.388	0.529	-15.488	-0.079	16.343	5.713	5.765	5.626	5.690	5.341	5.630	5.692	5.811
75	14	6.271	0.039	9.764	1.719	-12.106	-0.409	16.202	7.208	7.364	7.071	7.133	6.769	7.281	7.245	7.507
75	15	6.521	0.021	12.503	2.452	-8.596	-0.825	16.036	9.044	9.126	8.901	9.116	8.561	9.155	9.124	9.282
75	17	6.841	0.059	15.380	2.830	-2.120	-0.778	15.833	11.299	11.409	11.074	11.247	10.551	11.279	11.344	11.686
75	18	7.129	0.048	18.383	4.215	3.159	-0.955	15.562	14.058	14.132	13.732	13.843	12.896	14.092	14.076	14.825
76	5	5.445	0.023	10.161	-1.729	17.189	-0.173	16.461	4.433	4.372	4.280	4.487	4.186	4.349	4.298	4.612
75	19	5.869	0.034	12.269	0.875	25.010	-1.155	16.329	5.821	5.679	5.614	5.780	5.511	5.694	5.691	6.027
75	20	6.247	0.008	14.525	0.662	29.508	-1.035	16.194	7.278	7.188	7.175	7.396	6.928	7.214	7.229	7.625
75	21	6.566	0.009	17.517	4.109	37.951	-0.790	16.029	9.027	8.840	8.907	9.282	8.617	9.287	8.994	9.541
75	22	6.902	-0.045	19.998	3.345	41.267	-0.378	15.831	11.275	10.957	11.078	11.351	10.675	11.272	10.948	11.931
76	9	4.629	0.063	8.734	-1.013	24.039	-0.189	16.633	2.458	2.432	2.344	2.541	2.391	2.395	2.406	2.494
76	10	4.828	0.091	10.582	-1.269	32.809	-0.653	16.556	3.322	3.335	3.205	3.409	3.181	3.254	3.268	3.368
76	11	5.235	0.091	12.707	-0.581	42.448	-0.841	16.463	4.353	4.426	4.202	4.412	4.205	4.295	4.269	4.478
76	12	5.760	-0.003	14.851	-0.472	49.524	-2.177	16.349	5.651	5.591	5.404	5.683	5.438	5.494	5.444	5.943
76	13	6.253	-0.066	17.297	0.480	56.150	-2.044	16.213	7.255	6.800	6.876	7.236	6.901	7.015	6.877	7.569
76	17	4.342	0.071	10.105	-0.572	34.882	-0.619	16.632	2.446	2.394	2.329	2.533	2.385	2.403	2.402	2.489
76	18	4.699	0.102	12.118	-0.532	44.622	-0.530	16.558	3.254	3.260	3.205	3.424	3.252	3.316	3.210	3.304
76	19	5.029	0.148	14.214	0.485	57.042	0.323	16.463	4.322	4.388	4.189	4.476	4.192	4.272	4.299	4.385
76	20	5.436	0.076	16.334	0.415	62.223	-0.764	16.349	5.519	5.659	5.375	5.796	5.406	5.500	5.534	5.924
76	21	5.861	0.141	18.813	1.523	71.234	-2.696	16.215	7.136	7.025	6.784	7.273	6.813	6.940	6.976	7.478
78	5	4.024	0.071	11.063	0.823	43.225	-0.091	16.632	2.453	2.370	2.366	2.591	2.438	2.661	2.335	2.479
78	6	4.273	0.112	12.964	0.276	54.620	-0.494	16.557	3.251	3.169	3.205	3.452	3.207	3.457	3.197	3.296
78	7	4.710	0.074	14.918	0.842	65.430	0.166	16.463	4.266	4.378	4.188	4.455	4.167	4.520	4.364	4.355
78	8	5.176	0.058	17.193	2.570	74.632	1.010	16.348	5.535	5.644	5.314	5.741	5.352	5.713	5.712	5.898
78	9	5.673	0.115	19.659	1.739	82.181	-1.127	16.213	7.082	7.080	6.753	7.289	6.836	7.094	7.227	7.469

Table C27c. Full Vehicle: Drone America x8, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 20 deg, RPM = 5,000 to 9,200 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
75	6	0.126	0.057	0.134	0.155	0.315	0.199	0.003	0.066	0.071	0.073	0.074	0.073	0.073	0.071	0.069
75	7	0.131	0.057	0.134	0.163	0.315	0.198	0.003	0.080	0.083	0.086	0.087	0.087	0.085	0.086	0.083
75	8	0.138	0.057	0.134	0.162	0.318	0.198	0.004	0.094	0.094	0.099	0.099	0.099	0.098	0.100	0.098
75	9	0.135	0.057	0.134	0.160	0.305	0.206	0.004	0.109	0.112	0.113	0.113	0.110	0.113	0.113	0.113
75	10	0.139	0.060	0.135	0.169	0.307	0.205	0.003	0.119	0.125	0.124	0.125	0.120	0.124	0.125	0.126
75	11	0.145	0.063	0.137	0.186	0.316	0.207	0.003	0.135	0.140	0.137	0.139	0.131	0.139	0.138	0.140
75	12	0.143	0.057	0.134	0.163	0.288	0.202	0.003	0.079	0.084	0.080	0.083	0.082	0.080	0.084	0.083
75	13	0.148	0.057	0.135	0.172	0.286	0.201	0.003	0.094	0.092	0.095	0.093	0.093	0.093	0.096	0.096
75	14	0.157	0.057	0.135	0.172	0.292	0.203	0.004	0.107	0.108	0.108	0.100	0.105	0.107	0.108	0.110
75	15	0.158	0.057	0.136	0.172	0.280	0.212	0.003	0.118	0.121	0.119	0.119	0.116	0.119	0.121	0.122
75	17	0.163	0.062	0.138	0.180	0.279	0.209	0.003	0.130	0.133	0.130	0.130	0.124	0.130	0.131	0.134
75	18	0.173	0.067	0.143	0.197	0.308	0.210	0.003	0.146	0.148	0.144	0.144	0.135	0.146	0.146	0.153
76	5	0.142	0.057	0.136	0.164	0.293	0.203	0.002	0.081	0.084	0.081	0.083	0.081	0.080	0.083	0.085
75	19	0.149	0.057	0.137	0.170	0.294	0.202	0.003	0.094	0.096	0.094	0.095	0.095	0.094	0.097	0.098
75	20	0.159	0.058	0.137	0.181	0.309	0.203	0.003	0.106	0.108	0.107	0.107	0.106	0.106	0.108	0.111
75	21	0.160	0.058	0.139	0.172	0.304	0.208	0.003	0.118	0.119	0.119	0.120	0.116	0.120	0.119	0.124
75	22	0.165	0.066	0.141	0.195	0.307	0.212	0.003	0.129	0.129	0.130	0.131	0.125	0.130	0.128	0.136
76	9	0.128	0.059	0.135	0.169	0.288	0.198	0.003	0.055	0.056	0.055	0.056	0.055	0.054	0.056	0.056
76	10	0.131	0.058	0.135	0.163	0.295	0.200	0.003	0.068	0.068	0.068	0.069	0.069	0.068	0.067	0.070
76	11	0.140	0.057	0.136	0.162	0.323	0.201	0.003	0.084	0.076	0.084	0.071	0.083	0.080	0.082	0.083
76	12	0.147	0.057	0.138	0.168	0.321	0.202	0.003	0.092	0.093	0.092	0.094	0.096	0.091	0.093	0.097
76	13	0.161	0.059	0.139	0.182	0.346	0.203	0.003	0.105	0.104	0.104	0.107	0.105	0.104	0.104	0.111
76	17	0.124	0.059	0.135	0.169	0.298	0.198	0.003	0.054	0.056	0.054	0.057	0.057	0.054	0.056	0.056
76	18	0.129	0.058	0.136	0.163	0.309	0.201	0.003	0.068	0.064	0.069	0.067	0.069	0.068	0.069	0.069
76	19	0.137	0.057	0.137	0.165	0.348	0.202	0.003	0.080	0.081	0.080	0.083	0.083	0.079	0.083	0.082
76	20	0.143	0.057	0.138	0.171	0.342	0.200	0.003	0.091	0.095	0.091	0.095	0.094	0.091	0.095	0.097
76	21	0.154	0.059	0.139	0.187	0.368	0.204	0.003	0.104	0.106	0.103	0.107	0.101	0.105	0.100	0.111
78	5	0.120	0.059	0.136	0.174	0.308	0.201	0.002	0.054	0.055	0.055	0.057	0.056	0.058	0.055	0.056
78	6	0.123	0.058	0.136	0.164	0.323	0.202	0.003	0.067	0.068	0.068	0.071	0.057	0.074	0.058	0.073
78	7	0.133	0.057	0.137	0.168	0.363	0.203	0.003	0.084	0.068	0.085	0.070	0.066	0.088	0.070	0.088
78	8	0.138	0.058	0.139	0.178	0.362	0.203	0.003	0.091	0.093	0.091	0.094	0.095	0.094	0.094	0.098
78	9	0.152	0.059	0.140	0.190	0.389	0.204	0.003	0.104	0.105	0.103	0.106	0.105	0.106	0.105	0.111

Table C29a. Full Vehicle: Drone America x8, nominal speed 40 ft/s, yaw = -5 deg, pitch = -40 to 20 deg, RPM = 5,600 to 9,200 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
88	5	39.58	1.90	0.00243	-5	-39.95	7000	7000	7000	7000	7000	7000	7000	7000
88	6	39.74	1.92	0.00243	-5	-39.95	7700	7700	7700	7700	7700	7700	7700	7700
88	7	39.42	1.88	0.00242	-5	-39.95	8400	8400	8400	8400	8400	8400	8400	8400
88	8	40.05	1.94	0.00242	-5	-39.95	9200	9200	9200	9200	9200	9200	9200	9200
88	9	39.87	1.92	0.00242	-5	-19.92	7000	7000	7000	7000	7000	7000	7000	7000
88	10	39.16	1.86	0.00242	-5	-19.92	7700	7700	7700	7700	7700	7700	7700	7700
88	11	39.96	1.93	0.00242	-5	-19.92	8400	8400	8400	8400	8400	8400	8400	8400
88	12	39.98	1.93	0.00242	-5	-19.92	9200	9200	9200	9200	9200	9200	9200	9200
88	13	39.51	1.89	0.00242	-5	-9.91	6200	6200	6200	6200	6200	6200	6200	6200
88	14	39.89	1.92	0.00242	-5	-9.91	7000	7000	7000	7000	7000	7000	7000	7000
88	15	39.67	1.90	0.00242	-5	-9.91	7700	7700	7700	7700	7700	7700	7700	7700
88	16	40.19	1.95	0.00241	-5	-9.91	8400	8400	8400	8400	8400	8400	8400	8400
88	17	39.52	1.89	0.00241	-5	-9.91	9200	9200	9200	9200	9200	9200	9200	9200
88	22	39.63	1.89	0.00241	-5	-4.99	5600	5600	5600	5600	5600	5600	5600	5600
88	23	39.90	1.92	0.00241	-5	-4.99	6200	6200	6200	6200	6200	6200	6200	6200
88	24	39.38	1.87	0.00241	-5	-4.99	7000	7000	7000	7000	7000	7000	7000	7000
88	25	40.10	1.94	0.00241	-5	-4.99	7700	7700	7700	7700	7700	7700	7700	7700
88	26	39.97	1.92	0.00241	-5	-4.99	8400	8400	8400	8400	8400	8400	8400	8400
89	5	40.09	1.93	0.00240	-5	-1.99	5600	5600	5600	5600	5600	5600	5600	5600
89	6	39.64	1.89	0.00240	-5	-1.99	6200	6200	6200	6200	6200	6200	6200	6200
89	7	39.37	1.86	0.00240	-5	-1.99	7000	7000	7000	7000	7000	7000	7000	7000
89	8	39.57	1.88	0.00240	-5	-1.99	7700	7700	7700	7700	7700	7700	7700	7700
87	5	39.84	1.88	0.00237	-5	-0.05	5600	5600	5600	5600	5600	5600	5600	5600
87	6	39.62	1.86	0.00237	-5	-0.05	6200	6200	6200	6200	6200	6200	6200	6200
87	7	39.71	1.87	0.00237	-5	-0.05	7000	7000	7000	7000	7000	7000	7000	7000

Table C29b. Full Vehicle: Drone America x8, nominal speed 40 ft/s, yaw = -5 deg, pitch = -40 to 20 deg, RPM = 5,600 to 9,200 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
88	5	4.818	-0.387	-1.290	4.373	-48.245	-1.257	16.448	5.072	5.230	5.418	5.689	5.314	5.641	5.432	5.354
88	6	5.131	-0.392	1.304	5.418	-46.898	-0.589	16.278	6.933	7.251	7.307	7.561	7.026	7.585	7.396	7.255
88	7	5.230	-0.276	4.567	5.460	-44.775	0.331	16.060	9.362	9.722	9.646	9.913	9.249	9.944	9.863	9.770
88	8	5.584	-0.232	7.936	5.513	-45.280	0.996	15.745	12.724	13.132	12.930	13.221	12.392	13.394	13.376	13.373
88	9	5.988	-0.411	8.249	-0.232	-15.414	-0.232	16.369	6.244	6.354	6.183	6.264	5.794	6.289	6.237	6.402
88	10	6.268	-0.473	11.509	0.115	-8.740	-1.040	16.193	8.174	8.343	8.171	8.217	7.607	8.212	8.177	8.498
88	11	6.817	-0.475	14.538	0.514	-4.329	-1.575	15.973	10.663	10.751	10.525	10.509	9.807	10.587	10.432	10.967
88	12	7.184	-0.428	18.593	1.748	3.137	-1.520	15.645	14.261	14.411	13.970	13.843	13.081	14.182	14.160	14.626
88	13	5.524	-0.489	10.208	-1.540	18.473	-1.479	16.523	4.628	4.456	4.465	4.580	4.237	4.445	4.374	4.741
88	14	6.028	-0.573	13.262	-3.075	28.060	-2.496	16.364	6.336	6.226	6.192	6.377	5.931	6.276	6.197	6.578
88	15	6.279	-0.560	16.203	-3.671	35.155	-2.399	16.187	8.199	8.117	8.180	8.425	7.764	8.285	8.137	8.646
88	16	6.772	-0.561	19.377	-3.884	41.456	-2.466	15.974	10.565	10.444	10.559	10.644	9.909	10.668	10.190	11.153
88	17	7.183	-0.677	23.687	-1.880	49.335	-1.902	15.649	13.954	13.859	13.978	14.168	13.220	14.200	13.982	14.740
88	22	4.884	-0.435	10.665	-2.458	33.763	-2.949	16.626	3.383	3.424	3.318	3.446	3.171	3.406	3.326	3.405
88	23	5.240	-0.479	12.801	-3.299	43.460	-3.505	16.531	4.476	4.436	4.322	4.554	4.239	4.434	4.274	4.638
88	24	5.801	-0.610	15.759	-4.535	53.276	-2.982	16.373	6.298	6.108	6.027	6.371	5.934	6.144	5.931	6.634
88	25	6.369	-0.610	18.758	-4.793	60.132	-3.348	16.202	8.191	7.838	7.999	8.355	7.769	7.982	7.816	8.658
88	26	6.720	-0.634	21.953	-6.108	69.556	-2.870	15.987	10.664	10.108	10.325	10.706	9.961	10.290	10.250	11.080
89	5	4.754	-0.347	12.396	-4.764	45.782	-2.164	16.631	3.309	3.270	3.298	3.500	3.251	3.379	3.182	3.336
89	6	5.001	-0.418	14.430	-4.199	56.374	-2.034	16.537	4.330	4.366	4.262	4.540	4.227	4.410	4.332	4.441
89	7	5.549	-0.591	17.225	-3.975	65.871	-3.201	16.376	6.208	6.183	5.987	6.347	5.859	6.080	6.049	6.474
89	8	6.025	-0.455	20.454	-6.135	74.082	-2.468	16.206	8.078	8.013	7.800	8.354	7.739	7.912	7.934	8.434
87	5	4.407	-0.257	13.083	-6.066	54.042	-1.779	16.675	3.283	3.159	3.255	3.456	3.211	3.350	3.176	3.319
87	6	4.733	-0.350	15.133	-6.026	64.083	-1.245	16.581	4.250	4.361	4.208	4.550	4.180	4.335	4.298	4.366
87	7	5.326	-0.510	18.083	-5.481	74.980	-1.126	16.424	6.037	6.226	5.796	6.235	5.809	6.022	5.921	6.347

**Table C29c. Full Vehicle: Drone America x8, nominal speed 40 ft/s, yaw = -5 deg, pitch = -40 to 20 deg,
RPM = 5,600 to 9,200 (uniform) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
88	5	0.132	0.057	0.134	0.165	0.314	0.197	0.002	0.085	0.090	0.091	0.093	0.092	0.085	0.092	0.091
88	6	0.136	0.057	0.134	0.162	0.310	0.200	0.002	0.101	0.107	0.106	0.108	0.105	0.101	0.107	0.106
88	7	0.137	0.060	0.135	0.168	0.306	0.206	0.002	0.117	0.122	0.121	0.123	0.117	0.115	0.122	0.122
88	8	0.146	0.063	0.139	0.183	0.323	0.209	0.001	0.135	0.140	0.138	0.140	0.131	0.137	0.140	0.140
88	9	0.150	0.058	0.135	0.171	0.287	0.201	0.002	0.098	0.102	0.099	0.100	0.098	0.092	0.100	0.102
88	10	0.155	0.058	0.136	0.169	0.281	0.203	0.002	0.113	0.117	0.115	0.114	0.111	0.107	0.115	0.118
88	11	0.163	0.062	0.138	0.182	0.278	0.211	0.002	0.128	0.131	0.128	0.127	0.121	0.120	0.126	0.131
88	12	0.173	0.068	0.144	0.198	0.305	0.214	0.001	0.148	0.151	0.146	0.145	0.137	0.144	0.147	0.151
88	13	0.143	0.057	0.136	0.163	0.291	0.204	0.001	0.083	0.085	0.083	0.084	0.082	0.075	0.083	0.087
88	14	0.151	0.058	0.137	0.170	0.296	0.202	0.002	0.099	0.101	0.100	0.101	0.100	0.092	0.100	0.104
88	15	0.156	0.059	0.138	0.169	0.301	0.203	0.002	0.113	0.115	0.115	0.116	0.111	0.107	0.114	0.119
88	16	0.163	0.065	0.141	0.188	0.305	0.208	0.002	0.127	0.127	0.129	0.128	0.122	0.121	0.124	0.133
88	17	0.177	0.076	0.150	0.205	0.348	0.227	0.001	0.145	0.146	0.146	0.148	0.138	0.144	0.145	0.152
88	22	0.132	0.058	0.136	0.161	0.296	0.202	0.001	0.069	0.071	0.070	0.071	0.060	0.065	0.058	0.075
88	23	0.139	0.058	0.137	0.165	0.318	0.203	0.001	0.081	0.085	0.082	0.084	0.083	0.075	0.082	0.085
88	24	0.149	0.059	0.138	0.178	0.328	0.203	0.002	0.098	0.100	0.098	0.101	0.099	0.091	0.097	0.104
88	25	0.159	0.059	0.139	0.176	0.338	0.207	0.002	0.113	0.113	0.113	0.115	0.112	0.105	0.112	0.119
88	26	0.162	0.067	0.142	0.200	0.350	0.212	0.002	0.128	0.126	0.127	0.129	0.123	0.118	0.124	0.132
89	5	0.130	0.058	0.136	0.164	0.309	0.200	0.001	0.068	0.070	0.069	0.071	0.069	0.062	0.068	0.070
89	6	0.136	0.057	0.137	0.163	0.340	0.202	0.001	0.080	0.083	0.081	0.084	0.083	0.074	0.082	0.083
89	7	0.145	0.059	0.139	0.176	0.348	0.201	0.002	0.097	0.100	0.097	0.101	0.100	0.090	0.097	0.102
89	8	0.152	0.059	0.140	0.177	0.360	0.205	0.002	0.112	0.113	0.112	0.115	0.112	0.104	0.112	0.117
87	5	0.125	0.059	0.136	0.169	0.323	0.201	0.001	0.067	0.069	0.068	0.070	0.070	0.061	0.067	0.069
87	6	0.133	0.058	0.138	0.166	0.356	0.202	0.001	0.079	0.084	0.080	0.084	0.083	0.073	0.081	0.082
87	7	0.141	0.058	0.139	0.177	0.364	0.203	0.002	0.097	0.096	0.097	0.098	0.099	0.090	0.097	0.101

Table C30a. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -30 deg, pitch = -10 to 10 deg, RPM = 5,600 to 8,400 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
90	5	19.20	0.44	0.00237	-30	-9.91	5600	5600	5600	5600	5600	5600	5600	5600
90	6	19.89	0.47	0.00237	-30	-9.91	6200	6200	6200	6200	6200	6200	6200	6200
90	7	20.55	0.50	0.00237	-30	-9.91	7000	7000	7000	7000	7000	7000	7000	7000
90	8	20.67	0.51	0.00237	-30	-9.91	7700	7700	7700	7700	7700	7700	7700	7700
90	9	21.09	0.53	0.00237	-30	-9.91	8400	8400	8400	8400	8400	8400	8400	8400
90	10	20.58	0.50	0.00237	-30	-4.99	5600	5600	5600	5600	5600	5600	5600	5600
90	11	19.92	0.47	0.00237	-30	-4.99	6200	6200	6200	6200	6200	6200	6200	6200
90	12	20.32	0.49	0.00236	-30	-4.99	7000	7000	7000	7000	7000	7000	7000	7000
90	13	20.29	0.49	0.00236	-30	-4.99	7700	7700	7700	7700	7700	7700	7700	7700
90	14	19.88	0.47	0.00236	-30	-4.99	8400	8400	8400	8400	8400	8400	8400	8400
90	15	19.54	0.45	0.00236	-30	-1.99	5600	5600	5600	5600	5600	5600	5600	5600
90	16	19.64	0.46	0.00236	-30	-1.99	6200	6200	6200	6200	6200	6200	6200	6200
90	17	19.77	0.46	0.00236	-30	-1.99	7000	7000	7000	7000	7000	7000	7000	7000
90	18	20.70	0.46	0.00236	-30	-1.99	7700	7700	7700	7700	7700	7700	7700	7700
90	19	20.26	0.49	0.00236	-30	-1.99	8400	8400	8400	8400	8400	8400	8400	8400
90	20	20.14	0.48	0.00236	-30	-0.05	5600	5600	5600	5600	5600	5600	5600	5600
90	21	20.09	0.48	0.00236	-30	-0.05	6200	6200	6200	6200	6200	6200	6200	6200
90	22	19.73	0.46	0.00236	-30	-0.05	7000	7000	7000	7000	7000	7000	7000	7000
90	23	19.27	0.44	0.00236	-30	-0.05	7700	7700	7700	7700	7700	7700	7700	7700
90	24	20.34	0.49	0.00236	-30	-0.05	8400	8400	8400	8400	8400	8400	8400	8400
90	25	19.98	0.47	0.00236	-30	2.03	5600	5600	5600	5600	5600	5600	5600	5600
90	26	19.77	0.46	0.00236	-30	2.03	6200	6200	6200	6200	6200	6200	6200	6200
90	27	20.54	0.50	0.00236	-30	2.03	7000	7000	7000	7000	7000	7000	7000	7000
90	28	19.41	0.45	0.00236	-30	2.03	7700	7700	7700	7700	7700	7700	7700	7700
90	29	20.45	0.49	0.00236	-30	2.03	8400	8400	8400	8400	8400	8400	8400	8400
90	30	19.78	0.46	0.00237	-30	5.03	5600	5600	5600	5600	5600	5600	5600	5600
90	31	19.52	0.45	0.00237	-30	5.02	6200	6200	6200	6200	6200	6200	6200	6200
90	32	20.23	0.48	0.00237	-30	5.02	7000	7000	7000	7000	7000	7000	7000	7000
90	33	19.49	0.45	0.00237	-30	5.02	7700	7700	7700	7700	7700	7700	7700	7700
90	34	22.19	0.58	0.00237	-30	5.02	8400	8400	8400	8400	8400	8400	8400	8400
90	35	20.09	0.48	0.00237	-30	9.94	5600	5600	5600	5600	5600	5600	5600	5600
90	36	19.83	0.47	0.00237	-30	9.95	6200	6200	6200	6200	6200	6200	6200	6200
90	37	20.40	0.49	0.00237	-30	9.95	7000	7000	7000	7000	7000	7000	7000	7000
90	38	19.66	0.46	0.00237	-30	9.94	7700	7700	7700	7700	7700	7700	7700	7700
90	39	19.75	0.46	0.00237	-30	9.95	8400	8400	8400	8400	8400	8400	8400	8400

Table C30b. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -30 deg, pitch = -10 to 10 deg, RPM = 5,600 to 8,400 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
90	5	1.945	-0.989	8.050	-12.353	17.882	0.532	16.631	3.298	3.286	3.364	3.290	3.074	3.353	3.238	3.450
90	6	2.184	-1.109	9.926	-14.836	22.131	0.628	16.537	4.309	4.383	4.378	4.362	4.020	4.378	4.272	4.565
90	7	2.611	-1.240	12.871	-18.463	26.290	0.226	16.378	6.046	6.151	6.086	6.143	5.755	6.219	5.976	6.379
90	8	2.890	-1.331	15.777	-20.970	31.607	-0.147	16.199	8.091	8.151	8.047	7.997	7.574	8.168	7.936	8.391
90	9	3.199	-1.491	18.861	-24.800	35.676	0.265	15.988	10.271	10.578	10.320	10.441	9.421	10.643	9.948	10.599
90	10	2.147	-1.082	8.657	-17.333	26.726	0.978	16.631	3.342	3.295	3.267	3.300	3.069	3.332	3.243	3.411
90	11	2.259	-1.122	10.381	-21.019	29.403	0.917	16.538	4.313	4.417	4.376	4.278	4.029	4.391	4.168	4.448
90	12	2.622	-1.275	13.348	-24.165	35.200	0.161	16.379	5.992	6.172	6.000	6.138	5.715	6.148	5.976	6.330
90	13	2.896	-1.372	16.135	-25.538	38.338	0.114	16.207	7.831	8.082	7.828	8.093	7.416	8.123	7.871	8.303
90	14	3.060	-1.447	19.285	-28.113	42.704	0.494	15.986	10.159	10.587	10.141	10.410	9.815	10.390	10.046	10.941
90	15	2.035	-0.997	8.929	-20.702	29.221	0.454	16.631	3.341	3.297	3.251	3.356	3.070	3.296	3.183	3.330
90	16	2.240	-1.100	10.873	-24.298	34.103	0.381	16.536	4.314	4.403	4.366	4.386	4.083	4.310	4.259	4.418
90	17	2.560	-1.247	13.736	-28.416	39.645	-0.504	16.381	5.978	6.164	6.008	6.165	5.700	6.086	5.981	6.169
90	18	2.910	-1.419	16.610	-31.585	45.829	-0.277	16.204	7.910	8.162	7.807	8.147	7.426	8.064	7.960	8.269
90	19	3.101	-1.510	19.564	-32.567	49.238	-0.083	15.993	10.148	10.588	10.058	10.474	9.591	10.381	10.416	10.495
90	20	2.089	-1.035	9.227	-22.869	32.885	0.526	16.632	3.356	3.311	3.254	3.352	3.079	3.239	3.139	3.331
90	21	2.260	-1.143	11.137	-26.551	36.971	-0.202	16.538	4.321	4.404	4.255	4.392	4.035	4.306	4.217	4.439
90	22	2.568	-1.261	14.024	-31.031	42.478	-0.872	16.380	5.995	6.189	6.000	6.161	5.705	6.034	5.991	6.151
90	23	2.714	-1.337	16.706	-31.696	47.587	-0.537	16.206	7.911	8.090	7.809	8.014	7.424	8.009	7.975	8.262
90	24	3.119	-1.518	19.833	-35.826	53.725	-0.585	15.992	10.180	10.550	10.026	10.474	9.319	10.221	9.024	10.398
90	25	2.020	-1.082	9.572	-23.950	35.150	0.627	16.631	3.356	3.310	3.251	3.362	3.075	3.308	3.144	3.323
90	26	2.161	-1.114	11.387	-27.463	39.219	-0.759	16.539	4.324	4.406	4.247	4.387	4.028	4.310	4.191	4.378
90	27	2.630	-1.356	14.392	-32.986	47.023	-1.277	16.381	5.998	6.176	5.986	6.166	5.763	6.021	5.964	6.147
90	28	2.739	-1.372	16.932	-34.472	51.117	-0.827	16.208	7.906	8.093	7.804	7.993	7.493	7.938	7.959	8.120
90	29	3.127	-1.581	20.009	-38.891	58.448	-0.879	15.998	10.146	10.478	10.028	10.402	9.537	10.272	10.399	10.359
90	30	1.854	-0.887	9.955	-24.955	41.003	0.191	16.633	3.352	3.287	3.244	3.310	3.030	3.291	3.127	3.319
90	31	2.035	-1.133	11.880	-28.915	45.503	0.209	16.539	4.321	4.411	4.184	4.385	4.077	4.317	4.159	4.416
90	32	2.512	-1.362	14.729	-34.657	52.231	-1.216	16.383	5.995	6.162	5.868	6.155	5.706	6.015	5.971	6.141
90	33	2.681	-1.349	17.208	-38.026	56.887	-0.799	16.211	7.918	8.103	7.731	8.017	7.432	7.916	7.889	8.099
90	34	3.315	-1.758	20.943	-47.470	69.437	-1.256	15.996	10.201	10.595	9.973	10.425	9.481	10.121	9.972	10.426
90	35	1.768	-0.793	10.772	-29.027	50.909	1.915	16.633	3.283	3.365	3.234	3.292	3.069	3.299	3.110	3.352
90	36	1.917	-0.983	12.428	-31.308	55.521	2.066	16.542	4.307	4.334	4.167	4.261	4.028	4.422	4.117	4.437
90	37	2.253	-1.191	15.346	-36.847	63.947	1.180	16.387	6.084	5.942	5.825	6.029	5.753	6.029	5.947	6.153
90	38	2.556	-1.243	17.792	-41.560	67.475	-0.331	16.215	7.925	8.052	7.485	8.019	7.464	7.818	7.941	8.019
90	39	2.903	-1.440	20.852	-45.686	73.910	0.220	16.006	10.166	10.344	9.743	10.403	9.535	10.086	10.297	10.349

Table C30c. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -30 deg, pitch = -10 to 10 deg, RPM = 5,600 to 8,400 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
90	5	0.096	0.059	0.135	0.163	0.280	0.194	0.001	0.068	0.069	0.070	0.067	0.068	0.061	0.068	0.070
90	6	0.099	0.059	0.136	0.166	0.288	0.195	0.001	0.080	0.083	0.082	0.081	0.081	0.074	0.078	0.085
90	7	0.106	0.060	0.136	0.182	0.293	0.195	0.002	0.096	0.100	0.099	0.098	0.097	0.092	0.098	0.101
90	8	0.108	0.060	0.138	0.184	0.292	0.196	0.002	0.112	0.115	0.114	0.112	0.109	0.106	0.112	0.117
90	9	0.110	0.063	0.140	0.198	0.296	0.201	0.002	0.124	0.129	0.127	0.126	0.118	0.121	0.123	0.128
90	10	0.098	0.059	0.135	0.172	0.288	0.196	0.001	0.068	0.069	0.069	0.068	0.067	0.061	0.068	0.070
90	11	0.101	0.059	0.136	0.179	0.297	0.196	0.001	0.079	0.084	0.082	0.082	0.079	0.074	0.080	0.083
90	12	0.106	0.061	0.137	0.194	0.302	0.195	0.002	0.095	0.100	0.098	0.098	0.096	0.091	0.097	0.101
90	13	0.109	0.060	0.138	0.196	0.301	0.199	0.002	0.110	0.115	0.112	0.112	0.108	0.106	0.112	0.116
90	14	0.108	0.064	0.140	0.206	0.304	0.203	0.002	0.123	0.129	0.126	0.125	0.121	0.118	0.122	0.131
90	15	0.097	0.059	0.135	0.178	0.290	0.196	0.001	0.068	0.070	0.069	0.068	0.066	0.060	0.067	0.069
90	16	0.100	0.059	0.136	0.185	0.302	0.196	0.001	0.080	0.084	0.082	0.082	0.081	0.073	0.081	0.082
90	17	0.105	0.060	0.137	0.205	0.306	0.196	0.002	0.095	0.100	0.098	0.098	0.096	0.090	0.098	0.099
90	18	0.108	0.060	0.138	0.211	0.310	0.199	0.002	0.110	0.115	0.111	0.113	0.109	0.105	0.112	0.115
90	19	0.109	0.064	0.140	0.218	0.313	0.205	0.002	0.123	0.129	0.125	0.126	0.119	0.119	0.126	0.127
90	20	0.098	0.059	0.135	0.182	0.294	0.197	0.001	0.068	0.070	0.069	0.068	0.066	0.060	0.067	0.069
90	21	0.101	0.059	0.136	0.192	0.306	0.197	0.001	0.080	0.084	0.081	0.082	0.080	0.073	0.081	0.082
90	22	0.106	0.061	0.137	0.213	0.311	0.196	0.002	0.095	0.100	0.098	0.098	0.096	0.090	0.098	0.099
90	23	0.107	0.060	0.138	0.213	0.312	0.198	0.002	0.110	0.115	0.111	0.112	0.109	0.105	0.112	0.115
90	24	0.109	0.064	0.140	0.230	0.320	0.204	0.002	0.123	0.129	0.124	0.126	0.116	0.117	0.118	0.126
90	25	0.097	0.059	0.135	0.184	0.296	0.196	0.001	0.068	0.070	0.069	0.069	0.066	0.061	0.067	0.069
90	26	0.100	0.059	0.136	0.194	0.306	0.198	0.001	0.080	0.084	0.081	0.082	0.080	0.073	0.080	0.082
90	27	0.106	0.061	0.137	0.215	0.316	0.197	0.002	0.095	0.100	0.098	0.098	0.096	0.090	0.097	0.099
90	28	0.107	0.060	0.138	0.218	0.317	0.199	0.002	0.110	0.115	0.112	0.112	0.109	0.104	0.112	0.114
90	29	0.109	0.065	0.141	0.238	0.328	0.206	0.002	0.123	0.129	0.124	0.126	0.119	0.118	0.125	0.126
90	30	0.096	0.059	0.135	0.187	0.303	0.197	0.001	0.068	0.069	0.069	0.068	0.066	0.060	0.066	0.069
90	31	0.099	0.059	0.136	0.197	0.315	0.197	0.001	0.080	0.084	0.080	0.082	0.079	0.073	0.080	0.082
90	32	0.105	0.061	0.137	0.220	0.325	0.198	0.002	0.095	0.100	0.096	0.098	0.097	0.089	0.097	0.099
90	33	0.107	0.060	0.138	0.228	0.326	0.200	0.002	0.110	0.115	0.111	0.112	0.109	0.104	0.112	0.114
90	34	0.111	0.067	0.141	0.265	0.348	0.210	0.002	0.124	0.129	0.124	0.126	0.119	0.116	0.123	0.126
90	35	0.095	0.058	0.136	0.197	0.317	0.199	0.001	0.068	0.070	0.068	0.068	0.066	0.061	0.066	0.069
90	36	0.098	0.060	0.137	0.205	0.333	0.198	0.001	0.079	0.083	0.080	0.080	0.080	0.074	0.080	0.082
90	37	0.102	0.061	0.138	0.227	0.341	0.198	0.002	0.096	0.098	0.096	0.097	0.097	0.090	0.097	0.099
90	38	0.106	0.060	0.139	0.240	0.346	0.202	0.002	0.110	0.114	0.109	0.112	0.109	0.103	0.112	0.113
90	39	0.107	0.065	0.141	0.259	0.356	0.208	0.002	0.123	0.128	0.122	0.126	0.119	0.116	0.124	0.126

Table C31a. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 5,600 to 8,400 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
91	5	19.89	0.47	0.00238	-45	-9.91	5600	5600	5600	5600	5600	5600	5600	5600
91	6	20.39	0.49	0.00238	-45	-9.91	6200	6200	6200	6200	6200	6200	6200	6200
91	7	20.68	0.51	0.00238	-45	-9.91	7000	7000	7000	7000	7000	7000	7000	7000
91	9	20.27	0.49	0.00238	-45	-9.91	7700	7700	7700	7700	7700	7700	7700	7700
91	10	20.68	0.51	0.00238	-45	-9.91	8400	8400	8400	8400	8400	8400	8400	8400
91	15	20.04	0.48	0.00238	-45	-4.99	5600	5600	5600	5600	5600	5600	5600	5600
91	16	20.31	0.49	0.00238	-45	-4.99	6200	6200	6200	6200	6200	6200	6200	6200
91	17	20.57	0.50	0.00238	-45	-4.99	7000	7000	7000	7000	7000	7000	7000	7000
91	18	20.32	0.49	0.00238	-45	-4.99	7700	7700	7700	7700	7700	7700	7700	7700
91	19	20.51	0.50	0.00238	-45	-4.99	8400	8400	8400	8400	8400	8400	8400	8400
91	24	20.61	0.51	0.00238	-45	-1.99	5600	5600	5600	5600	5600	5600	5600	5600
91	25	20.50	0.50	0.00238	-45	-1.99	6200	6200	6200	6200	6200	6200	6200	6200
91	26	20.61	0.51	0.00238	-45	-1.99	7000	7000	7000	7000	7000	7000	7000	7000
91	27	20.57	0.50	0.00238	-45	-1.99	7700	7700	7700	7700	7700	7700	7700	7700
91	28	20.06	0.48	0.00238	-45	-1.99	8400	8400	8400	8400	8400	8400	8400	8400
91	33	19.91	0.47	0.00238	-45	0.11	5600	5600	5600	5600	5600	5600	5600	5600
91	34	19.86	0.47	0.00238	-45	0.11	6200	6200	6200	6200	6200	6200	6200	6200
91	35	19.85	0.47	0.00238	-45	-0.01	7000	7000	7000	7000	7000	7000	7000	7000
91	36	19.81	0.47	0.00238	-45	0.04	7700	7700	7700	7700	7700	7700	7700	7700
91	37	20.20	0.49	0.00238	-45	0.11	8400	8400	8400	8400	8400	8400	8400	8400
92	9	19.29	0.45	0.00241	-45	2.03	5600	5600	5600	5600	5600	5600	5600	5600
92	10	20.09	0.49	0.00241	-45	2.03	6200	6200	6200	6200	6200	6200	6200	6200
92	11	20.00	0.48	0.00241	-45	2.03	7000	7000	7000	7000	7000	7000	7000	7000
92	12	19.48	0.46	0.00241	-45	2.03	7700	7700	7700	7700	7700	7700	7700	7700
92	13	20.28	0.50	0.00241	-45	2.03	8400	8400	8400	8400	8400	8400	8400	8400
92	17	20.39	0.50	0.00241	-45	5.03	5600	5600	5600	5600	5600	5600	5600	5600
92	18	19.99	0.48	0.00241	-45	5.03	6200	6200	6200	6200	6200	6200	6200	6200
92	19	19.44	0.45	0.00241	-45	5.03	7000	7000	7000	7000	7000	7000	7000	7000
92	20	19.55	0.46	0.00241	-45	5.03	7700	7700	7700	7700	7700	7700	7700	7700
92	21	20.26	0.49	0.00241	-45	5.03	8400	8400	8400	8400	8400	8400	8400	8400
92	25	20.51	0.51	0.00241	-45	9.95	5600	5600	5600	5600	5600	5600	5600	5600
92	26	20.02	0.48	0.00241	-45	9.95	6200	6200	6200	6200	6200	6200	6200	6200
92	27	19.96	0.48	0.00241	-45	9.95	7000	7000	7000	7000	7000	7000	7000	7000
92	28	19.09	0.44	0.00241	-45	9.95	7700	7700	7700	7700	7700	7700	7700	7700
92	29	20.14	0.49	0.00241	-45	9.95	8400	8400	8400	8400	8400	8400	8400	8400

**Table C31b. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg,
RPM = 5,600 to 8,400 (uniform) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
91	5	1.563	-1.437	7.898	-13.420	15.610	-0.129	16.630	3.348	3.288	3.300	3.278	3.054	3.413	3.263	3.529
91	6	1.743	-1.579	9.782	-16.280	19.441	0.151	16.535	4.429	4.405	4.303	4.302	4.006	4.471	4.266	4.635
91	7	1.971	-1.800	12.649	-19.477	23.868	0.492	16.378	6.146	6.163	5.996	5.964	5.556	6.302	6.020	6.494
91	9	2.136	-1.904	15.457	-22.359	28.126	0.983	16.199	8.108	8.099	7.878	7.900	7.393	8.295	8.014	8.503
91	10	2.421	-2.092	18.475	-26.782	34.343	1.610	15.981	10.606	10.491	10.227	10.209	9.590	10.655	10.290	10.925
91	15	1.614	-1.424	8.347	-20.328	22.306	0.036	16.633	3.352	3.291	3.248	3.212	2.955	3.416	3.191	3.422
91	16	1.769	-1.591	10.375	-23.223	25.548	0.287	16.535	4.432	4.385	4.294	4.341	4.007	4.500	4.281	4.538
91	17	1.990	-1.791	13.229	-26.874	30.612	0.752	16.378	6.190	6.137	5.923	6.066	5.571	6.292	6.039	6.483
91	18	2.088	-1.962	15.937	-29.460	35.229	1.147	16.203	8.042	8.077	7.794	7.894	7.396	8.291	7.932	8.501
91	19	2.352	-2.123	18.954	-33.652	41.641	1.788	15.985	10.448	10.420	10.072	10.304	9.551	10.658	10.189	10.910
91	24	1.644	-1.463	8.855	-24.957	26.014	-0.190	16.632	3.357	3.297	3.232	3.285	2.963	3.412	3.193	3.414
91	25	1.796	-1.571	10.716	-27.851	30.648	0.241	16.537	4.441	4.356	4.233	4.300	3.924	4.450	4.285	4.531
91	26	2.023	-1.767	13.511	-32.084	35.378	0.857	16.378	6.136	6.123	5.910	6.087	5.564	6.297	6.030	6.385
91	27	2.195	-1.980	16.210	-34.759	39.548	1.329	16.206	8.107	7.992	7.743	7.915	7.363	8.281	7.893	8.334
91	28	2.286	-2.126	19.174	-37.911	46.064	1.801	15.988	10.361	10.396	9.988	10.244	9.460	10.606	9.966	10.806
91	33	1.524	-1.399	9.084	-26.918	28.079	-0.145	16.633	3.359	3.297	3.179	3.283	2.955	3.420	3.183	3.408
91	34	1.666	-1.501	10.912	-30.184	32.392	-0.060	16.538	4.435	4.345	4.210	4.311	3.939	4.460	4.263	4.526
91	35	1.923	-1.655	13.685	-33.433	37.320	0.868	16.380	6.142	6.030	5.865	6.083	5.561	6.307	6.081	6.322
91	36	2.079	-1.828	16.357	-36.857	42.923	1.236	16.204	8.103	8.067	7.668	7.914	7.394	8.264	8.050	8.360
91	37	2.322	-2.120	19.418	-41.216	48.242	1.713	15.991	10.345	10.399	9.797	10.248	9.616	10.639	10.532	10.807
92	9	1.397	-1.410	9.656	-29.456	31.378	0.099	16.616	3.439	3.338	3.192	3.289	3.070	3.486	3.214	3.447
92	10	1.603	-1.646	11.678	-33.436	36.107	0.559	16.521	4.462	4.416	4.158	4.366	4.016	4.584	4.309	4.540
92	11	1.896	-1.698	14.353	-37.488	42.389	0.449	16.361	6.259	6.146	5.887	6.135	5.660	6.346	6.053	6.402
92	12	2.065	-1.863	16.913	-40.524	46.267	0.578	16.183	8.190	8.051	7.731	8.051	7.450	8.335	8.083	8.453
92	13	2.361	-2.179	20.003	-46.362	53.080	0.759	15.963	10.621	10.488	9.937	10.421	9.714	10.735	10.511	10.909
92	17	1.483	-1.380	10.129	-35.528	37.777	-1.169	16.616	3.492	3.342	3.139	3.283	3.056	3.417	3.186	3.442
92	18	1.533	-1.558	12.027	-38.248	41.332	0.448	16.522	4.471	4.396	4.100	4.367	4.017	4.527	4.272	4.516
92	19	1.735	-1.692	14.686	-40.513	45.837	0.497	16.363	6.255	6.125	5.752	6.144	5.614	6.340	6.042	6.365
92	20	1.987	-1.791	17.177	-44.104	51.830	0.219	16.185	8.239	8.053	7.599	8.059	7.380	8.268	8.033	8.460
92	21	2.299	-2.070	20.261	-51.065	58.011	0.308	15.968	10.643	10.334	9.885	10.409	9.615	10.649	10.336	10.838
92	25	1.303	-1.225	10.959	-40.734	45.741	-1.574	16.618	3.607	3.268	3.120	3.201	2.956	3.413	3.178	3.521
92	26	1.438	-1.314	12.614	-44.893	48.443	-1.914	16.524	4.671	4.232	4.056	4.277	3.993	4.446	4.247	4.578
92	27	1.628	-1.550	15.479	-51.159	54.506	-0.443	16.366	6.297	6.112	5.688	6.072	5.606	6.290	6.016	6.317
92	28	1.796	-1.517	17.732	-50.570	56.030	-1.349	16.190	8.301	7.929	7.475	8.050	7.453	8.225	8.019	8.320
92	29	2.087	-1.792	20.940	-57.184	65.266	-1.228	15.975	10.683	10.250	9.582	10.380	9.560	10.610	10.217	10.841

Table C31c. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 5,600 to 8,400 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
91	5	0.094	0.061	0.135	0.168	0.279	0.195	0.001	0.068	0.070	0.069	0.068	0.067	0.062	0.069	0.071
91	6	0.096	0.062	0.136	0.173	0.286	0.197	0.001	0.081	0.083	0.082	0.081	0.080	0.075	0.081	0.085
91	7	0.099	0.064	0.136	0.187	0.287	0.196	0.002	0.097	0.100	0.098	0.097	0.097	0.092	0.098	0.102
91	9	0.099	0.062	0.137	0.188	0.289	0.198	0.002	0.112	0.115	0.113	0.111	0.108	0.107	0.113	0.117
91	10	0.101	0.067	0.140	0.205	0.295	0.204	0.002	0.127	0.129	0.126	0.124	0.119	0.121	0.124	0.131
91	15	0.094	0.061	0.135	0.180	0.284	0.196	0.001	0.068	0.070	0.069	0.068	0.065	0.062	0.068	0.070
91	16	0.096	0.061	0.136	0.185	0.290	0.197	0.001	0.081	0.083	0.082	0.082	0.079	0.075	0.082	0.084
91	17	0.099	0.063	0.137	0.202	0.294	0.197	0.002	0.097	0.100	0.097	0.097	0.096	0.092	0.098	0.102
91	18	0.099	0.063	0.138	0.206	0.297	0.199	0.002	0.112	0.114	0.112	0.111	0.108	0.107	0.112	0.117
91	19	0.101	0.068	0.140	0.227	0.304	0.206	0.002	0.126	0.128	0.125	0.125	0.118	0.121	0.125	0.130
91	24	0.094	0.061	0.135	0.189	0.289	0.196	0.001	0.069	0.070	0.069	0.068	0.066	0.062	0.068	0.070
91	25	0.096	0.061	0.136	0.195	0.294	0.198	0.001	0.081	0.083	0.081	0.081	0.079	0.074	0.082	0.084
91	26	0.100	0.064	0.137	0.220	0.299	0.198	0.002	0.097	0.100	0.097	0.098	0.095	0.093	0.098	0.101
91	27	0.101	0.063	0.138	0.222	0.303	0.200	0.002	0.112	0.114	0.111	0.111	0.107	0.107	0.112	0.116
91	28	0.100	0.068	0.140	0.237	0.311	0.207	0.002	0.125	0.128	0.124	0.125	0.118	0.120	0.123	0.130
91	33	0.094	0.061	0.135	0.194	0.291	0.196	0.001	0.068	0.070	0.068	0.068	0.066	0.062	0.067	0.070
91	34	0.096	0.062	0.136	0.204	0.298	0.198	0.001	0.081	0.083	0.081	0.081	0.079	0.075	0.081	0.084
91	35	0.098	0.063	0.137	0.218	0.301	0.199	0.002	0.097	0.099	0.097	0.097	0.096	0.092	0.099	0.101
91	36	0.100	0.062	0.138	0.227	0.308	0.201	0.002	0.112	0.113	0.111	0.111	0.108	0.107	0.113	0.116
91	37	0.101	0.068	0.140	0.246	0.314	0.204	0.002	0.125	0.128	0.123	0.125	0.119	0.121	0.127	0.130
92	9	0.093	0.061	0.135	0.199	0.293	0.195	0.001	0.069	0.070	0.068	0.068	0.066	0.063	0.068	0.070
92	10	0.095	0.062	0.136	0.209	0.300	0.197	0.001	0.081	0.084	0.080	0.082	0.081	0.076	0.082	0.083
92	11	0.100	0.064	0.137	0.235	0.310	0.199	0.002	0.098	0.100	0.097	0.098	0.095	0.093	0.098	0.102
92	12	0.100	0.063	0.138	0.236	0.313	0.203	0.002	0.113	0.114	0.111	0.112	0.109	0.108	0.113	0.117
92	13	0.101	0.070	0.141	0.267	0.323	0.214	0.002	0.127	0.128	0.123	0.125	0.120	0.121	0.126	0.130
92	17	0.093	0.061	0.135	0.215	0.300	0.197	0.001	0.070	0.070	0.068	0.068	0.066	0.062	0.067	0.070
92	18	0.094	0.062	0.136	0.223	0.307	0.197	0.001	0.082	0.083	0.079	0.081	0.080	0.076	0.082	0.084
92	19	0.097	0.063	0.137	0.237	0.313	0.197	0.002	0.098	0.099	0.096	0.098	0.095	0.093	0.098	0.101
92	20	0.099	0.062	0.139	0.249	0.321	0.202	0.002	0.113	0.114	0.110	0.112	0.108	0.107	0.113	0.117
92	21	0.101	0.069	0.141	0.278	0.330	0.209	0.002	0.127	0.127	0.123	0.126	0.119	0.121	0.125	0.129
92	25	0.092	0.060	0.136	0.232	0.311	0.198	0.001	0.071	0.069	0.067	0.067	0.067	0.062	0.067	0.071
92	26	0.094	0.062	0.137	0.246	0.320	0.200	0.001	0.083	0.081	0.079	0.080	0.080	0.075	0.081	0.084
92	27	0.097	0.062	0.138	0.268	0.325	0.199	0.002	0.098	0.099	0.094	0.097	0.096	0.092	0.098	0.101
92	28	0.098	0.061	0.139	0.267	0.327	0.205	0.002	0.114	0.113	0.108	0.112	0.108	0.107	0.113	0.116
92	29	0.099	0.069	0.142	0.299	0.343	0.212	0.002	0.128	0.126	0.120	0.125	0.119	0.120	0.124	0.130

Table C32a. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -60 deg, pitch = -10 to 10 deg, RPM = 5,600 to 8,400 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
93	5	20.00	0.48	0.00241	-60	-9.91	5600	5600	5600	5600	5600	5600	5600	5600
93	6	20.01	0.48	0.00241	-60	-9.91	6200	6200	6200	6200	6200	6200	6200	6200
93	7	20.15	0.49	0.00241	-60	-9.90	7000	7000	7000	7000	7000	7000	7000	7000
93	8	20.05	0.48	0.00241	-60	-9.91	7700	7700	7700	7700	7700	7700	7700	7700
93	9	20.01	0.48	0.00241	-60	-9.91	8400	8400	8400	8400	8400	8400	8400	8400
93	10	19.35	0.45	0.00240	-60	-4.98	5600	5600	5600	5600	5600	5600	5600	5600
93	11	19.36	0.45	0.00240	-60	-4.98	6200	6200	6200	6200	6200	6200	6200	6200
93	12	19.33	0.45	0.00240	-60	-4.98	7000	7000	7000	7000	7000	7000	7000	7000
93	13	20.48	0.50	0.00240	-60	-4.98	7700	7700	7700	7700	7700	7700	7700	7700
93	14	20.20	0.49	0.00240	-60	-4.98	8400	8400	8400	8400	8400	8400	8400	8400
93	15	20.22	0.49	0.00240	-60	-1.98	5600	5600	5600	5600	5600	5600	5600	5600
93	16	19.93	0.48	0.00240	-60	-1.98	6200	6200	6200	6200	6200	6200	6200	6200
93	17	19.54	0.46	0.00240	-60	-1.98	7000	7000	7000	7000	7000	7000	7000	7000
93	18	20.47	0.50	0.00240	-60	-1.98	7700	7700	7700	7700	7700	7700	7700	7700
93	19	20.21	0.49	0.00240	-60	-1.98	8400	8400	8400	8400	8400	8400	8400	8400
93	20	20.37	0.50	0.00240	-60	-0.04	5600	5600	5600	5600	5600	5600	5600	5600
93	21	20.29	0.49	0.00240	-60	-0.05	6200	6200	6200	6200	6200	6200	6200	6200
93	22	19.84	0.47	0.00240	-60	-0.04	7000	7000	7000	7000	7000	7000	7000	7000
93	23	19.19	0.44	0.00240	-60	-0.04	7700	7700	7700	7700	7700	7700	7700	7700
93	24	20.52	0.50	0.00240	-60	-0.04	8400	8400	8400	8400	8400	8400	8400	8400
93	25	20.25	0.49	0.00240	-60	2.03	5600	5600	5600	5600	5600	5600	5600	5600
93	26	19.90	0.47	0.00240	-60	2.03	6200	6200	6200	6200	6200	6200	6200	6200
93	27	20.23	0.49	0.00240	-60	2.03	7000	7000	7000	7000	7000	7000	7000	7000
93	28	20.48	0.50	0.00240	-60	2.03	7700	7700	7700	7700	7700	7700	7700	7700
93	29	20.73	0.51	0.00239	-60	2.04	8400	8400	8400	8400	8400	8400	8400	8400
93	30	20.54	0.50	0.00239	-60	5.03	5600	5600	5600	5600	5600	5600	5600	5600
93	31	19.99	0.48	0.00239	-60	5.03	6200	6200	6200	6200	6200	6200	6200	6200
93	32	20.52	0.50	0.00239	-60	5.03	7000	7000	7000	7000	7000	7000	7000	7000
93	33	19.89	0.47	0.00239	-60	5.03	7700	7700	7700	7700	7700	7700	7700	7700
93	34	19.27	0.44	0.00239	-60	5.03	8400	8400	8400	8400	8400	8400	8400	8400
93	35	19.27	0.44	0.00239	-60	9.95	5600	5600	5600	5600	5600	5600	5600	5600
93	36	19.46	0.45	0.00239	-60	9.95	6200	6200	6200	6200	6200	6200	6200	6200
93	37	19.95	0.48	0.00239	-60	9.95	7000	7000	7000	7000	7000	7000	7000	7000
93	38	20.02	0.48	0.00239	-60	9.95	7700	7700	7700	7700	7700	7700	7700	7700
93	39	20.52	0.50	0.00239	-60	9.95	8400	8400	8400	8400	8400	8400	8400	8400

**Table C32b. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -60 deg, pitch = -10 to 10 deg,
RPM = 5,600 to 8,400 (uniform) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
93	5	1.221	-1.793	8.419	-15.702	13.002	-0.042	16.614	3.464	3.267	3.272	3.273	3.043	3.493	3.254	3.521
93	6	1.337	-2.003	10.411	-19.051	15.648	0.037	16.514	4.554	4.374	4.282	4.376	4.022	4.652	4.446	4.653
93	7	1.510	-2.312	13.382	-24.340	18.643	1.024	16.350	6.332	6.227	6.029	6.141	5.733	6.503	6.166	6.524
93	8	1.728	-2.423	16.237	-27.260	23.419	1.951	16.172	8.370	8.111	7.894	8.005	7.396	8.539	8.125	8.601
93	9	1.849	-2.710	19.354	-29.834	25.995	2.766	15.948	10.724	10.554	10.226	10.474	9.675	10.979	10.497	11.018
93	10	1.191	-1.745	8.937	-22.855	17.753	-0.722	16.612	3.475	3.265	3.218	3.286	3.004	3.550	3.249	3.527
93	11	1.288	-1.956	10.892	-26.816	20.896	-0.754	16.518	4.518	4.303	4.162	4.360	3.998	4.602	4.348	4.656
93	12	1.472	-2.239	13.842	-31.535	24.078	0.333	16.355	6.281	6.040	5.894	6.128	5.664	6.507	6.206	6.523
93	13	1.745	-2.626	16.792	-36.235	28.915	1.085	16.178	8.220	8.009	7.746	7.973	7.427	8.474	8.146	8.523
93	14	1.841	-2.827	19.947	-40.409	31.761	2.062	15.954	10.704	10.414	10.003	10.477	9.507	11.036	10.421	10.920
93	15	1.204	-1.748	9.333	-27.131	21.083	-1.130	16.616	3.486	3.271	3.102	3.231	2.983	3.545	3.248	3.417
93	16	1.346	-1.926	11.238	-30.478	24.808	-0.966	16.520	4.516	4.295	4.084	4.256	4.000	4.600	4.338	4.640
93	17	1.504	-2.235	14.225	-35.805	29.804	-0.251	16.356	6.298	6.026	5.756	6.029	5.639	6.502	6.162	6.737
93	18	1.752	-2.590	17.079	-41.468	32.146	0.319	16.184	8.217	7.862	7.569	7.971	7.398	8.476	8.136	8.501
93	19	1.870	-2.808	20.174	-45.730	35.409	1.340	15.962	10.707	10.190	9.840	10.389	9.362	10.840	10.244	10.966
93	20	1.146	-1.730	9.734	-30.581	22.772	-1.669	16.616	3.482	3.268	3.057	3.231	2.970	3.549	3.263	3.452
93	21	1.316	-1.896	11.561	-34.354	26.027	-1.778	16.520	4.577	4.303	4.050	4.241	3.936	4.651	4.341	4.633
93	22	1.567	-2.171	14.412	-39.177	31.313	-0.372	16.360	6.340	6.016	5.734	6.068	5.484	6.506	6.161	6.391
93	23	1.695	-2.323	17.218	-42.878	33.187	0.739	16.183	8.291	7.838	7.549	7.989	7.318	8.490	8.108	8.485
93	24	1.935	-2.755	20.510	-49.876	39.855	0.925	15.962	10.689	10.302	9.719	10.370	9.300	10.860	10.384	10.965
93	25	1.061	-1.641	10.042	-33.534	24.468	-1.726	16.616	3.479	3.270	3.027	3.220	2.996	3.525	3.296	3.453
93	26	1.226	-1.821	11.847	-36.800	27.776	-1.980	16.522	4.521	4.306	3.999	4.245	3.899	4.602	4.347	4.592
93	27	1.551	-2.127	14.851	-41.912	33.823	-1.046	16.362	6.300	6.014	5.643	6.003	5.464	6.461	6.160	6.465
93	28	1.816	-2.406	17.678	-46.310	39.587	0.268	16.185	8.230	7.840	7.473	7.971	7.220	8.495	8.128	8.449
93	29	1.990	-2.676	20.832	-51.978	43.368	1.036	15.965	10.668	10.094	9.632	10.397	9.319	10.907	10.460	10.904
93	30	1.003	-1.565	10.642	-39.631	27.122	-1.837	16.620	3.478	3.149	3.023	3.219	2.920	3.498	3.250	3.430
93	31	1.127	-1.704	12.435	-42.354	30.103	-2.074	16.525	4.564	4.200	3.877	4.236	3.881	4.647	4.335	4.504
93	32	1.387	-2.022	15.459	-48.483	35.688	-1.660	16.366	6.281	5.938	5.501	5.999	5.474	6.465	6.164	6.318
93	33	1.710	-2.210	18.017	-50.453	39.948	-0.720	16.193	8.201	7.765	7.236	7.959	7.160	8.447	8.117	8.291
93	34	1.903	-2.390	21.047	-53.849	38.922	1.465	15.966	10.695	10.039	9.591	10.401	9.374	10.925	10.485	10.823
93	35	0.856	-1.263	10.978	-43.837	30.550	-2.696	16.617	3.709	3.123	3.018	3.168	2.958	3.509	3.236	3.389
93	36	0.921	-1.468	12.756	-50.823	33.438	-4.729	16.529	4.524	4.132	3.882	4.193	3.880	4.603	4.267	4.504
93	37	1.227	-1.788	16.022	-56.272	38.852	-4.097	16.370	6.267	5.811	5.490	5.939	5.532	6.466	6.069	6.256
93	38	1.492	-2.000	19.046	-62.295	41.597	-3.226	16.194	8.193	7.712	7.219	7.951	7.226	8.461	8.053	8.260
93	39	1.792	-2.270	22.341	-67.959	47.070	-3.624	15.977	10.704	9.946	9.275	10.283	9.363	10.867	10.391	10.680

**Table C32c. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -60 deg, pitch = -10 to 10 deg,
RPM = 5,600 to 8,400 (uniform) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
93	5	0.092	0.064	0.135	0.178	0.279	0.194	0.001	0.070	0.069	0.069	0.067	0.066	0.063	0.069	0.071
93	6	0.092	0.064	0.136	0.177	0.280	0.195	0.001	0.082	0.084	0.082	0.082	0.074	0.079	0.071	0.089
93	7	0.094	0.065	0.137	0.188	0.284	0.196	0.002	0.098	0.100	0.098	0.098	0.096	0.095	0.099	0.103
93	8	0.096	0.065	0.138	0.193	0.286	0.197	0.002	0.114	0.115	0.112	0.112	0.109	0.109	0.113	0.118
93	9	0.096	0.070	0.140	0.211	0.289	0.204	0.002	0.128	0.129	0.126	0.126	0.120	0.123	0.126	0.131
93	10	0.091	0.063	0.135	0.187	0.281	0.195	0.001	0.070	0.069	0.069	0.068	0.066	0.064	0.068	0.072
93	11	0.092	0.064	0.136	0.195	0.284	0.196	0.001	0.082	0.082	0.081	0.081	0.080	0.076	0.082	0.085
93	12	0.094	0.065	0.137	0.207	0.288	0.196	0.002	0.098	0.099	0.097	0.098	0.096	0.094	0.100	0.102
93	13	0.096	0.066	0.138	0.219	0.293	0.198	0.002	0.113	0.113	0.112	0.111	0.108	0.109	0.114	0.118
93	14	0.096	0.071	0.141	0.239	0.295	0.205	0.002	0.128	0.127	0.124	0.126	0.119	0.124	0.125	0.130
93	15	0.092	0.063	0.135	0.199	0.284	0.196	0.001	0.070	0.069	0.067	0.067	0.066	0.064	0.068	0.070
93	16	0.092	0.063	0.136	0.203	0.286	0.197	0.001	0.082	0.082	0.080	0.080	0.079	0.077	0.082	0.085
93	17	0.094	0.065	0.137	0.219	0.293	0.197	0.002	0.098	0.099	0.094	0.098	0.096	0.095	0.100	0.105
93	18	0.096	0.066	0.138	0.232	0.295	0.199	0.002	0.113	0.112	0.110	0.111	0.107	0.109	0.114	0.118
93	19	0.097	0.073	0.141	0.258	0.299	0.206	0.002	0.128	0.126	0.122	0.126	0.117	0.122	0.125	0.131
93	20	0.091	0.062	0.135	0.205	0.285	0.197	0.001	0.069	0.069	0.067	0.067	0.065	0.064	0.068	0.071
93	21	0.093	0.064	0.136	0.214	0.288	0.198	0.001	0.082	0.082	0.079	0.080	0.080	0.077	0.083	0.085
93	22	0.095	0.064	0.137	0.230	0.294	0.199	0.002	0.098	0.098	0.095	0.097	0.095	0.094	0.100	0.101
93	23	0.096	0.064	0.139	0.236	0.296	0.199	0.002	0.113	0.112	0.109	0.111	0.107	0.109	0.114	0.117
93	24	0.097	0.071	0.141	0.269	0.304	0.204	0.002	0.128	0.126	0.121	0.125	0.117	0.123	0.126	0.131
93	25	0.091	0.062	0.136	0.214	0.287	0.197	0.001	0.069	0.069	0.066	0.067	0.066	0.064	0.069	0.071
93	26	0.092	0.063	0.136	0.221	0.290	0.198	0.001	0.082	0.082	0.079	0.080	0.080	0.076	0.082	0.084
93	27	0.094	0.064	0.137	0.234	0.297	0.198	0.002	0.098	0.098	0.094	0.096	0.094	0.094	0.099	0.102
93	28	0.097	0.065	0.139	0.248	0.305	0.200	0.002	0.113	0.112	0.109	0.111	0.106	0.109	0.114	0.117
93	29	0.098	0.071	0.141	0.278	0.309	0.208	0.002	0.127	0.125	0.121	0.126	0.116	0.123	0.126	0.130
93	30	0.091	0.062	0.136	0.231	0.289	0.197	0.001	0.069	0.068	0.066	0.067	0.065	0.063	0.068	0.070
93	31	0.091	0.063	0.136	0.236	0.292	0.199	0.001	0.082	0.081	0.077	0.079	0.079	0.077	0.082	0.084
93	32	0.094	0.064	0.138	0.254	0.299	0.199	0.002	0.098	0.098	0.093	0.096	0.094	0.094	0.099	0.101
93	33	0.096	0.064	0.139	0.261	0.306	0.201	0.002	0.113	0.111	0.106	0.111	0.106	0.109	0.114	0.116
93	34	0.097	0.070	0.142	0.283	0.305	0.206	0.002	0.127	0.125	0.120	0.126	0.117	0.123	0.126	0.129
93	35	0.090	0.061	0.136	0.244	0.293	0.198	0.001	0.072	0.067	0.066	0.066	0.065	0.063	0.068	0.070
93	36	0.091	0.063	0.137	0.265	0.297	0.202	0.001	0.082	0.080	0.077	0.079	0.078	0.076	0.081	0.083
93	37	0.093	0.063	0.138	0.281	0.304	0.203	0.002	0.098	0.096	0.093	0.095	0.094	0.094	0.099	0.100
93	38	0.095	0.063	0.140	0.302	0.308	0.205	0.002	0.112	0.111	0.106	0.111	0.106	0.109	0.113	0.115
93	39	0.097	0.070	0.143	0.333	0.317	0.218	0.002	0.128	0.124	0.117	0.124	0.117	0.123	0.126	0.128

**Table C33a. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg,
RPM = 5,600 to 8,400 (uniform) - Conditions**

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
94	6	20.14	0.48	0.00237	-90	-9.90	5600	5600	5600	5600	5600	5600	5600	5600
94	7	20.36	0.49	0.00237	-90	-9.90	6200	6200	6200	6200	6200	6200	6200	6200
94	8	20.55	0.50	0.00237	-90	-9.90	7000	7000	7000	7000	7000	7000	7000	7000
94	9	20.13	0.48	0.00237	-90	-9.90	7700	7700	7700	7700	7700	7700	7700	7700
94	10	20.56	0.50	0.00237	-90	-9.90	8400	8400	8400	8400	8400	8400	8400	8400
94	15	20.23	0.48	0.00237	-90	-4.98	5600	5600	5600	5600	5600	5600	5600	5600
94	16	20.19	0.48	0.00237	-90	-4.98	6200	6200	6200	6200	6200	6200	6200	6200
94	17	20.24	0.48	0.00237	-90	-4.98	7000	7000	7000	7000	7000	7000	7000	7000
94	18	20.23	0.48	0.00237	-90	-4.98	7700	7700	7700	7700	7700	7700	7700	7700
94	19	20.32	0.49	0.00237	-90	-4.98	8400	8400	8400	8400	8400	8400	8400	8400
94	24	19.46	0.45	0.00237	-90	-1.98	5600	5600	5600	5600	5600	5600	5600	5600
94	25	19.88	0.47	0.00237	-90	-1.98	6200	6200	6200	6200	6200	6200	6200	6200
94	26	19.61	0.46	0.00237	-90	-1.98	7000	7000	7000	7000	7000	7000	7000	7000
94	27	20.32	0.49	0.00237	-90	-1.98	7700	7700	7700	7700	7700	7700	7700	7700
94	28	19.98	0.47	0.00237	-90	-1.98	8400	8400	8400	8400	8400	8400	8400	8400
95	5	20.31	0.49	0.00237	-90	-0.04	5600	5600	5600	5600	5600	5600	5600	5600
95	6	19.89	0.47	0.00236	-90	-0.04	6200	6200	6200	6200	6200	6200	6200	6200
95	7	19.55	0.45	0.00236	-90	-0.04	7000	7000	7000	7000	7000	7000	7000	7000
95	8	19.46	0.45	0.00236	-90	-0.04	7700	7700	7700	7700	7700	7700	7700	7700
95	9	20.05	0.48	0.00236	-90	-0.04	8400	8400	8400	8400	8400	8400	8400	8400
95	14	20.06	0.48	0.00236	-90	2.04	5600	5600	5600	5600	5600	5600	5600	5600
95	15	19.74	0.46	0.00236	-90	2.04	6200	6200	6200	6200	6200	6200	6200	6200
95	16	20.11	0.48	0.00236	-90	2.04	7000	7000	7000	7000	7000	7000	7000	7000
95	17	19.77	0.46	0.00236	-90	2.04	7700	7700	7700	7700	7700	7700	7700	7700
95	18	19.29	0.44	0.00236	-90	2.04	8400	8400	8400	8400	8400	8400	8400	8400
98	5	20.32	0.50	0.00242	-90	5.03	5600	5600	5600	5600	5600	5600	5600	5600
98	6	20.20	0.49	0.00242	-90	5.03	6200	6200	6200	6200	6200	6200	6200	6200
98	7	19.55	0.46	0.00242	-90	5.03	7000	7000	7000	7000	7000	7000	7000	7000
98	9	20.35	0.50	0.00242	-90	5.03	7700	7700	7700	7700	7700	7700	7700	7700
98	10	19.52	0.46	0.00241	-90	5.03	8400	8400	8400	8400	8400	8400	8400	8400
98	14	20.26	0.50	0.00241	-90	9.95	5600	5600	5600	5600	5600	5600	5600	5600
98	15	19.64	0.47	0.00241	-90	9.95	6200	6200	6200	6200	6200	6200	6200	6200
98	16	20.28	0.50	0.00241	-90	9.95	7000	7000	7000	7000	7000	7000	7000	7000
98	17	19.81	0.47	0.00241	-90	9.95	7700	7700	7700	7700	7700	7700	7700	7700
98	18	19.31	0.45	0.00241	-90	9.95	8400	8400	8400	8400	8400	8400	8400	8400

**Table C33b. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg,
RPM = 5,600 to 8,400 (uniform) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
94	6	0.009	-2.026	8.533	-16.097	-0.948	0.545	16.619	3.327	3.202	3.226	3.292	3.121	3.546	3.210	3.318
94	7	0.022	-2.254	10.480	-19.876	-0.481	0.785	16.523	4.439	4.229	4.223	4.320	4.117	4.653	4.253	4.420
94	8	0.070	-2.607	13.340	-25.974	0.066	1.168	16.363	6.132	5.997	5.955	6.146	5.741	6.513	6.000	6.178
94	9	0.073	-2.820	16.194	-30.434	-0.091	1.744	16.184	8.176	7.867	7.884	8.058	7.491	8.516	8.016	8.121
94	10	0.085	-3.174	19.332	-34.565	-0.592	2.035	15.968	10.510	10.084	10.036	10.464	9.626	10.922	10.364	10.528
94	15	-0.008	-2.011	9.323	-25.546	1.014	0.422	16.620	3.333	3.124	3.167	3.277	3.011	3.502	3.228	3.289
94	16	-0.000	-2.225	11.401	-29.415	0.574	0.743	16.525	4.422	4.151	4.142	4.304	4.033	4.655	4.319	4.339
94	17	0.023	-2.522	14.239	-34.437	0.539	1.228	16.367	6.128	5.804	5.823	6.081	5.718	6.525	6.017	6.167
94	18	0.045	-2.784	17.138	-39.301	1.392	1.734	16.190	8.140	7.645	7.606	8.049	7.464	8.508	7.960	8.115
94	19	0.094	-3.202	20.478	-45.520	0.602	1.492	15.971	10.412	9.923	9.905	10.533	9.610	11.058	10.436	10.458
94	24	0.003	-1.885	9.719	-30.064	1.130	0.732	16.620	3.338	3.083	3.155	3.269	3.011	3.561	3.301	3.286
94	25	-0.003	-2.153	11.715	-35.121	0.869	1.146	16.527	4.427	4.037	4.131	4.294	3.986	4.664	4.259	4.329
94	26	0.004	-2.438	14.523	-40.615	1.536	1.680	16.367	6.178	5.750	5.815	6.078	5.527	6.546	6.019	6.125
94	27	0.020	-2.793	17.476	-46.552	1.908	1.575	16.190	8.098	7.536	7.646	8.051	7.342	8.576	8.064	8.031
94	28	0.048	-3.145	20.687	-53.058	2.367	1.497	15.975	10.452	9.844	9.938	10.423	9.564	10.935	10.395	10.345
95	5	0.103	-1.929	10.203	-35.166	0.717	1.161	16.620	3.336	3.163	3.178	3.350	3.037	3.551	3.224	3.228
95	6	0.049	-2.156	11.982	-38.255	0.810	1.707	16.531	4.267	4.029	4.069	4.309	3.862	4.755	4.268	4.359
95	7	0.074	-2.563	14.898	-44.632	0.778	2.016	16.372	6.117	5.664	5.646	6.174	5.459	6.564	6.048	6.048
95	8	0.008	-2.699	17.474	-48.853	1.769	2.336	16.203	7.892	7.420	7.514	7.898	7.205	8.458	7.908	8.106
95	9	0.079	-3.150	20.776	-56.543	3.121	1.742	15.990	10.257	9.735	9.677	10.317	9.242	10.663	10.253	10.468
95	14	0.108	-1.804	10.445	-35.747	1.562	0.905	16.621	3.395	2.997	3.096	3.239	2.977	3.659	3.343	3.274
95	15	0.061	-2.050	12.180	-42.313	1.569	1.111	16.529	4.422	4.027	4.071	4.247	3.968	4.611	4.313	4.314
95	16	0.001	-2.466	15.032	-49.530	1.505	1.636	16.373	6.128	5.654	5.782	6.014	5.510	6.479	6.063	5.988
95	17	-0.011	-2.725	17.703	-54.146	-0.584	2.093	16.206	7.912	7.293	7.531	7.911	7.228	8.461	7.942	7.873
95	18	-0.006	-3.025	20.886	-60.392	0.789	1.130	15.982	10.486	9.718	9.969	10.307	9.338	10.862	10.292	10.258
98	5	0.085	-1.807	10.987	-42.292	3.539	0.924	16.570	3.532	3.098	3.071	3.330	3.021	3.675	3.371	3.250
98	6	0.109	-2.013	13.028	-48.877	3.698	0.651	16.474	4.564	4.134	4.177	4.357	3.976	4.783	4.455	4.334
98	7	-0.130	-2.420	15.811	-56.875	3.462	0.853	16.314	6.364	5.844	5.793	6.239	5.622	6.647	6.200	6.116
98	9	-0.104	-2.797	18.801	-65.618	2.367	-0.485	16.137	8.322	7.676	7.709	8.167	7.375	8.708	8.192	7.889
98	10	-0.055	-3.094	21.694	-68.777	-1.245	-0.138	15.911	10.844	9.908	9.908	10.678	9.631	11.237	10.726	10.363
98	14	-0.016	-1.659	11.740	-46.360	5.669	0.113	16.569	3.534	2.971	3.000	3.438	3.009	3.713	3.417	3.291
98	15	0.025	-1.850	13.583	-53.711	4.272	1.056	16.473	4.777	3.998	4.033	4.490	3.889	4.845	4.463	4.255
98	16	0.021	-2.225	16.982	-66.428	1.440	1.059	16.317	6.412	5.705	5.696	6.141	5.638	6.705	6.294	5.936
98	17	-0.117	-2.505	19.610	-73.054	-0.544	1.777	16.142	8.298	7.597	7.615	8.074	7.420	8.750	8.248	7.848
98	18	-0.129	-2.734	22.539	-77.050	-0.453	0.673	15.926	10.644	9.879	9.810	10.430	9.570	11.138	10.660	10.203

**Table C33c. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg,
RPM = 5,600 to 8,400 (uniform) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
94	6	0.088	0.066	0.135	0.187	0.273	0.194	0.001	0.068	0.068	0.069	0.068	0.067	0.064	0.068	0.069
94	7	0.088	0.065	0.136	0.177	0.274	0.196	0.001	0.081	0.081	0.082	0.081	0.081	0.077	0.081	0.083
94	8	0.088	0.066	0.137	0.186	0.282	0.197	0.002	0.097	0.098	0.098	0.098	0.098	0.095	0.097	0.100
94	9	0.089	0.067	0.138	0.197	0.278	0.198	0.002	0.112	0.112	0.113	0.112	0.109	0.110	0.108	0.115
94	10	0.089	0.072	0.140	0.219	0.279	0.201	0.002	0.126	0.125	0.125	0.127	0.119	0.124	0.123	0.128
94	15	0.088	0.065	0.135	0.201	0.273	0.194	0.001	0.068	0.068	0.068	0.068	0.062	0.065	0.060	0.071
94	16	0.088	0.065	0.136	0.198	0.274	0.196	0.001	0.081	0.081	0.081	0.081	0.065	0.080	0.067	0.088
94	17	0.088	0.065	0.137	0.208	0.280	0.197	0.002	0.096	0.096	0.097	0.097	0.097	0.095	0.098	0.099
94	18	0.089	0.067	0.138	0.222	0.278	0.199	0.002	0.112	0.110	0.111	0.112	0.109	0.109	0.111	0.114
94	19	0.089	0.073	0.141	0.250	0.280	0.202	0.002	0.125	0.123	0.123	0.127	0.119	0.124	0.124	0.127
94	24	0.088	0.065	0.135	0.209	0.273	0.195	0.001	0.068	0.067	0.067	0.068	0.056	0.066	0.063	0.072
94	25	0.088	0.064	0.136	0.212	0.275	0.198	0.001	0.081	0.079	0.080	0.080	0.080	0.077	0.081	0.082
94	26	0.088	0.065	0.137	0.226	0.281	0.198	0.002	0.097	0.096	0.096	0.097	0.098	0.095	0.097	0.099
94	27	0.089	0.067	0.139	0.244	0.280	0.201	0.002	0.112	0.109	0.110	0.112	0.108	0.110	0.109	0.114
94	28	0.089	0.073	0.141	0.273	0.281	0.203	0.002	0.126	0.122	0.123	0.126	0.119	0.123	0.125	0.126
95	5	0.088	0.065	0.136	0.220	0.274	0.195	0.001	0.068	0.067	0.068	0.069	0.066	0.064	0.068	0.068
95	6	0.088	0.064	0.136	0.221	0.276	0.197	0.001	0.079	0.079	0.079	0.080	0.075	0.080	0.072	0.085
95	7	0.088	0.066	0.137	0.238	0.283	0.198	0.002	0.097	0.095	0.096	0.097	0.083	0.098	0.083	0.104
95	8	0.089	0.066	0.139	0.251	0.282	0.202	0.002	0.110	0.109	0.109	0.111	0.108	0.109	0.110	0.114
95	9	0.089	0.074	0.141	0.286	0.280	0.204	0.002	0.125	0.122	0.122	0.125	0.110	0.123	0.117	0.130
95	14	0.088	0.064	0.136	0.223	0.274	0.195	0.001	0.068	0.065	0.067	0.067	0.068	0.065	0.068	0.069
95	15	0.088	0.064	0.136	0.233	0.276	0.197	0.001	0.080	0.079	0.079	0.080	0.079	0.076	0.082	0.081
95	16	0.089	0.065	0.137	0.253	0.284	0.199	0.002	0.096	0.095	0.095	0.097	0.096	0.094	0.098	0.098
95	17	0.089	0.067	0.139	0.269	0.282	0.201	0.002	0.110	0.108	0.109	0.111	0.107	0.109	0.112	0.112
95	18	0.089	0.074	0.141	0.299	0.282	0.205	0.002	0.126	0.121	0.124	0.125	0.117	0.123	0.122	0.126
98	5	0.088	0.064	0.136	0.244	0.275	0.196	0.001	0.070	0.067	0.066	0.068	0.067	0.065	0.070	0.068
98	6	0.088	0.064	0.137	0.254	0.278	0.197	0.001	0.082	0.081	0.080	0.081	0.081	0.078	0.084	0.081
98	7	0.089	0.066	0.138	0.278	0.293	0.200	0.002	0.099	0.097	0.096	0.099	0.096	0.096	0.100	0.099
98	9	0.089	0.068	0.139	0.307	0.285	0.201	0.002	0.114	0.111	0.110	0.113	0.108	0.111	0.114	0.112
98	10	0.089	0.074	0.142	0.326	0.283	0.205	0.002	0.129	0.123	0.123	0.128	0.119	0.126	0.127	0.125
98	14	0.088	0.062	0.136	0.250	0.275	0.197	0.001	0.070	0.066	0.066	0.069	0.066	0.066	0.070	0.069
98	15	0.088	0.066	0.137	0.273	0.283	0.200	0.001	0.084	0.079	0.079	0.082	0.083	0.079	0.083	0.080
98	16	0.089	0.066	0.139	0.311	0.288	0.199	0.002	0.099	0.096	0.095	0.097	0.097	0.096	0.100	0.097
98	17	0.089	0.066	0.140	0.333	0.283	0.201	0.002	0.113	0.110	0.110	0.112	0.109	0.111	0.114	0.112
98	18	0.089	0.073	0.142	0.355	0.285	0.208	0.002	0.127	0.122	0.122	0.126	0.119	0.125	0.128	0.124

Table C34a. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = 0 deg, pitch = -10 to 10 deg, RPM = 5,000 to 7,400 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
71	5	20.47	0.50	0.00241	0	-10.08	7400	7400	5000	5000	5000	5000	7400	7400
71	6	20.14	0.49	0.00241	0	-10.08	6800	6800	5600	5600	5600	5600	6800	6800
71	7	20.23	0.49	0.00240	0	-10.08	5600	5600	6800	6800	6800	6800	5600	5600
71	8	20.16	0.49	0.00240	0	-10.08	5000	5000	7400	7400	7400	7400	5000	5000
71	9	20.49	0.50	0.00240	0	-10.08	7400	7400	7400	7400	5000	5000	5000	5000
71	10	19.95	0.48	0.00240	0	-10.07	6800	6800	6800	6800	5600	5600	5600	5600
71	16	20.08	0.48	0.00240	0	-4.98	7400	7400	5000	5000	5000	5000	7400	7400
71	17	19.95	0.48	0.00240	0	-4.98	6800	6800	5600	5600	5600	5600	6800	6800
71	18	19.87	0.47	0.00240	0	-4.99	5600	5600	6800	6800	6800	6800	5600	5600
71	19	20.00	0.48	0.00240	0	-4.98	5000	5000	7400	7400	7400	7400	5000	5000
71	20	20.37	0.50	0.00240	0	-4.98	7400	7400	7400	7400	5000	5000	5000	5000
71	21	20.15	0.49	0.00240	0	-4.98	6800	6800	6800	6800	5600	5600	5600	5600
73	6	19.65	0.48	0.00247	0	-1.99	7400	7400	5000	5000	5000	5000	7400	7400
73	7	19.83	0.49	0.00247	0	-1.99	6800	6800	5600	5600	5600	5600	6800	6800
73	8	19.31	0.46	0.00247	0	-1.99	5600	5600	6800	6800	6800	6800	5600	5600
73	9	19.24	0.46	0.00247	0	-1.99	5000	5000	7400	7400	7400	7400	5000	5000
73	10	20.11	0.50	0.00247	0	-1.99	7400	7400	7400	7400	5000	5000	5000	5000
73	11	19.86	0.49	0.00247	0	-1.99	6800	6800	6800	6800	5600	5600	5600	5600
73	17	19.57	0.47	0.00247	0	0.11	7400	7400	5000	5000	5000	5000	7400	7400
73	18	19.47	0.47	0.00247	0	0.11	6800	6800	5600	5600	5600	5600	6800	6800
73	19	18.88	0.44	0.00247	0	0.11	5600	5600	6800	6800	6800	6800	5600	5600
73	20	20.18	0.50	0.00247	0	0.11	5000	5000	7400	7400	7400	7400	5000	5000
73	21	21.57	0.57	0.00247	0	0.11	7400	7400	7400	7400	5000	5000	5000	5000
73	22	19.29	0.46	0.00247	0	0.11	7400	7400	7400	7400	5000	5000	5000	5000
73	23	19.01	0.45	0.00247	0	0.11	6800	6800	6800	6800	5600	5600	5600	5600
73	24	19.90	0.49	0.00247	0	0.11	5600	5600	5600	5600	6800	6800	6800	6800
73	32	20.08	0.50	0.00247	0	2.03	6800	6800	5600	5600	5600	5600	6800	6800
73	33	19.77	0.48	0.00247	0	2.03	5600	5600	6800	6800	6800	6800	5600	5600
73	34	20.02	0.49	0.00247	0	2.03	6800	6800	6800	6800	5600	5600	5600	5600
74	11	19.42	0.46	0.00245	0	5.02	6800	6800	5600	5600	5600	5600	6800	6800
74	12	20.09	0.50	0.00245	0	5.03	5600	5600	6800	6800	6800	6800	5600	5600
74	13	19.64	0.47	0.00245	0	5.02	6800	6800	6800	6800	5600	5600	5600	5600
74	19	19.36	0.46	0.00244	0	9.94	6800	6800	5600	5600	5600	5600	6800	6800
74	20	19.35	0.46	0.00244	0	9.94	5600	5600	6800	6800	6800	6800	5600	5600
74	21	19.61	0.47	0.00244	0	9.95	6800	6800	6800	6800	5600	5600	5600	5600

Table C34b. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = 0 deg, pitch = -10 to 10 deg, RPM = 5,000 to 7,400 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
71	5	2.089	0.008	10.257	2.346	77.205	0.091	16.411	7.236	7.253	2.463	2.481	2.275	2.517	7.215	7.544
71	6	2.301	0.011	10.365	1.241	50.407	0.134	16.444	5.650	5.702	3.392	3.429	3.198	3.426	5.693	5.895
71	7	2.801	0.011	11.247	0.470	1.635	0.504	16.444	3.320	3.330	5.708	5.762	5.372	5.832	3.370	3.466
71	8	3.088	-0.048	12.035	0.587	-21.178	0.845	16.415	2.426	2.506	7.158	7.332	6.843	7.303	2.472	2.615
71	9	2.560	0.566	11.054	-45.777	25.167	4.637	16.375	7.202	7.190	7.266	7.410	2.402	2.548	2.485	2.525
71	10	2.483	0.294	10.704	-22.281	25.945	2.644	16.423	5.663	5.706	5.720	5.755	3.170	3.442	3.366	3.469
71	16	2.072	-0.008	11.091	2.095	84.787	0.728	16.415	7.042	7.232	2.479	2.498	2.381	2.536	7.239	7.378
71	17	2.311	-0.021	11.043	1.939	58.192	1.241	16.448	5.527	5.683	3.368	3.351	3.160	3.433	5.710	5.806
71	18	2.863	-0.026	12.010	1.224	11.526	0.776	16.444	3.322	3.353	5.640	5.799	5.390	5.833	3.374	3.456
71	19	3.118	0.004	12.806	0.719	-11.169	0.385	16.413	2.527	2.518	7.104	7.295	6.833	7.323	2.534	2.548
71	20	2.536	0.578	11.839	-45.739	34.858	4.129	16.377	7.116	7.233	7.202	7.340	2.318	2.554	2.492	2.532
71	21	2.543	0.239	11.469	-21.336	34.045	3.550	16.430	5.511	5.588	5.660	5.806	3.171	3.402	3.370	3.443
73	6	1.974	-0.236	11.275	4.012	89.815	-0.787	16.410	7.206	7.375	2.527	2.557	2.381	2.532	7.418	7.550
73	7	2.240	-0.142	11.523	3.329	65.223	-0.300	16.440	5.704	5.776	3.408	3.489	3.284	3.438	5.857	5.964
73	8	2.728	-0.152	12.290	0.045	17.339	-0.738	16.441	3.425	3.446	5.806	5.917	5.541	5.787	3.521	3.546
73	9	2.933	-0.050	12.874	0.627	-5.775	-0.911	16.409	2.590	2.586	7.266	7.457	7.010	7.339	2.661	2.647
73	10	2.486	0.505	12.140	-47.693	38.882	3.693	16.369	7.210	7.463	7.430	7.498	2.466	2.548	2.562	2.619
73	11	2.452	0.164	11.785	-22.158	40.072	2.690	16.421	5.728	5.799	5.806	5.913	3.243	3.455	3.516	3.550
73	17	1.970	-0.185	11.631	3.044	95.285	-0.359	16.412	7.184	7.405	2.551	2.560	2.448	2.536	7.497	7.563
73	18	2.208	-0.181	11.668	2.390	68.566	-0.757	16.442	5.706	5.853	3.458	3.515	3.282	3.397	5.924	5.960
73	19	2.664	-0.148	12.420	1.534	22.876	-0.630	16.446	3.428	3.445	5.726	5.917	5.537	5.794	3.579	3.560
73	20	3.043	-0.141	13.249	0.128	-1.071	-0.304	16.408	2.592	2.588	7.260	7.445	7.011	7.327	2.664	2.673
73	21	2.684	0.522	12.519	-44.640	43.754	4.635	16.376	7.143	7.411	7.326	7.536	2.400	2.515	2.663	2.630
73	22	2.360	0.444	12.173	-46.183	41.117	3.699	16.376	7.232	7.429	7.326	7.521	2.376	2.530	2.583	2.606
73	23	2.357	0.132	11.762	-23.401	42.365	2.561	16.426	5.729	5.906	5.816	5.953	3.295	3.420	3.523	3.551
73	24	2.526	-0.415	11.962	25.984	43.715	-3.638	16.463	3.420	3.389	3.408	3.498	5.591	5.863	5.959	5.995
73	32	2.283	-0.068	11.655	3.332	71.567	1.038	16.440	5.677	5.896	3.329	3.519	3.285	3.428	5.892	5.952
73	33	2.677	-0.005	12.594	0.307	26.925	0.109	16.444	3.437	3.457	5.645	5.924	5.550	5.784	3.533	3.547
73	34	2.421	0.336	12.186	-20.251	50.420	4.114	16.420	5.713	5.871	5.689	5.905	3.246	3.411	3.535	3.552
74	11	2.064	0.194	12.340	1.479	80.788	0.206	16.439	5.731	5.829	3.317	3.493	3.229	3.376	5.922	5.933
74	12	2.530	0.098	13.510	-0.759	33.576	-0.839	16.442	3.374	3.580	5.561	5.923	5.497	5.727	3.532	3.488
74	13	2.277	0.467	12.894	-23.323	57.206	4.608	16.426	5.724	5.821	5.623	5.901	3.251	3.395	3.533	3.490
74	19	1.724	0.024	13.193	-0.573	91.560	-0.846	16.443	5.607	5.961	3.324	3.516	3.220	3.311	5.912	5.819
74	20	2.043	0.037	13.948	-1.158	41.264	-1.869	16.439	3.366	3.642	5.652	5.907	5.464	5.551	3.649	3.476
74	21	1.772	0.415	13.664	-24.619	65.464	5.219	16.427	5.698	5.925	5.616	5.888	3.244	3.239	3.560	3.485

**Table C34c. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = 0 deg, pitch = -10 to 10 deg,
RPM = 5,000 to 7,400 (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
71	5	0.105	0.059	0.135	0.166	0.372	0.195	0.003	0.103	0.105	0.063	0.062	0.061	0.063	0.105	0.108
71	6	0.101	0.057	0.135	0.157	0.319	0.195	0.003	0.091	0.093	0.074	0.071	0.071	0.073	0.094	0.096
71	7	0.105	0.057	0.136	0.157	0.275	0.195	0.003	0.071	0.073	0.093	0.091	0.089	0.093	0.073	0.075
71	8	0.108	0.057	0.136	0.158	0.283	0.195	0.003	0.061	0.064	0.104	0.103	0.100	0.105	0.064	0.065
71	9	0.105	0.058	0.136	0.242	0.290	0.198	0.003	0.105	0.109	0.108	0.109	0.056	0.057	0.058	0.057
71	10	0.102	0.057	0.136	0.180	0.289	0.196	0.003	0.095	0.085	0.098	0.087	0.071	0.070	0.072	0.071
71	16	0.102	0.059	0.136	0.166	0.381	0.196	0.003	0.101	0.105	0.064	0.062	0.062	0.063	0.105	0.107
71	17	0.102	0.057	0.136	0.157	0.331	0.196	0.003	0.090	0.093	0.074	0.071	0.071	0.073	0.094	0.095
71	18	0.105	0.057	0.136	0.157	0.277	0.196	0.003	0.071	0.073	0.093	0.091	0.089	0.093	0.074	0.075
71	19	0.109	0.057	0.136	0.159	0.278	0.195	0.004	0.062	0.064	0.104	0.103	0.100	0.106	0.065	0.064
71	20	0.105	0.058	0.136	0.242	0.299	0.198	0.004	0.109	0.094	0.113	0.094	0.048	0.060	0.048	0.061
71	21	0.103	0.057	0.136	0.179	0.296	0.198	0.003	0.091	0.096	0.094	0.095	0.070	0.069	0.071	0.071
73	6	0.100	0.059	0.136	0.166	0.391	0.197	0.003	0.103	0.107	0.064	0.063	0.062	0.064	0.107	0.108
73	7	0.101	0.057	0.136	0.159	0.343	0.196	0.003	0.092	0.094	0.075	0.072	0.072	0.074	0.096	0.097
73	8	0.104	0.058	0.136	0.158	0.281	0.197	0.003	0.072	0.075	0.094	0.093	0.091	0.094	0.076	0.076
73	9	0.107	0.057	0.136	0.161	0.278	0.197	0.003	0.063	0.065	0.106	0.105	0.102	0.106	0.067	0.066
73	10	0.104	0.057	0.136	0.249	0.303	0.198	0.004	0.110	0.099	0.113	0.100	0.057	0.058	0.059	0.059
73	11	0.102	0.057	0.136	0.182	0.304	0.198	0.003	0.093	0.096	0.096	0.097	0.071	0.071	0.073	0.072
73	17	0.104	0.059	0.136	0.168	0.408	0.196	0.003	0.103	0.107	0.065	0.063	0.063	0.064	0.108	0.109
73	18	0.101	0.057	0.136	0.159	0.350	0.196	0.003	0.092	0.095	0.075	0.073	0.072	0.073	0.096	0.097
73	19	0.103	0.057	0.136	0.160	0.284	0.197	0.003	0.072	0.075	0.094	0.093	0.091	0.094	0.077	0.076
73	20	0.109	0.057	0.136	0.163	0.278	0.198	0.004	0.063	0.066	0.105	0.105	0.102	0.106	0.067	0.066
73	21	0.107	0.058	0.136	0.240	0.311	0.199	0.003	0.110	0.100	0.113	0.097	0.046	0.060	0.054	0.063
73	22	0.103	0.057	0.136	0.244	0.306	0.198	0.003	0.110	0.100	0.112	0.102	0.057	0.057	0.060	0.059
73	23	0.101	0.057	0.136	0.184	0.306	0.198	0.003	0.098	0.083	0.101	0.083	0.070	0.071	0.074	0.073
73	24	0.103	0.058	0.136	0.194	0.310	0.199	0.002	0.069	0.072	0.071	0.072	0.096	0.095	0.099	0.098
73	32	0.102	0.057	0.136	0.161	0.355	0.197	0.003	0.092	0.095	0.074	0.073	0.072	0.073	0.096	0.097
73	33	0.104	0.058	0.136	0.161	0.288	0.198	0.003	0.072	0.075	0.093	0.093	0.091	0.094	0.076	0.076
73	34	0.103	0.058	0.136	0.181	0.319	0.200	0.004	0.094	0.093	0.096	0.095	0.071	0.070	0.073	0.073
74	11	0.100	0.058	0.136	0.162	0.372	0.197	0.004	0.092	0.095	0.073	0.072	0.072	0.073	0.096	0.096
74	12	0.102	0.058	0.137	0.175	0.294	0.199	0.003	0.072	0.076	0.092	0.093	0.091	0.093	0.076	0.075
74	13	0.101	0.058	0.136	0.187	0.329	0.202	0.003	0.094	0.097	0.094	0.096	0.071	0.070	0.073	0.072
74	19	0.097	0.057	0.137	0.164	0.394	0.198	0.003	0.091	0.096	0.073	0.073	0.071	0.072	0.096	0.095
74	20	0.098	0.058	0.137	0.179	0.303	0.202	0.003	0.072	0.077	0.093	0.093	0.090	0.091	0.077	0.075
74	21	0.097	0.058	0.137	0.195	0.342	0.204	0.003	0.093	0.097	0.094	0.097	0.069	0.068	0.073	0.072

Table C35a. Full Vehicle: Drone America x8, nominal speed 40 ft/s, yaw = 0 deg, pitch = -10 to 0 deg, RPM = 5,600 to 6,800* (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
76	6	39.73	1.87	0.00237	0	-9.91	6800	6800	5600	5600	5600	5600	6800	6800
76	7	40.05	1.90	0.00236	0	-9.91	5600	5600	6800	6800	6800	6800	5600	5600
76	8	39.72	1.86	0.00236	0	-9.91	6800	6800	6800	6800	5600	5600	5600	5600
76	14	40.18	1.90	0.00236	0	-4.99	6800	6800	5600	5600	5600	5600	6800	6800
76	15	40.49	1.93	0.00236	0	-4.99	5600	5600	6800	6800	6800	6800	5600	5600
76	16	40.56	1.94	0.00236	0	-4.99	6800	6800	6800	6800	5600	5600	5600	5600
76	22	39.99	1.88	0.00236	0	-1.99	6800	6800	5600	5600	5600	5600	6800	6800
76	23	40.08	1.89	0.00236	0	-1.99	5600	5600	6800	6800	6800	6800	5600	5600
76	24	39.61	1.85	0.00236	0	-1.99	6800	6800	6800	6800	5600	5600	5600	5600
81	6	39.05	1.87	0.00245	0	0.11	6300	6300	7700	7700	7700	7700	6300	6300
81	7	39.30	1.89	0.00245	0	0.11	7700	7700	7700	7700	6300	6300	6300	6300

**Table C35b. Full Vehicle: Drone America x8, nominal speed 40 ft/s, yaw = 0 deg, pitch = -10 to 0 deg,
RPM = 5,600 to 6,800* (differential) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
76	6	5.265	-0.004	9.520	-1.231	44.388	-0.753	16.452	5.724	5.577	3.230	3.374	3.203	3.238	5.525	5.989
76	7	5.722	0.048	11.093	-0.331	-9.307	0.211	16.449	3.433	3.337	5.475	5.744	5.362	5.644	3.296	3.467
76	8	5.438	0.360	10.195	-20.521	17.919	2.927	16.430	5.768	5.633	5.591	5.715	3.220	3.297	3.314	3.468
76	14	5.335	-0.039	11.917	-0.081	67.958	-1.109	16.454	5.591	5.559	3.197	3.386	3.216	3.156	5.378	6.004
76	15	5.542	0.083	13.618	0.524	11.427	-0.665	16.454	3.288	3.305	5.389	5.744	5.444	5.584	3.306	3.345
76	16	5.405	0.428	12.784	-19.928	40.824	4.213	16.436	5.632	5.548	5.441	5.719	3.225	3.220	3.258	3.344
76	22	5.017	0.073	13.566	0.365	81.701	-0.998	16.451	5.572	5.604	3.179	3.414	3.215	3.209	5.532	5.863
76	23	5.056	0.096	14.911	0.480	27.616	0.033	16.459	3.279	3.226	5.268	5.752	5.392	5.571	3.240	3.320
76	24	4.931	0.441	14.195	-18.478	54.185	5.723	16.438	5.572	5.563	5.369	5.720	3.232	3.344	3.254	3.331
81	6	5.495	-0.012	19.605	2.455	39.795	1.734	16.223	4.601	4.744	7.870	8.512	7.963	8.431	4.897	4.767
81	7	5.385	0.375	18.688	-23.768	76.908	10.876	16.194	8.170	8.131	7.836	8.533	4.574	4.973	4.820	4.776

**Table C35c. Full Vehicle: Drone America x8, nominal speed 40 ft/s, yaw = 0 deg, pitch = -10 to 0 deg,
RPM = 5,600 to 6,800* (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
76	6	0.139	0.058	0.135	0.164	0.312	0.200	0.002	0.091	0.092	0.072	0.071	0.071	0.071	0.092	0.096
76	7	0.145	0.058	0.136	0.169	0.281	0.200	0.003	0.072	0.073	0.091	0.091	0.089	0.091	0.073	0.074
76	8	0.141	0.058	0.136	0.188	0.285	0.203	0.003	0.093	0.095	0.094	0.095	0.070	0.068	0.070	0.071
76	14	0.140	0.058	0.136	0.166	0.350	0.200	0.003	0.090	0.092	0.072	0.071	0.071	0.070	0.090	0.096
76	15	0.142	0.057	0.137	0.167	0.281	0.200	0.003	0.070	0.072	0.090	0.091	0.090	0.091	0.073	0.073
76	16	0.141	0.058	0.137	0.183	0.307	0.203	0.003	0.092	0.094	0.092	0.094	0.070	0.067	0.069	0.070
76	22	0.135	0.058	0.137	0.166	0.374	0.200	0.003	0.090	0.092	0.072	0.071	0.071	0.070	0.092	0.095
76	23	0.135	0.057	0.137	0.170	0.291	0.202	0.003	0.070	0.071	0.089	0.091	0.089	0.091	0.072	0.073
76	24	0.133	0.058	0.137	0.181	0.324	0.206	0.003	0.091	0.095	0.091	0.094	0.071	0.068	0.069	0.069
81	6	0.147	0.059	0.140	0.181	0.336	0.208	0.003	0.084	0.088	0.111	0.115	0.112	0.116	0.090	0.090
81	7	0.142	0.058	0.139	0.198	0.369	0.224	0.003	0.113	0.114	0.112	0.116	0.088	0.088	0.088	0.088

Table C36a. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -5 deg, pitch = -10 to 10 deg, RPM = 6,200 to 7,700 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
82	20	18.98	0.44	0.00244	-5	-9.91	7700	7700	6200	6200	6200	6200	7700	7700
82	21	19.22	0.45	0.00244	-5	-9.91	6200	6200	7700	7700	7700	7700	6200	6200
82	22	19.27	0.45	0.00244	-5	-9.91	7700	7700	7700	7700	6200	6200	6200	6200
83	10	20.10	0.49	0.00243	-5	-4.99	7700	7700	6200	6200	6200	6200	7700	7700
83	11	20.42	0.51	0.00243	-5	-4.99	6200	6200	7700	7700	7700	7700	6200	6200
83	13	20.25	0.50	0.00243	-5	-4.99	7700	7700	7700	7700	6200	6200	6200	6200
84	10	20.39	0.50	0.00241	-5	-1.99	7700	7700	6200	6200	6200	6200	7700	7700
84	11	20.45	0.50	0.00241	-5	-1.99	6200	6200	7700	7700	7700	7700	6200	6200
84	12	20.48	0.51	0.00241	-5	-1.99	7700	7700	7700	7700	6200	6200	6200	6200
85	5	20.07	0.48	0.00239	-5	-0.05	7700	7700	6200	6200	6200	6200	7700	7700
85	6	19.99	0.48	0.00239	-5	-0.05	6200	6200	7700	7700	7700	7700	6200	6200
85	7	20.67	0.51	0.00239	-5	-0.05	7700	7700	7700	7700	6200	6200	6200	6200
85	8	19.44	0.45	0.00239	-5	-0.05	6200	6200	6200	6200	7700	7700	7700	7700
85	14	20.34	0.49	0.00239	-5	2.03	7700	7700	6200	6200	6200	6200	7700	7700
85	15	20.21	0.49	0.00239	-5	2.03	6200	6200	7700	7700	7700	7700	6200	6200
85	16	20.71	0.51	0.00238	-5	2.03	7700	7700	7700	7700	6200	6200	6200	6200
85	17	20.03	0.48	0.00238	-5	2.03	6200	6200	6200	6200	7700	7700	7700	7700
85	23	20.89	0.52	0.00238	-5	5.02	6200	6200	7700	7700	7700	7700	6200	6200
85	24	20.88	0.52	0.00238	-5	5.02	7700	7700	7700	7700	6200	6200	6200	6200
86	10	20.03	0.48	0.00238	-5	9.94	6200	6200	7700	7700	7700	7700	6200	6200
86	11	20.32	0.49	0.00238	-5	9.94	7700	7700	7700	7700	6200	6200	6200	6200

**Table C36b. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -5 deg, pitch = -10 to 10 deg,
RPM = 6,200 to 7,700 (differential) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
82	20	2.332	-0.251	13.109	0.503	68.110	0.879	16.220	8.303	8.320	4.559	4.568	4.295	4.793	8.415	8.733
82	21	3.139	-0.246	14.182	-0.941	-4.385	0.765	16.225	4.528	4.494	8.305	8.406	7.812	8.842	4.576	4.709
82	22	2.739	0.262	13.525	-35.686	31.565	3.911	16.197	8.284	8.249	8.295	8.358	4.274	4.822	4.587	4.729
83	10	2.484	-0.134	13.566	-1.871	77.445	0.431	16.229	8.041	8.299	4.558	4.561	4.198	4.731	8.252	8.395
83	11	3.358	-0.007	14.893	-3.850	8.993	-0.917	16.231	4.469	4.520	8.100	8.314	7.779	8.570	4.571	4.630
83	13	2.841	0.302	14.118	-37.956	41.393	3.236	16.199	8.146	8.245	8.307	8.364	4.282	4.823	4.465	4.642
84	10	2.514	-0.371	14.196	-0.804	83.879	1.362	16.237	7.925	8.220	4.482	4.600	4.278	4.607	8.238	8.341
84	11	3.313	-0.234	15.404	-4.335	19.892	-0.440	16.239	4.515	4.554	8.088	8.220	7.687	8.211	4.563	4.514
84	12	2.844	0.073	14.736	-37.926	50.711	4.202	16.208	8.003	8.302	8.212	8.306	4.230	4.552	4.503	4.524
85	5	2.511	-0.363	14.396	-2.103	88.386	1.285	16.411	7.783	8.143	4.436	4.478	4.161	4.492	8.146	8.204
85	6	3.198	-0.252	15.508	-5.061	24.896	-1.046	16.414	4.386	4.542	7.802	8.101	7.513	7.974	4.492	4.540
85	7	2.836	0.042	14.905	-36.589	54.843	4.358	16.385	7.769	8.044	8.026	8.147	4.183	4.465	4.506	4.463
85	8	2.697	-0.544	14.791	29.958	52.697	-3.792	16.437	4.390	4.528	4.406	4.483	7.632	8.105	8.089	8.108
85	14	2.542	-0.302	14.537	-3.495	92.736	0.404	16.410	7.769	8.115	4.402	4.472	4.161	4.366	8.163	8.154
85	15	3.183	-0.256	15.828	-6.843	27.892	-1.047	16.413	4.341	4.582	7.743	8.109	7.665	7.920	4.563	4.458
85	16	2.811	-0.006	15.113	-35.983	60.615	4.548	16.384	7.799	8.068	7.879	8.159	4.182	4.397	4.509	4.472
85	17	2.743	-0.489	15.001	26.165	57.647	-4.267	16.440	4.402	4.465	4.291	4.516	7.616	7.920	8.109	8.145
85	23	2.980	-0.218	16.450	-9.146	34.635	-1.510	16.411	4.373	4.660	7.617	8.118	7.674	7.894	4.517	4.458
85	24	2.729	0.101	15.631	-37.682	67.958	5.616	16.381	7.846	8.202	7.824	8.146	4.191	4.391	4.491	4.466
86	10	2.474	-0.005	16.986	-9.423	42.082	-3.346	16.407	4.362	4.788	7.822	8.107	7.647	7.851	4.626	4.404
86	11	2.251	0.368	16.380	-40.485	74.955	7.543	16.384	7.807	8.132	7.744	8.165	4.184	4.319	4.556	4.410

Table C36c. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -5 deg, pitch = -10 to 10 deg, RPM = 6,200 to 7,700 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
82	20	0.101	0.057	0.136	0.156	0.344	0.197	0.002	0.114	0.115	0.088	0.083	0.083	0.088	0.116	0.120
82	21	0.109	0.057	0.137	0.155	0.278	0.195	0.002	0.084	0.086	0.115	0.113	0.110	0.119	0.087	0.089
82	22	0.105	0.057	0.137	0.211	0.294	0.199	0.002	0.114	0.116	0.116	0.115	0.083	0.086	0.086	0.087
83	10	0.104	0.057	0.137	0.159	0.364	0.197	0.003	0.112	0.115	0.087	0.083	0.082	0.087	0.115	0.117
83	11	0.112	0.057	0.137	0.158	0.281	0.198	0.003	0.083	0.086	0.113	0.113	0.109	0.117	0.087	0.089
83	13	0.107	0.057	0.137	0.218	0.306	0.200	0.003	0.112	0.116	0.116	0.115	0.082	0.086	0.085	0.086
84	10	0.103	0.058	0.137	0.160	0.375	0.199	0.002	0.110	0.114	0.087	0.083	0.082	0.078	0.114	0.116
84	11	0.112	0.057	0.137	0.161	0.290	0.198	0.002	0.083	0.086	0.113	0.112	0.108	0.106	0.085	0.086
84	12	0.107	0.057	0.137	0.220	0.318	0.201	0.002	0.111	0.115	0.115	0.114	0.082	0.075	0.084	0.084
85	5	0.104	0.057	0.137	0.161	0.385	0.198	0.002	0.110	0.114	0.086	0.082	0.082	0.077	0.113	0.115
85	6	0.112	0.057	0.137	0.162	0.298	0.198	0.002	0.083	0.086	0.111	0.111	0.107	0.105	0.085	0.086
85	7	0.107	0.057	0.137	0.217	0.324	0.202	0.002	0.110	0.115	0.114	0.114	0.082	0.075	0.084	0.083
85	8	0.107	0.058	0.137	0.200	0.328	0.201	0.001	0.080	0.086	0.082	0.085	0.111	0.106	0.114	0.115
85	14	0.104	0.058	0.137	0.163	0.394	0.199	0.002	0.110	0.114	0.086	0.082	0.082	0.076	0.114	0.114
85	15	0.111	0.057	0.138	0.165	0.297	0.198	0.002	0.082	0.087	0.111	0.111	0.108	0.104	0.086	0.086
85	16	0.106	0.057	0.137	0.217	0.333	0.202	0.002	0.110	0.115	0.112	0.114	0.082	0.074	0.084	0.083
85	17	0.106	0.058	0.137	0.193	0.331	0.201	0.001	0.081	0.085	0.081	0.083	0.111	0.105	0.114	0.115
85	23	0.108	0.057	0.138	0.174	0.302	0.201	0.002	0.082	0.087	0.110	0.111	0.108	0.104	0.085	0.086
85	24	0.106	0.057	0.138	0.222	0.347	0.205	0.002	0.110	0.116	0.112	0.114	0.082	0.074	0.084	0.083
86	10	0.103	0.058	0.138	0.178	0.311	0.207	0.002	0.082	0.089	0.112	0.111	0.108	0.104	0.087	0.085
86	11	0.101	0.058	0.138	0.232	0.360	0.211	0.002	0.110	0.116	0.111	0.114	0.082	0.073	0.084	0.083

Table C37a. Full Vehicle: Drone America x8, nominal speed 40 ft/s, yaw = -5 deg, pitch = -10 to 0 deg, RPM = 6,200 to 7,700 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
88	18	39.93	1.92	0.00241	-5	-9.91	7700	7700	6200	6200	6200	6200	7700	7700
88	19	39.48	1.88	0.00241	-5	-9.91	6200	6200	7700	7700	7700	7700	6200	6200
88	20	39.80	1.91	0.00241	-5	-9.91	7700	7700	7700	7700	6200	6200	6200	6200
88	21	39.91	1.92	0.00241	-5	-9.91	6200	6200	6200	6200	7700	7700	7700	7700
88	27	40.19	1.94	0.00241	-5	-4.99	6200	6200	7700	7700	7700	7700	6200	6200
88	28	39.40	1.87	0.00241	-5	-4.99	7700	7700	7700	7700	6200	6200	6200	6200
88	29	39.07	1.84	0.00241	-5	-4.99	6200	6200	6200	6200	7700	7700	7700	7700
89	9	39.73	1.89	0.00240	-5	-1.99	6200	6200	7700	7700	7700	7700	6200	6200
89	10	39.72	1.89	0.00239	-5	-1.99	7700	7700	7700	7700	6200	6200	6200	6200
89	11	40.17	1.93	0.00239	-5	-1.99	6200	6200	6200	6200	7700	7700	7700	7700
89	12	39.95	1.91	0.00239	-5	-0.04	6200	6200	6200	6200	7700	7700	7700	7700
89	13	39.65	1.88	0.00239	-5	-0.04	6200	6200	7700	7700	7700	7700	6200	6200
89	14	39.89	1.90	0.00239	-5	0.00	7700	7700	7700	7700	6200	6200	6200	6200

**Table C37b. Full Vehicle: Drone America x8, nominal speed 40 ft/s, yaw = -5 deg, pitch = -10 to 0 deg,
RPM = 6,200 to 7,700 (differential) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
88	18	5.484	-0.489	11.977	-3.318	61.163	-2.432	16.357	8.161	8.076	4.413	4.583	4.223	4.440	8.035	8.604
88	19	6.173	-0.464	14.549	-1.550	-11.303	-1.627	16.355	4.605	4.558	8.050	8.371	7.727	8.151	4.483	4.692
88	20	5.923	-0.128	13.222	-30.888	27.763	0.996	16.328	8.235	8.188	8.093	8.316	4.251	4.498	4.389	4.686
88	21	5.896	-0.867	13.101	25.448	24.731	-4.461	16.385	4.621	4.511	4.426	4.653	7.758	8.196	7.980	8.517
88	27	5.920	-0.357	17.179	-6.049	13.047	-3.984	16.365	4.434	4.496	7.852	8.368	7.758	8.063	4.383	4.545
88	28	5.705	-0.060	15.619	-31.764	53.495	2.764	16.341	8.229	7.662	8.011	8.254	4.251	4.441	4.293	4.580
88	29	5.455	-0.986	15.593	23.358	48.554	-8.332	16.397	4.415	4.509	4.401	4.563	7.625	7.932	7.777	8.529
89	9	5.649	-0.298	18.610	-6.306	27.969	-1.926	16.373	4.372	4.428	7.666	8.313	7.759	8.012	4.386	4.451
89	10	5.489	-0.042	17.268	-33.414	67.087	5.473	16.345	8.081	7.805	7.802	8.224	4.229	4.429	4.378	4.510
89	11	5.535	-0.791	17.447	21.700	62.174	-9.769	16.402	4.364	4.332	4.324	4.564	7.684	7.789	7.709	8.436
89	12	5.376	-0.772	18.435	21.986	71.959	-10.582	16.403	4.270	4.326	4.309	4.565	7.699	7.842	7.928	8.185
89	13	5.400	-0.333	19.301	-6.212	36.405	-0.970	16.373	4.322	4.419	7.582	8.353	7.734	8.071	4.394	4.448
89	14	5.375	-0.784	18.385	21.958	71.822	-10.701	16.399	4.328	4.427	4.315	4.632	7.681	7.836	7.930	8.267

**Table C37c. Full Vehicle: Drone America x8, nominal speed 40 ft/s, yaw = -5 deg, pitch = -10 to 0 deg,
RPM = 6,200 to 7,700 (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
88	18	0.142	0.058	0.136	0.166	0.336	0.201	0.002	0.113	0.114	0.086	0.084	0.082	0.077	0.113	0.119
88	19	0.153	0.058	0.137	0.168	0.287	0.203	0.002	0.085	0.087	0.114	0.114	0.109	0.106	0.085	0.088
88	20	0.149	0.057	0.137	0.204	0.297	0.203	0.002	0.114	0.116	0.115	0.116	0.083	0.075	0.083	0.086
88	21	0.149	0.059	0.137	0.197	0.294	0.205	0.002	0.083	0.085	0.083	0.084	0.112	0.107	0.114	0.119
88	27	0.150	0.058	0.139	0.171	0.290	0.206	0.002	0.083	0.086	0.112	0.114	0.109	0.105	0.084	0.087
88	28	0.146	0.058	0.138	0.209	0.330	0.204	0.002	0.114	0.111	0.114	0.115	0.084	0.075	0.082	0.085
88	29	0.144	0.059	0.138	0.194	0.329	0.213	0.002	0.081	0.085	0.082	0.085	0.112	0.105	0.111	0.118
89	9	0.146	0.058	0.139	0.173	0.303	0.204	0.002	0.082	0.085	0.110	0.113	0.109	0.105	0.084	0.085
89	10	0.143	0.058	0.139	0.213	0.349	0.206	0.002	0.112	0.113	0.112	0.115	0.084	0.074	0.083	0.084
89	11	0.145	0.059	0.139	0.193	0.346	0.216	0.001	0.080	0.084	0.081	0.084	0.112	0.104	0.111	0.118
89	12	0.142	0.059	0.139	0.195	0.361	0.222	0.001	0.079	0.083	0.081	0.084	0.112	0.104	0.113	0.115
89	13	0.142	0.058	0.140	0.176	0.311	0.208	0.002	0.082	0.085	0.109	0.113	0.109	0.105	0.084	0.085
89	14	0.143	0.059	0.139	0.196	0.370	0.221	0.001	0.080	0.085	0.081	0.085	0.112	0.104	0.112	0.116

**Table C38a. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg,
RPM = 6,200 to 7,700 (differential) - Conditions**

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
91	11	19.62	0.46	0.00238	-45	-9.91	7700	7700	6200	6200	6200	6200	7700	7700
91	12	19.77	0.46	0.00238	-45	-9.91	6200	6200	7700	7700	7700	7700	6200	6200
91	13	19.65	0.46	0.00238	-45	-9.91	7700	7700	7700	7700	6200	6200	6200	6200
91	14	19.95	0.47	0.00238	-45	-9.91	6200	6200	6200	6200	7700	7700	7700	7700
91	20	20.18	0.48	0.00238	-45	-4.99	7700	7700	6200	6200	6200	6200	7700	7700
91	21	20.34	0.49	0.00238	-45	-4.99	6200	6200	7700	7700	7700	7700	6200	6200
91	22	20.23	0.49	0.00238	-45	-4.99	7700	7700	7700	7700	6200	6200	6200	6200
91	23	20.20	0.49	0.00238	-45	-4.99	6200	6200	6200	6200	7700	7700	7700	7700
91	29	20.12	0.48	0.00238	-45	-1.99	7700	7700	6200	6200	6200	6200	7700	7700
91	30	20.54	0.50	0.00238	-45	-1.99	6200	6200	7700	7700	7700	7700	6200	6200
91	31	20.46	0.50	0.00238	-45	-1.99	7700	7700	7700	7700	6200	6200	6200	6200
91	32	20.49	0.50	0.00238	-45	-1.99	6200	6200	6200	6200	7700	7700	7700	7700
92	5	19.90	0.48	0.00241	-45	-0.05	7700	7700	6200	6200	6200	6200	7700	7700
92	6	20.23	0.49	0.00241	-45	-0.05	6200	6200	7700	7700	7700	7700	6200	6200
92	7	20.10	0.49	0.00241	-45	-0.05	7700	7700	7700	7700	6200	6200	6200	6200
92	8	20.42	0.50	0.00241	-45	-0.05	6200	6200	6200	6200	7700	7700	7700	7700
92	14	19.63	0.46	0.00241	-45	2.03	6200	6200	7700	7700	7700	7700	6200	6200
92	15	19.98	0.48	0.00241	-45	2.03	7700	7700	7700	7700	6200	6200	6200	6200
92	16	20.28	0.49	0.00241	-45	2.03	6200	6200	6200	6200	7700	7700	7700	7700
92	22	20.34	0.50	0.00241	-45	5.03	6200	6200	7700	7700	7700	7700	6200	6200
92	23	19.80	0.47	0.00241	-45	5.03	7700	7700	7700	7700	6200	6200	6200	6200
92	24	20.36	0.50	0.00241	-45	5.03	6200	6200	6200	6200	7700	7700	7700	7700
92	30	20.02	0.48	0.00241	-45	9.95	6200	6200	7700	7700	7700	7700	6200	6200
92	31	20.15	0.49	0.00241	-45	9.95	7700	7700	7700	7700	6200	6200	6200	6200
92	32	20.23	0.49	0.00241	-45	9.95	6200	6200	6200	6200	7700	7700	7700	7700

**Table C38b. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg,
RPM = 6,200 to 7,700 (differential) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
91	11	1.573	-1.686	12.327	-20.299	57.721	-0.283	16.363	8.068	8.105	4.359	4.308	3.994	4.542	7.847	8.436
91	12	2.205	-1.732	13.048	-19.590	-12.206	1.840	16.367	4.487	4.390	7.849	7.978	7.358	8.272	4.327	4.648
91	13	1.938	-1.305	12.151	-53.656	25.889	2.473	16.337	8.083	8.143	7.944	7.843	4.014	4.507	4.288	4.668
91	14	1.908	-2.070	13.077	14.123	21.819	-1.092	16.393	4.443	4.415	4.367	4.343	7.367	8.250	7.926	8.486
91	20	1.689	-1.685	12.762	-26.843	64.454	-0.374	16.367	8.025	8.012	4.290	4.308	3.985	4.532	7.852	8.400
91	21	2.272	-1.802	13.674	-27.451	-4.751	2.415	16.369	4.501	4.385	7.733	8.024	7.365	8.267	4.308	4.632
91	22	1.924	-1.439	12.603	-60.409	32.683	2.225	16.343	8.041	8.095	7.789	7.811	3.954	4.497	4.288	4.598
91	23	1.990	-2.091	13.686	8.029	29.819	-1.353	16.395	4.445	4.407	4.255	4.338	7.353	8.236	8.045	8.395
91	29	1.696	-1.732	12.997	-30.482	70.094	-0.684	16.366	8.064	8.020	4.226	4.316	3.931	4.476	8.021	8.387
91	30	2.188	-1.952	14.273	-31.476	0.380	3.213	16.369	4.495	4.385	7.591	8.025	7.433	8.294	4.333	4.635
91	31	1.951	-1.452	12.929	-64.762	36.472	2.443	16.343	8.025	7.976	7.715	7.961	3.987	4.495	4.274	4.592
91	32	1.954	-2.121	14.179	2.723	34.625	-1.910	16.395	4.460	4.402	4.250	4.317	7.377	8.292	7.942	8.374
92	5	1.706	-1.732	13.561	-34.866	73.540	-0.994	16.351	8.061	8.140	4.202	4.385	3.985	4.535	7.989	8.435
92	6	2.190	-1.936	14.777	-35.083	4.829	3.656	16.354	4.549	4.386	7.685	8.091	7.425	8.318	4.350	4.618
92	7	1.957	-1.451	13.453	-69.363	40.483	2.668	16.324	8.137	8.122	7.741	8.029	4.011	4.492	4.267	4.638
92	8	1.940	-2.228	14.911	-1.298	38.622	-2.398	16.377	4.570	4.472	4.236	4.444	7.371	8.372	8.011	8.371
92	14	2.050	-1.815	14.880	-37.035	7.643	3.217	16.353	4.604	4.374	7.659	8.027	7.421	8.343	4.367	4.614
92	15	1.924	-1.440	13.581	-71.755	43.475	2.578	16.325	8.173	8.074	7.691	8.048	3.978	4.447	4.262	4.639
92	16	1.903	-2.232	15.196	-3.805	42.182	-2.528	16.379	4.533	4.391	4.176	4.438	7.362	8.382	8.018	8.343
92	22	2.088	-1.806	15.347	-43.785	15.500	4.296	16.352	4.704	4.372	7.574	8.020	7.342	8.360	4.343	4.626
92	23	1.852	-1.344	13.859	-75.678	47.905	2.784	16.325	8.182	8.075	7.637	8.010	4.009	4.448	4.259	4.635
92	24	1.820	-2.174	15.641	-9.912	48.044	-2.997	16.378	4.607	4.401	4.168	4.435	7.361	8.312	8.003	8.347
92	30	1.945	-1.657	15.757	-50.008	23.023	4.783	16.359	4.797	4.272	7.286	8.005	7.348	8.248	4.240	4.622
92	31	1.680	-1.183	14.589	-81.757	55.228	1.472	16.333	8.199	7.924	7.418	7.965	3.951	4.440	4.206	4.610
92	32	1.630	-1.929	16.069	-17.906	54.056	-4.759	16.384	4.865	4.164	4.060	4.305	7.358	8.272	7.927	8.162

Table C38c. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 6,200 to 7,700 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
91	11	0.095	0.061	0.136	0.180	0.327	0.197	0.002	0.112	0.113	0.085	0.081	0.080	0.077	0.111	0.117
91	12	0.100	0.061	0.136	0.179	0.280	0.196	0.002	0.083	0.085	0.112	0.110	0.106	0.107	0.083	0.087
91	13	0.098	0.059	0.136	0.269	0.287	0.199	0.002	0.112	0.115	0.113	0.111	0.080	0.075	0.082	0.085
91	14	0.097	0.064	0.137	0.171	0.287	0.196	0.001	0.081	0.084	0.082	0.082	0.109	0.107	0.113	0.118
91	20	0.096	0.062	0.137	0.196	0.339	0.198	0.002	0.112	0.112	0.085	0.081	0.080	0.077	0.111	0.117
91	21	0.100	0.062	0.137	0.195	0.279	0.197	0.002	0.084	0.085	0.111	0.110	0.106	0.107	0.083	0.087
91	22	0.098	0.060	0.136	0.291	0.294	0.199	0.002	0.112	0.115	0.112	0.111	0.081	0.075	0.081	0.084
91	23	0.098	0.064	0.137	0.169	0.295	0.197	0.001	0.081	0.084	0.081	0.082	0.109	0.107	0.114	0.117
91	29	0.096	0.062	0.137	0.206	0.350	0.199	0.002	0.112	0.113	0.084	0.081	0.079	0.077	0.112	0.116
91	30	0.100	0.063	0.137	0.206	0.279	0.198	0.002	0.083	0.084	0.110	0.110	0.105	0.108	0.084	0.087
91	31	0.098	0.060	0.136	0.306	0.299	0.200	0.002	0.112	0.114	0.111	0.112	0.080	0.075	0.081	0.084
91	32	0.098	0.065	0.137	0.170	0.302	0.198	0.001	0.081	0.084	0.081	0.082	0.108	0.108	0.113	0.117
92	5	0.096	0.063	0.137	0.218	0.357	0.200	0.002	0.112	0.113	0.084	0.081	0.080	0.077	0.112	0.116
92	6	0.100	0.063	0.137	0.216	0.280	0.199	0.002	0.084	0.085	0.110	0.111	0.106	0.107	0.083	0.087
92	7	0.098	0.060	0.137	0.322	0.304	0.201	0.002	0.113	0.115	0.111	0.112	0.080	0.075	0.081	0.085
92	8	0.098	0.065	0.137	0.168	0.305	0.198	0.002	0.082	0.084	0.081	0.082	0.109	0.108	0.113	0.117
92	14	0.099	0.062	0.137	0.221	0.281	0.199	0.002	0.084	0.084	0.110	0.110	0.106	0.108	0.084	0.087
92	15	0.098	0.060	0.137	0.331	0.308	0.203	0.002	0.113	0.115	0.111	0.113	0.081	0.074	0.081	0.084
92	16	0.098	0.066	0.138	0.171	0.313	0.199	0.001	0.082	0.083	0.080	0.082	0.109	0.109	0.113	0.116
92	22	0.099	0.062	0.138	0.241	0.284	0.201	0.002	0.085	0.085	0.109	0.110	0.105	0.108	0.083	0.087
92	23	0.098	0.060	0.137	0.346	0.314	0.203	0.002	0.113	0.114	0.110	0.112	0.080	0.075	0.081	0.084
92	24	0.097	0.065	0.138	0.174	0.319	0.200	0.002	0.083	0.084	0.080	0.082	0.109	0.108	0.113	0.116
92	30	0.098	0.062	0.138	0.260	0.290	0.201	0.002	0.086	0.083	0.106	0.110	0.105	0.107	0.083	0.087
92	31	0.097	0.060	0.137	0.367	0.325	0.203	0.002	0.113	0.113	0.108	0.112	0.080	0.074	0.081	0.084
92	32	0.096	0.064	0.138	0.187	0.329	0.203	0.001	0.085	0.081	0.079	0.081	0.108	0.108	0.112	0.115

Table C39a. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 6,200 to 7,700 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
94	11	19.89	0.47	0.00237	-90	-9.90	7700	7700	6200	6200	6200	6200	7700	7700
94	12	19.89	0.47	0.00237	-90	-9.90	6200	6200	7700	7700	7700	7700	6200	6200
94	13	19.63	0.46	0.00237	-90	-9.90	7700	7700	7700	7700	6200	6200	6200	6200
94	14	19.92	0.47	0.00237	-90	-9.90	6200	6200	6200	6200	7700	7700	7700	7700
94	20	20.39	0.49	0.00237	-90	-4.98	7700	7700	7700	7700	6200	6200	6200	6200
94	21	20.53	0.50	0.00237	-90	-4.98	6200	6200	6200	6200	7700	7700	7700	7700
94	22	20.52	0.50	0.00237	-90	-4.98	7700	7700	6200	6200	6200	6200	7700	7700
94	23	20.31	0.49	0.00237	-90	-4.98	6200	6200	7700	7700	7700	7700	6200	6200
94	29	20.73	0.51	0.00237	-90	-1.98	7700	7700	6200	6200	6200	6200	7700	7700
94	30	20.66	0.50	0.00237	-90	-1.98	6200	6200	7700	7700	7700	7700	6200	6200
94	31	20.67	0.51	0.00236	-90	-1.98	7700	7700	7700	7700	6200	6200	6200	6200
94	32	20.20	0.48	0.00236	-90	-1.98	6200	6200	6200	6200	7700	7700	7700	7700
95	10	20.85	0.51	0.00236	-90	-0.04	7700	7700	6200	6200	6200	6200	7700	7700
95	11	20.87	0.51	0.00236	-90	-0.04	6200	6200	7700	7700	7700	7700	6200	6200
95	12	20.71	0.51	0.00236	-90	-0.04	7700	7700	7700	7700	6200	6200	6200	6200
95	13	20.70	0.51	0.00236	-90	-0.04	6200	6200	6200	6200	7700	7700	7700	7700
95	19	19.86	0.47	0.00236	-90	2.04	7700	7700	6200	6200	6200	6200	7700	7700
95	20	20.54	0.50	0.00236	-90	2.04	6200	6200	7700	7700	7700	7700	6200	6200
95	21	20.17	0.48	0.00236	-90	2.04	7700	7700	7700	7700	6200	6200	6200	6200
95	22	20.02	0.47	0.00236	-90	2.04	6200	6200	6200	6200	7700	7700	7700	7700
98	11	20.34	0.50	0.00241	-90	5.03	7700	7700	6200	6200	6200	6200	7700	7700
98	12	19.69	0.47	0.00241	-90	5.03	6200	6200	7700	7700	7700	7700	6200	6200
98	13	19.39	0.45	0.00241	-90	5.03	6200	6200	6200	6200	7700	7700	7700	7700
98	19	19.06	0.44	0.00241	-90	9.95	7700	7700	6200	6200	6200	6200	7700	7700
98	20	20.41	0.50	0.00241	-90	9.95	6200	6200	7700	7700	7700	7700	6200	6200
98	21	20.65	0.51	0.00241	-90	9.95	6200	6200	6200	6200	7700	7700	7700	7700

**Table C39b. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg,
RPM = 6,200 to 7,700 (differential) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
94	11	-0.247	-2.454	13.298	-24.689	31.323	-1.599	16.350	8.146	7.962	4.178	4.439	4.141	4.678	7.961	8.075
94	12	0.419	-2.512	13.475	-26.566	-33.233	3.995	16.354	4.435	4.221	7.867	8.026	7.441	8.423	4.348	4.426
94	13	0.086	-2.023	12.650	-60.500	-1.766	1.818	16.324	8.093	7.830	7.846	8.118	4.099	4.652	4.278	4.431
94	14	0.022	-2.916	14.042	8.570	1.024	0.364	16.383	4.428	4.197	4.226	4.324	7.414	8.436	8.046	8.026
94	20	0.048	-2.053	13.574	-68.707	-0.339	1.843	16.326	8.083	7.634	7.742	8.123	4.077	4.713	4.271	4.396
94	21	0.031	-2.962	14.841	-4.134	1.568	1.305	16.387	4.433	4.152	4.159	4.313	7.223	8.517	7.845	8.024
94	22	-0.325	-2.511	14.173	-33.336	32.967	-1.159	16.360	7.971	7.539	4.139	4.307	4.109	4.654	7.879	8.046
94	23	0.390	-2.523	14.278	-35.471	-32.095	3.383	16.360	4.423	4.162	7.569	7.927	7.415	8.449	4.351	4.380
94	29	-0.325	-2.538	14.653	-39.860	33.171	-0.976	16.358	7.973	7.512	4.147	4.337	4.042	4.690	8.023	7.971
94	30	0.309	-2.514	14.668	-42.545	-30.211	3.484	16.361	4.420	4.139	7.545	7.941	7.252	8.454	4.362	4.385
94	31	0.008	-2.090	14.039	-73.837	1.067	1.706	16.333	8.081	7.505	7.591	7.965	4.074	4.718	4.262	4.380
94	32	-0.079	-2.940	15.172	-10.117	2.916	1.928	16.388	4.430	4.084	4.154	4.308	7.178	8.502	7.945	7.951
95	10	-0.198	-2.575	15.127	-44.383	33.063	-0.389	16.358	7.961	7.429	4.143	4.370	4.084	4.692	8.021	8.043
95	11	0.331	-2.486	14.879	-46.345	-28.639	3.988	16.370	4.430	4.083	7.337	7.845	7.140	8.324	4.274	4.312
95	12	0.084	-2.122	14.370	-77.772	-0.092	2.305	16.335	7.999	7.393	7.631	7.944	4.109	4.774	4.259	4.332
95	13	0.080	-2.938	15.598	-15.123	2.935	1.188	16.388	4.443	4.147	4.155	4.364	7.229	8.433	7.814	7.921
95	19	-0.182	-2.462	15.126	-46.474	31.973	-0.674	16.358	8.021	7.362	4.146	4.363	3.988	4.741	8.037	8.037
95	20	0.326	-2.362	15.117	-48.211	-28.321	4.138	16.369	4.381	4.042	7.276	7.852	7.197	8.326	4.481	4.251
95	21	0.033	-2.025	14.546	-79.716	0.063	2.273	16.340	7.935	7.380	7.287	7.811	4.108	4.646	4.392	4.442
95	22	0.032	-2.742	15.745	-17.570	3.283	2.734	16.391	4.457	4.019	4.043	4.394	7.093	8.320	7.958	7.905
98	11	-0.233	-2.391	15.707	-56.400	32.252	-1.842	16.303	8.280	7.609	4.185	4.400	4.075	4.829	8.197	7.885
98	12	0.229	-2.221	15.660	-53.308	-26.974	3.770	16.307	4.655	4.115	7.490	8.064	7.302	8.670	4.529	4.315
98	13	0.086	-2.642	16.356	-22.795	3.811	0.740	16.335	4.705	4.085	4.130	4.436	7.226	8.645	8.149	7.832
98	19	-0.375	-2.010	16.065	-62.706	32.674	-5.497	16.308	8.275	7.402	4.117	4.480	3.975	4.871	8.206	7.749
98	20	0.504	-2.198	16.694	-64.963	-26.678	7.217	16.309	4.822	4.058	7.373	7.974	7.370	8.657	4.495	4.344
98	21	0.071	-2.636	17.388	-30.126	3.361	-2.179	16.334	4.850	3.950	3.923	4.630	7.243	8.682	8.233	7.802

Table C39c. Full Vehicle: Drone America x8, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 6,200 to 7,700 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
94	11	0.088	0.065	0.137	0.185	0.291	0.198	0.002	0.112	0.112	0.082	0.083	0.082	0.078	0.111	0.113
94	12	0.089	0.065	0.137	0.189	0.294	0.199	0.002	0.083	0.082	0.112	0.110	0.106	0.109	0.083	0.085
94	13	0.088	0.063	0.136	0.287	0.277	0.198	0.002	0.112	0.113	0.113	0.113	0.081	0.078	0.075	0.085
94	14	0.088	0.068	0.137	0.162	0.275	0.195	0.001	0.081	0.081	0.081	0.081	0.097	0.112	0.100	0.119
94	20	0.089	0.063	0.137	0.316	0.277	0.199	0.002	0.112	0.111	0.111	0.113	0.082	0.077	0.081	0.082
94	21	0.088	0.068	0.137	0.160	0.275	0.197	0.001	0.081	0.081	0.080	0.081	0.108	0.110	0.111	0.114
94	22	0.089	0.065	0.137	0.206	0.293	0.198	0.002	0.111	0.108	0.084	0.081	0.081	0.079	0.111	0.113
94	23	0.089	0.066	0.137	0.212	0.293	0.199	0.002	0.083	0.082	0.109	0.110	0.106	0.109	0.083	0.085
94	29	0.089	0.066	0.137	0.225	0.294	0.199	0.002	0.111	0.108	0.083	0.081	0.080	0.079	0.112	0.113
94	30	0.089	0.066	0.137	0.233	0.293	0.200	0.002	0.083	0.082	0.109	0.110	0.105	0.109	0.083	0.085
94	31	0.088	0.063	0.137	0.334	0.278	0.200	0.002	0.112	0.109	0.110	0.112	0.081	0.077	0.082	0.082
94	32	0.088	0.069	0.138	0.166	0.277	0.197	0.001	0.081	0.080	0.080	0.080	0.108	0.110	0.111	0.113
95	10	0.088	0.066	0.138	0.239	0.294	0.199	0.002	0.111	0.107	0.084	0.081	0.080	0.079	0.113	0.113
95	11	0.089	0.066	0.137	0.245	0.292	0.201	0.002	0.083	0.081	0.107	0.109	0.104	0.108	0.083	0.084
95	12	0.089	0.063	0.137	0.349	0.281	0.202	0.002	0.111	0.109	0.110	0.112	0.080	0.078	0.081	0.082
95	13	0.088	0.069	0.138	0.174	0.279	0.197	0.001	0.081	0.081	0.080	0.081	0.107	0.109	0.112	0.113
95	19	0.088	0.066	0.138	0.245	0.294	0.199	0.002	0.111	0.107	0.083	0.081	0.080	0.079	0.112	0.113
95	20	0.089	0.066	0.137	0.250	0.291	0.201	0.002	0.082	0.081	0.107	0.109	0.104	0.108	0.084	0.083
95	21	0.089	0.063	0.137	0.356	0.280	0.202	0.002	0.111	0.108	0.108	0.111	0.082	0.076	0.082	0.083
95	22	0.088	0.068	0.138	0.176	0.279	0.198	0.001	0.081	0.079	0.079	0.081	0.107	0.108	0.112	0.113
98	11	0.089	0.066	0.138	0.278	0.296	0.200	0.002	0.114	0.108	0.083	0.082	0.081	0.080	0.114	0.112
98	12	0.089	0.065	0.138	0.267	0.291	0.200	0.002	0.085	0.082	0.108	0.111	0.105	0.110	0.085	0.084
98	13	0.088	0.068	0.138	0.188	0.283	0.197	0.001	0.084	0.080	0.079	0.082	0.108	0.111	0.115	0.112
98	19	0.089	0.065	0.138	0.299	0.302	0.205	0.002	0.114	0.107	0.082	0.082	0.080	0.081	0.114	0.111
98	20	0.090	0.066	0.138	0.308	0.293	0.208	0.002	0.086	0.081	0.107	0.110	0.105	0.111	0.085	0.084
98	21	0.089	0.068	0.139	0.207	0.283	0.202	0.001	0.085	0.079	0.078	0.084	0.108	0.111	0.115	0.112

Wind Tunnel Data - SUI Endurance Full Vehicle

Table C40a. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 40 deg, RPM = 2,800 to 4,200 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
104	5	20.58	0.51	0.00239	0	-39.95	2800	2800	2800	2800
104	6	20.72	0.51	0.00239	0	-39.95	3200	3200	3200	3200
104	7	20.93	0.52	0.00239	0	-39.95	3500	3500	3500	3500
104	8	20.90	0.52	0.00239	0	-39.95	3800	3800	3800	3800
104	9	20.15	0.49	0.00239	0	-39.95	4200	4200	4200	4200
104	10	19.95	0.48	0.00239	0	-39.95	4500	4500	4500	4500
104	11	19.91	0.47	0.00239	0	-19.92	2800	2800	2800	2800
104	12	20.14	0.49	0.00239	0	-19.92	3200	3200	3200	3200
104	13	20.53	0.50	0.00239	0	-19.92	3500	3500	3500	3500
104	15	20.20	0.49	0.00239	0	-19.92	3800	3800	3800	3800
104	16	20.47	0.50	0.00240	0	-19.92	4200	4200	4200	4200
104	17	20.93	0.52	0.00240	0	-9.90	2800	2800	2800	2800
104	18	19.85	0.47	0.00240	0	-9.90	3200	3200	3200	3200
104	19	20.76	0.52	0.00240	0	-9.90	3500	3500	3500	3500
104	20	20.75	0.52	0.00240	0	-9.90	3800	3800	3800	3800
104	21	20.04	0.48	0.00240	0	-9.90	4200	4200	4200	4200
104	25	20.56	0.51	0.00240	0	-4.98	2800	2800	2800	2800
104	26	20.67	0.51	0.00240	0	-4.98	3200	3200	3200	3200
104	27	20.06	0.48	0.00240	0	-4.98	3500	3500	3500	3500
104	28	20.03	0.48	0.00240	0	-4.98	3800	3800	3800	3800
104	29	20.33	0.49	0.00240	0	-4.98	4200	4200	4200	4200
104	33	19.75	0.47	0.00240	0	-1.98	2800	2800	2800	2800
104	34	20.25	0.49	0.00240	0	-1.98	3200	3200	3200	3200
104	35	20.38	0.50	0.00240	0	-1.98	3500	3500	3500	3500
104	36	20.75	0.52	0.00240	0	-1.98	3800	3800	3800	3800
104	37	20.82	0.52	0.00240	0	-1.98	4200	4200	4200	4200
105	5	19.69	0.46	0.00240	0	-0.04	2800	2800	2800	2800
105	6	19.38	0.45	0.00240	0	-0.04	3200	3200	3200	3200
105	7	19.79	0.47	0.00240	0	-0.04	3500	3500	3500	3500
105	8	19.90	0.47	0.00240	0	-0.04	3800	3800	3800	3800
105	9	20.06	0.48	0.00239	0	-0.04	4200	4200	4200	4200
105	14	20.42	0.50	0.00239	0	2.03	2800	2800	2800	2800
105	15	20.31	0.49	0.00239	0	2.03	3200	3200	3200	3200
105	16	20.31	0.49	0.00239	0	2.03	3500	3500	3500	3500
105	17	20.53	0.50	0.00239	0	2.03	3800	3800	3800	3800
105	18	20.38	0.50	0.00239	0	2.04	4200	4200	4200	4200
105	22	20.20	0.49	0.00239	0	5.03	2800	2800	2800	2800
105	23	20.02	0.48	0.00239	0	5.03	3200	3200	3200	3200
105	24	20.01	0.48	0.00239	0	5.03	3500	3500	3500	3500
105	25	20.27	0.49	0.00239	0	5.03	3800	3800	3800	3800
105	26	20.30	0.49	0.00239	0	5.03	4200	4200	4200	4200
105	30	19.95	0.48	0.00239	0	9.95	2800	2800	2800	2800
105	31	20.02	0.48	0.00239	0	9.95	3200	3200	3200	3200
105	32	20.12	0.48	0.00239	0	9.95	3500	3500	3500	3500
105	33	19.99	0.48	0.00239	0	9.95	3800	3800	3800	3800
105	34	19.68	0.46	0.00239	0	9.95	4200	4200	4200	4200
105	38	19.77	0.47	0.00238	0	19.96	2800	2800	2800	2800
105	39	19.28	0.44	0.00238	0	19.96	3200	3200	3200	3200
105	40	19.10	0.43	0.00238	0	19.96	3500	3500	3500	3500
105	41	19.01	0.43	0.00238	0	19.96	3800	3800	3800	3800
105	42	20.50	0.50	0.00238	0	19.95	4200	4200	4200	4200
105	43	20.59	0.51	0.00238	0	39.99	2800	2800	2800	2800
105	44	20.05	0.48	0.00238	0	39.99	3200	3200	3200	3200
105	45	19.52	0.45	0.00238	0	39.99	3500	3500	3500	3500
105	46	18.91	0.43	0.00238	0	39.99	3800	3800	3800	3800
105	47	20.21	0.49	0.00238	0	39.99	4200	4200	4200	4200

Table C41a. Full Vehicle: SUI Endurance, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg, RPM = 2,800 to 4,200 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
106	5	40.72	1.97	0.00237	0	-39.95	2800	2800	2800	2800
106	6	40.20	1.92	0.00237	0	-39.95	3200	3200	3200	3200
106	7	39.78	1.88	0.00237	0	-39.95	3500	3500	3500	3500
106	8	40.37	1.93	0.00237	0	-39.95	3800	3800	3800	3800
106	9	40.45	1.94	0.00237	0	-39.95	4200	4200	4200	4200
106	10	40.31	1.92	0.00237	0	-39.95	4500	4500	4500	4500
106	11	40.41	1.93	0.00237	0	-39.95	4900	4900	4900	4900
106	12	40.06	1.90	0.00237	0	-19.92	2800	2800	2800	2800
106	13	40.39	1.93	0.00237	0	-19.92	3200	3200	3200	3200
106	14	40.09	1.90	0.00236	0	-19.92	3500	3500	3500	3500
106	15	39.86	1.88	0.00236	0	-19.92	3800	3800	3800	3800
106	16	39.90	1.88	0.00236	0	-19.92	4200	4200	4200	4200
106	17	40.12	1.90	0.00236	0	-19.92	4500	4500	4500	4500
106	18	40.14	1.90	0.00236	0	-9.90	2800	2800	2800	2800
106	19	40.22	1.91	0.00236	0	-9.90	3200	3200	3200	3200
106	20	40.35	1.92	0.00236	0	-9.90	3500	3500	3500	3500
106	21	40.08	1.90	0.00236	0	-9.90	3800	3800	3800	3800
106	22	40.12	1.90	0.00236	0	-9.90	4200	4200	4200	4200
106	26	40.20	1.91	0.00236	0	-4.98	2800	2800	2800	2800
106	27	39.90	1.88	0.00236	0	-4.98	3200	3200	3200	3200
106	28	39.42	1.83	0.00236	0	-4.98	3500	3500	3500	3500
106	29	39.61	1.85	0.00236	0	-4.98	3800	3800	3800	3800
106	30	40.30	1.91	0.00236	0	-4.98	4200	4200	4200	4200
106	34	40.21	1.90	0.00235	0	-1.98	2800	2800	2800	2800
106	35	40.00	1.88	0.00235	0	-1.98	3200	3200	3200	3200
106	36	39.86	1.87	0.00235	0	-1.98	3500	3500	3500	3500
106	37	40.45	1.92	0.00235	0	-1.98	3800	3800	3800	3800
106	38	40.52	1.93	0.00235	0	-1.98	4200	4200	4200	4200
107	5	40.79	1.93	0.00231	0	-0.04	2800	2800	2800	2800
107	6	40.27	1.88	0.00231	0	-0.04	3200	3200	3200	3200
107	7	40.80	1.92	0.00231	0	-0.04	3500	3500	3500	3500
107	8	40.84	1.93	0.00231	0	-0.04	3800	3800	3800	3800
107	9	40.60	1.91	0.00231	0	-0.04	4200	4200	4200	4200
107	13	40.46	1.89	0.00231	0	2.03	2800	2800	2800	2800
107	15	40.77	1.92	0.00231	0	2.04	3200	3200	3200	3200
107	16	40.10	1.86	0.00231	0	2.04	3500	3500	3500	3500
107	17	39.92	1.84	0.00231	0	2.04	3800	3800	3800	3800
107	18	40.75	1.92	0.00231	0	2.04	4200	4200	4200	4200
107	22	41.16	1.96	0.00231	0	5.03	2800	2800	2800	2800
107	23	40.64	1.91	0.00231	0	5.03	3200	3200	3200	3200
107	24	40.83	1.93	0.00231	0	5.03	3500	3500	3500	3500
107	25	40.32	1.88	0.00231	0	5.03	3800	3800	3800	3800
107	26	40.71	1.91	0.00231	0	5.03	4200	4200	4200	4200
108	6	40.56	1.94	0.00236	0	9.95	2800	2800	2800	2800
108	7	39.94	1.88	0.00236	0	9.95	3200	3200	3200	3200
108	8	40.42	1.92	0.00236	0	9.95	3500	3500	3500	3500
108	9	40.02	1.89	0.00236	0	9.95	3800	3800	3800	3800
108	13	40.70	1.95	0.00236	0	19.96	2500	2500	2500	2500
108	14	40.58	1.94	0.00236	0	19.96	2800	2800	2800	2800
108	15	40.17	1.90	0.00236	0	19.96	3200	3200	3200	3200
108	16	39.70	1.86	0.00236	0	19.96	3500	3500	3500	3500
108	17	40.11	1.90	0.00236	0	19.96	3800	3800	3800	3800
108	18	40.10	1.90	0.00236	0	39.99	2000	2000	2000	2000
108	19	39.42	1.83	0.00236	0	39.99	2500	2500	2500	2500
108	20	40.27	1.91	0.00236	0	39.99	2800	2800	2800	2800
108	21	40.15	1.90	0.00236	0	39.99	3200	3200	3200	3200
108	22	40.00	1.89	0.00236	0	39.99	3500	3500	3500	3500

Table C42a. Full Vehicle: SUI Endurance, nominal speed 60 ft/s, yaw = 0 deg, pitch = -40 to -20 deg, RPM = 4,200 to 5,000 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
109	5	60.66	4.34	0.00236	0	-39.95	4200	4200	4200	4200
109	6	60.68	4.34	0.00236	0	-39.95	4500	4500	4500	4500
109	7	60.12	4.26	0.00236	0	-39.95	5000	5000	5000	5000
109	8	60.46	4.31	0.00236	0	-29.94	4200	4200	4200	4200
109	9	60.66	4.34	0.00236	0	-29.94	4500	4500	4500	4500
109	10	59.97	4.24	0.00236	0	-29.94	4900	4900	4900	4900
109	11	60.52	4.32	0.00236	0	-19.92	4200	4200	4200	4200
109	12	60.64	4.34	0.00236	0	-19.92	4500	4500	4500	4500
109	13	60.69	4.35	0.00236	0	-19.92	4800	4800	4800	4800

**Table C42b. Full Vehicle: SUI Endurance, nominal speed 60 ft/s, yaw = 0 deg, pitch = -40 to -20 deg,
RPM = 4,200 to 5,000 (uniform) - Measurements**

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
109	5	1.661	0.017	-1.911	-1.862	-4.135	-0.034	16.745	2.432	2.682	3.082	2.898
109	6	1.702	0.028	-0.871	-1.881	-1.942	0.005	16.685	3.526	3.966	4.210	3.871
109	7	1.746	-0.069	1.268	-1.437	1.523	0.356	16.550	5.986	6.738	6.767	6.165
109	8	1.951	-0.623	1.747	1.727	2.784	1.641	16.660	4.146	4.619	4.510	4.142
109	9	2.024	-0.615	2.917	1.563	5.136	1.739	16.585	5.570	6.121	5.921	5.354
109	10	2.061	-0.185	4.713	-0.401	8.153	0.874	16.468	7.742	8.382	8.200	7.393
109	11	2.330	-1.197	5.304	4.703	8.828	3.319	16.595	5.458	5.964	5.690	5.152
109	12	2.438	-1.185	6.674	5.141	11.461	3.373	16.514	6.913	7.622	7.202	6.547
109	13	2.540	-0.939	7.919	3.706	12.932	2.923	16.435	8.368	9.007	8.750	7.958

**Table C42c. Full Vehicle: SUI Endurance, nominal speed 60 ft/s, yaw = 0 deg, pitch = -40 to -20 deg,
RPM = 4,200 to 5,000 (uniform) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
109	5	0.097	0.065	0.136	0.166	0.294	0.245	0.001	0.028	0.031	0.035	0.033
109	6	0.100	0.082	0.139	0.208	0.297	0.296	0.001	0.039	0.044	0.046	0.042
109	7	0.110	0.079	0.147	0.190	0.326	0.445	0.001	0.062	0.069	0.070	0.064
109	8	0.100	0.068	0.137	0.174	0.309	0.258	0.001	0.047	0.052	0.051	0.046
109	9	0.107	0.086	0.140	0.234	0.331	0.330	0.001	0.060	0.065	0.063	0.057
109	10	0.109	0.088	0.154	0.214	0.328	0.450	0.001	0.080	0.086	0.085	0.076
109	11	0.104	0.073	0.141	0.181	0.310	0.279	0.001	0.060	0.065	0.063	0.057
109	12	0.113	0.125	0.150	0.327	0.359	0.361	0.001	0.073	0.080	0.076	0.069
109	13	0.120	0.114	0.156	0.291	0.381	0.500	0.001	0.087	0.093	0.091	0.082

Table C44a. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -30 deg, pitch = -10 to 10 deg, RPM = 2,800 to 4,200 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
112	5	19.89	0.46	0.00234	-30	-9.90	2800	2800	2800	2800
112	6	19.96	0.47	0.00234	-30	-9.90	3200	3200	3200	3200
112	7	20.19	0.48	0.00234	-30	-9.90	3500	3500	3500	3500
112	8	20.14	0.47	0.00234	-30	-9.90	3800	3800	3800	3800
112	9	20.58	0.50	0.00234	-30	-9.90	4200	4200	4200	4200
112	10	20.22	0.48	0.00234	-30	-4.98	2800	2800	2800	2800
112	11	20.39	0.49	0.00234	-30	-4.98	3200	3200	3200	3200
112	12	20.45	0.49	0.00233	-30	-4.98	3500	3500	3500	3500
112	13	20.61	0.50	0.00233	-30	-4.98	3800	3800	3800	3800
112	14	20.66	0.50	0.00233	-30	-4.98	4200	4200	4200	4200
112	15	20.20	0.48	0.00233	-30	-1.98	2800	2800	2800	2800
112	16	20.23	0.48	0.00233	-30	-1.98	3200	3200	3200	3200
112	17	20.32	0.48	0.00233	-30	-1.98	3500	3500	3500	3500
112	18	20.24	0.48	0.00233	-30	-1.98	3800	3800	3800	3800
112	19	20.31	0.48	0.00233	-30	-1.98	4200	4200	4200	4200
112	20	20.17	0.47	0.00233	-30	-0.04	2800	2800	2800	2800
112	21	20.26	0.48	0.00233	-30	-0.04	3200	3200	3200	3200
112	22	20.23	0.48	0.00233	-30	0.04	3500	3500	3500	3500
112	23	20.27	0.48	0.00233	-30	-0.04	3800	3800	3800	3800
112	24	20.20	0.48	0.00233	-30	-0.04	4200	4200	4200	4200
112	25	19.96	0.46	0.00233	-30	2.03	2800	2800	2800	2800
112	26	19.81	0.46	0.00233	-30	2.03	3200	3200	3200	3200
112	27	19.92	0.46	0.00233	-30	2.03	3500	3500	3500	3500
112	28	19.91	0.46	0.00233	-30	2.04	3800	3800	3800	3800
112	29	20.42	0.49	0.00233	-30	2.03	4200	4200	4200	4200
112	30	20.29	0.48	0.00233	-30	5.03	2800	2800	2800	2800
112	31	20.36	0.48	0.00233	-30	5.03	3200	3200	3200	3200
112	32	20.30	0.48	0.00233	-30	5.03	3500	3500	3500	3500
112	33	20.06	0.47	0.00233	-30	5.03	3800	3800	3800	3800
112	34	20.00	0.47	0.00233	-30	5.03	4200	4200	4200	4200
112	35	20.35	0.48	0.00233	-30	9.95	2800	2800	2800	2800
112	36	20.05	0.47	0.00233	-30	9.95	3200	3200	3200	3200
112	37	20.26	0.48	0.00233	-30	9.95	3500	3500	3500	3500
112	38	20.16	0.47	0.00233	-30	9.95	3800	3800	3800	3800
112	39	19.95	0.46	0.00233	-30	9.95	4200	4200	4200	4200

Table C44b. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -30 deg, pitch = -10 to 10 deg, RPM = 2,800 to 4,200 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
112	5	0.320	-0.168	3.706	-2.069	4.529	0.051	16.806	1.570	1.699	1.690	1.581
112	6	0.358	-0.194	4.786	-2.563	6.010	0.105	16.768	2.258	2.405	2.384	2.257
112	7	0.389	-0.207	5.745	-2.981	7.061	0.151	16.731	2.904	3.134	3.117	2.928
112	8	0.418	-0.217	6.801	-3.341	8.417	0.225	16.685	3.733	4.013	3.924	3.793
112	9	0.474	-0.242	8.320	-4.135	9.831	0.331	16.610	5.044	5.462	5.378	5.181
112	10	0.297	-0.184	4.039	-1.376	4.901	-0.022	16.807	1.533	1.688	1.647	1.580
112	11	0.332	-0.195	5.128	-2.082	6.582	0.086	16.770	2.201	2.393	2.349	2.263
112	12	0.358	-0.205	6.018	-2.373	7.941	0.121	16.735	2.793	3.117	2.997	2.911
112	13	0.388	-0.220	7.062	-2.934	9.541	0.216	16.690	3.612	4.003	3.826	3.730
112	14	0.437	-0.222	8.559	-3.853	11.353	0.388	16.615	4.940	5.464	5.194	5.117
112	15	0.270	-0.180	4.213	-1.727	5.191	-0.110	16.807	1.554	1.687	1.637	1.569
112	16	0.301	-0.183	5.304	-2.475	6.734	0.070	16.770	2.232	2.375	2.331	2.258
112	17	0.328	-0.199	6.267	-2.852	8.382	0.141	16.731	2.919	3.127	3.015	2.968
112	18	0.346	-0.206	7.276	-3.625	10.111	0.249	16.688	3.711	4.031	3.831	3.731
112	19	0.389	-0.222	8.770	-4.776	12.811	0.407	16.613	5.037	5.566	5.158	5.090
112	20	0.247	-0.173	4.303	-1.947	5.696	-0.218	16.808	1.563	1.677	1.571	1.535
112	21	0.283	-0.176	5.447	-2.459	7.436	-0.015	16.770	2.239	2.421	2.245	2.258
112	22	0.309	-0.176	6.354	-3.117	9.254	0.127	16.735	2.895	3.128	2.869	2.920
112	23	0.329	-0.193	7.415	-3.929	11.149	0.288	16.689	3.723	4.035	3.684	3.729
112	24	0.372	-0.223	8.909	-5.290	13.885	0.494	16.614	5.046	5.568	5.036	5.100
112	25	0.220	-0.166	4.420	-2.212	6.413	-0.302	16.809	1.557	1.690	1.532	1.523
112	26	0.262	-0.169	5.543	-2.444	8.087	-0.077	16.772	2.232	2.420	2.149	2.254
112	27	0.284	-0.178	6.499	-3.065	9.737	0.105	16.736	2.880	3.126	2.781	2.972
112	28	0.311	-0.183	7.525	-3.789	11.755	0.313	16.690	3.698	4.046	3.562	3.790
112	29	0.366	-0.229	9.084	-5.068	14.907	0.529	16.616	5.040	5.584	4.892	5.117
112	30	0.198	-0.157	4.634	-2.923	7.195	-0.465	16.811	1.521	1.672	1.488	1.480
112	31	0.240	-0.168	5.845	-2.639	8.664	-0.306	16.773	2.210	2.417	2.112	2.248
112	32	0.272	-0.172	6.732	-2.949	10.417	-0.094	16.738	2.818	3.131	2.694	2.940
112	33	0.292	-0.176	7.729	-3.492	12.825	0.225	16.693	3.631	4.040	3.422	3.808
112	34	0.335	-0.207	9.227	-4.758	16.012	0.433	16.618	4.954	5.584	4.702	5.210
112	35	0.145	-0.106	5.132	-4.311	7.974	-0.550	16.810	1.550	1.712	1.462	1.504
112	36	0.187	-0.117	6.212	-3.775	9.069	-0.493	16.774	2.139	2.413	2.033	2.263
112	37	0.213	-0.129	7.179	-3.596	10.268	-0.399	16.740	2.732	3.090	2.580	2.999
112	38	0.236	-0.142	8.177	-4.194	12.536	-0.151	16.696	3.520	3.985	3.305	3.846
112	39	0.256	-0.191	9.568	-5.263	16.680	0.032	16.624	4.792	5.572	4.437	5.167

Table C44c. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -30 deg, pitch = -10 to 10 deg, RPM = 2,800 to 4,200 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
112	5	0.089	0.057	0.134	0.150	0.273	0.231	0.001	0.022	0.023	0.023	0.022
112	6	0.090	0.058	0.135	0.154	0.277	0.207	0.001	0.030	0.032	0.031	0.030
112	7	0.091	0.059	0.135	0.158	0.280	0.202	0.001	0.036	0.039	0.039	0.037
112	8	0.099	0.072	0.135	0.187	0.282	0.214	0.001	0.044	0.047	0.046	0.044
112	9	0.093	0.065	0.140	0.169	0.301	0.231	0.001	0.056	0.060	0.059	0.057
112	10	0.089	0.057	0.134	0.150	0.274	0.225	0.001	0.021	0.023	0.023	0.022
112	11	0.091	0.059	0.135	0.156	0.278	0.205	0.001	0.029	0.031	0.031	0.030
112	12	0.093	0.062	0.136	0.163	0.285	0.202	0.001	0.035	0.039	0.037	0.036
112	13	0.103	0.077	0.136	0.198	0.284	0.213	0.001	0.043	0.047	0.045	0.044
112	14	0.093	0.066	0.140	0.170	0.301	0.235	0.001	0.055	0.060	0.058	0.056
112	15	0.089	0.057	0.135	0.150	0.274	0.223	0.001	0.022	0.023	0.023	0.022
112	16	0.091	0.059	0.135	0.155	0.279	0.209	0.001	0.029	0.031	0.031	0.030
112	17	0.093	0.063	0.136	0.167	0.284	0.203	0.001	0.036	0.039	0.038	0.037
112	18	0.106	0.081	0.136	0.207	0.287	0.215	0.001	0.044	0.048	0.045	0.044
112	19	0.093	0.066	0.138	0.166	0.289	0.271	0.001	0.056	0.061	0.057	0.056
112	20	0.088	0.057	0.135	0.150	0.273	0.234	0.001	0.022	0.023	0.022	0.021
112	21	0.090	0.059	0.135	0.155	0.276	0.209	0.001	0.029	0.032	0.030	0.030
112	22	0.092	0.061	0.136	0.163	0.282	0.204	0.001	0.036	0.039	0.036	0.036
112	23	0.103	0.077	0.136	0.198	0.284	0.220	0.001	0.044	0.048	0.044	0.044
112	24	0.094	0.066	0.138	0.167	0.301	0.233	0.001	0.056	0.061	0.056	0.056
112	25	0.088	0.057	0.135	0.150	0.273	0.227	0.001	0.021	0.023	0.021	0.021
112	26	0.090	0.059	0.135	0.157	0.279	0.210	0.001	0.029	0.032	0.029	0.029
112	27	0.093	0.063	0.136	0.167	0.284	0.204	0.001	0.036	0.039	0.035	0.037
112	28	0.107	0.085	0.136	0.218	0.284	0.228	0.001	0.044	0.048	0.043	0.045
112	29	0.093	0.068	0.140	0.175	0.301	0.240	0.001	0.056	0.062	0.055	0.056
112	30	0.089	0.057	0.135	0.151	0.275	0.234	0.001	0.021	0.023	0.021	0.021
112	31	0.091	0.059	0.135	0.157	0.280	0.210	0.001	0.029	0.032	0.028	0.029
112	32	0.092	0.063	0.136	0.169	0.284	0.205	0.001	0.035	0.039	0.034	0.036
112	33	0.100	0.075	0.136	0.194	0.284	0.226	0.001	0.043	0.048	0.041	0.045
112	34	0.094	0.068	0.140	0.175	0.301	0.248	0.001	0.055	0.061	0.053	0.057
112	35	0.089	0.057	0.135	0.152	0.275	0.235	0.001	0.021	0.023	0.021	0.021
112	36	0.090	0.059	0.135	0.158	0.278	0.211	0.001	0.028	0.031	0.027	0.029
112	37	0.093	0.063	0.136	0.169	0.286	0.203	0.001	0.034	0.039	0.033	0.037
112	38	0.105	0.079	0.136	0.208	0.287	0.225	0.001	0.042	0.047	0.040	0.045
112	39	0.095	0.069	0.142	0.180	0.309	0.246	0.001	0.053	0.061	0.050	0.057

Table C45a. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 2,800 to 4,200 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
113	5	20.22	0.48	0.00233	-45	-9.90	2800	2800	2800	2800
113	6	20.43	0.49	0.00233	-45	-9.90	3200	3200	3200	3200
113	7	20.34	0.48	0.00233	-45	-9.90	3500	3500	3500	3500
113	8	20.42	0.48	0.00233	-45	-9.90	3800	3800	3800	3800
113	9	20.72	0.50	0.00233	-45	-9.90	4200	4200	4200	4200
113	14	20.05	0.47	0.00232	-45	-4.98	2800	2800	2800	2800
113	15	20.37	0.48	0.00232	-45	-4.98	3200	3200	3200	3200
113	16	20.11	0.47	0.00232	-45	-4.98	3500	3500	3500	3500
113	17	20.32	0.48	0.00232	-45	-4.98	3800	3800	3800	3800
113	18	20.56	0.49	0.00232	-45	-4.98	4200	4200	4200	4200
113	23	20.29	0.48	0.00232	-45	-1.98	2800	2800	2800	2800
113	24	20.50	0.49	0.00232	-45	-1.98	3200	3200	3200	3200
113	25	20.62	0.49	0.00232	-45	-1.99	3500	3500	3500	3500
113	26	20.48	0.49	0.00232	-45	-1.98	3800	3800	3800	3800
113	27	20.68	0.50	0.00232	-45	-1.98	4200	4200	4200	4200
113	32	20.42	0.48	0.00233	-45	-0.04	2800	2800	2800	2800
113	33	20.38	0.48	0.00233	-45	-0.04	3200	3200	3200	3200
113	34	20.30	0.48	0.00233	-45	-0.04	3500	3500	3500	3500
113	35	20.49	0.49	0.00233	-45	-0.04	3800	3800	3800	3800
113	36	20.52	0.49	0.00233	-45	-0.04	4200	4200	4200	4200
113	41	20.33	0.48	0.00233	-45	2.03	2800	2800	2800	2800
113	42	20.07	0.47	0.00233	-45	2.04	3200	3200	3200	3200
113	43	20.07	0.47	0.00233	-45	2.04	3500	3500	3500	3500
113	44	20.21	0.47	0.00233	-45	2.03	3800	3800	3800	3800
113	45	20.41	0.48	0.00233	-45	2.04	4200	4200	4200	4200
114	5	20.33	0.50	0.00240	-45	5.03	2800	2800	2800	2800
114	6	20.33	0.50	0.00240	-45	5.03	3200	3200	3200	3200
114	7	20.28	0.49	0.00240	-45	5.03	3500	3500	3500	3500
114	8	20.21	0.49	0.00240	-45	5.03	3800	3800	3800	3800
114	9	20.20	0.49	0.00240	-45	5.03	4200	4200	4200	4200
114	14	19.86	0.47	0.00240	-45	9.95	2800	2800	2800	2800
114	15	19.51	0.46	0.00240	-45	9.95	3200	3200	3200	3200
114	16	20.70	0.52	0.00240	-45	9.95	3500	3500	3500	3500
114	17	20.04	0.48	0.00240	-45	9.95	3800	3800	3800	3800
114	18	19.86	0.47	0.00240	-45	9.95	4200	4200	4200	4200

Table C45b. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 2,800 to 4,200 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
113	5	0.261	-0.292	3.713	-2.699	4.172	-0.144	16.808	1.554	1.689	1.592	1.573
113	6	0.302	-0.306	4.835	-3.658	5.309	-0.101	16.769	2.241	2.421	2.288	2.285
113	7	0.325	-0.322	5.775	-4.472	6.244	-0.069	16.734	2.885	3.108	2.929	2.949
113	8	0.357	-0.348	6.780	-5.366	7.767	0.013	16.689	3.706	4.005	3.729	3.725
113	9	0.418	-0.389	8.263	-6.486	8.725	0.087	16.615	5.028	5.435	5.095	5.133
113	14	0.239	-0.303	4.049	-2.821	3.831	-0.329	16.809	1.502	1.695	1.609	1.541
113	15	0.252	-0.300	5.139	-3.598	5.371	-0.215	16.772	2.155	2.417	2.257	2.235
113	16	0.272	-0.298	6.052	-4.353	6.231	-0.103	16.736	2.801	3.127	2.899	2.898
113	17	0.305	-0.318	7.089	-5.344	7.605	-0.052	16.692	3.605	4.008	3.684	3.719
113	18	0.354	-0.342	8.588	-6.834	9.056	0.008	16.617	4.905	5.457	5.020	5.107
113	23	0.206	-0.269	4.167	-2.981	3.989	-0.193	16.810	1.533	1.661	1.520	1.519
113	24	0.237	-0.279	5.350	-4.109	5.511	-0.152	16.771	2.226	2.424	2.212	2.232
113	25	0.255	-0.279	6.345	-4.774	6.581	-0.051	16.735	2.885	3.162	2.803	2.941
113	26	0.269	-0.278	7.355	-5.924	8.176	-0.001	16.692	3.712	4.028	3.538	3.713
113	27	0.311	-0.299	8.867	-7.135	9.990	0.113	16.619	5.030	5.475	4.794	5.089
113	32	0.186	-0.251	4.337	-3.522	4.378	-0.282	16.810	1.561	1.673	1.471	1.518
113	33	0.215	-0.261	5.481	-4.310	5.916	-0.154	16.773	2.234	2.422	2.102	2.227
113	34	0.229	-0.260	6.418	-4.951	7.278	-0.085	16.738	2.879	3.141	2.640	2.898
113	35	0.244	-0.264	7.475	-5.744	8.862	-0.046	16.695	3.685	4.033	3.346	3.715
113	36	0.277	-0.274	9.014	-7.194	10.662	0.106	16.622	5.022	5.482	4.601	5.080
113	41	0.160	-0.242	4.449	-3.717	4.843	-0.363	16.812	1.532	1.663	1.412	1.480
113	42	0.195	-0.243	5.570	-4.563	6.503	-0.199	16.775	2.219	2.429	2.020	2.190
113	43	0.202	-0.248	6.562	-4.906	8.017	-0.146	16.739	2.864	3.203	2.579	2.892
113	44	0.216	-0.247	7.617	-5.684	9.392	-0.051	16.696	3.644	4.043	3.289	3.723
113	45	0.246	-0.269	9.164	-6.638	12.078	0.117	16.622	5.009	5.582	4.489	5.074
114	5	0.207	-0.238	4.687	-3.076	5.679	-0.323	16.710	1.568	1.735	1.480	1.531
114	6	0.234	-0.245	5.819	-4.354	7.182	-0.245	16.674	2.277	2.489	2.061	2.226
114	7	0.244	-0.254	6.832	-4.680	9.019	-0.145	16.638	2.924	3.258	2.634	2.929
114	8	0.260	-0.264	7.966	-5.378	10.465	-0.021	16.593	3.773	4.172	3.411	3.825
114	9	0.288	-0.290	9.534	-6.235	13.096	0.150	16.521	5.116	5.692	4.581	5.237
114	14	0.140	-0.208	4.905	-4.517	7.010	-0.555	16.712	1.562	1.725	1.377	1.506
114	15	0.170	-0.209	5.989	-4.977	7.761	-0.481	16.678	2.183	2.445	1.958	2.186
114	16	0.197	-0.240	7.126	-5.994	9.071	-0.590	16.645	2.831	3.146	2.503	2.845
114	17	0.203	-0.235	8.109	-6.725	10.857	-0.339	16.602	3.648	3.971	3.211	3.707
114	18	0.209	-0.256	9.610	-7.234	13.674	-0.061	16.530	4.970	5.452	4.378	5.129

**Table C45c. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg,
RPM = 2,800 to 4,200 (uniform) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
113	5	0.089	0.057	0.134	0.150	0.274	0.229	0.001	0.022	0.023	0.022	0.022
113	6	0.090	0.060	0.135	0.158	0.277	0.208	0.001	0.029	0.032	0.030	0.030
113	7	0.091	0.059	0.135	0.157	0.280	0.201	0.001	0.036	0.039	0.037	0.037
113	8	0.104	0.070	0.136	0.182	0.298	0.215	0.001	0.044	0.047	0.044	0.044
113	9	0.095	0.068	0.140	0.174	0.299	0.236	0.001	0.055	0.060	0.057	0.056
113	14	0.089	0.057	0.134	0.150	0.274	0.225	0.001	0.021	0.023	0.022	0.021
113	15	0.091	0.060	0.135	0.158	0.278	0.213	0.001	0.028	0.032	0.030	0.029
113	16	0.092	0.062	0.136	0.165	0.281	0.201	0.001	0.035	0.039	0.036	0.036
113	17	0.110	0.074	0.136	0.192	0.300	0.218	0.001	0.043	0.047	0.044	0.044
113	18	0.095	0.068	0.139	0.175	0.298	0.243	0.001	0.054	0.060	0.056	0.056
113	23	0.089	0.057	0.134	0.151	0.274	0.233	0.001	0.021	0.023	0.021	0.021
113	24	0.091	0.061	0.135	0.160	0.278	0.210	0.001	0.029	0.032	0.029	0.029
113	25	0.092	0.061	0.136	0.161	0.282	0.202	0.001	0.036	0.039	0.035	0.036
113	26	0.108	0.073	0.136	0.192	0.297	0.229	0.001	0.044	0.047	0.042	0.044
113	27	0.095	0.069	0.139	0.176	0.295	0.238	0.001	0.056	0.060	0.054	0.056
113	32	0.089	0.057	0.134	0.151	0.275	0.217	0.001	0.022	0.023	0.021	0.021
113	33	0.091	0.062	0.135	0.163	0.279	0.213	0.001	0.029	0.032	0.028	0.029
113	34	0.091	0.061	0.136	0.162	0.282	0.205	0.001	0.036	0.039	0.034	0.036
113	35	0.112	0.075	0.136	0.198	0.304	0.222	0.001	0.043	0.047	0.040	0.044
113	36	0.096	0.070	0.139	0.180	0.299	0.247	0.001	0.056	0.060	0.052	0.056
113	41	0.089	0.057	0.134	0.151	0.274	0.233	0.001	0.021	0.023	0.020	0.021
113	42	0.090	0.060	0.135	0.159	0.278	0.207	0.001	0.029	0.032	0.027	0.029
113	43	0.092	0.061	0.136	0.163	0.282	0.205	0.001	0.036	0.040	0.033	0.036
113	44	0.108	0.074	0.136	0.192	0.301	0.225	0.001	0.043	0.049	0.040	0.044
113	45	0.095	0.071	0.138	0.179	0.293	0.279	0.001	0.055	0.061	0.051	0.056
114	5	0.090	0.057	0.134	0.151	0.277	0.244	0.001	0.022	0.024	0.021	0.021
114	6	0.091	0.060	0.135	0.159	0.280	0.208	0.001	0.030	0.032	0.028	0.029
114	7	0.093	0.062	0.136	0.165	0.284	0.203	0.001	0.036	0.040	0.034	0.036
114	8	0.107	0.073	0.137	0.188	0.300	0.214	0.001	0.044	0.049	0.041	0.045
114	9	0.095	0.071	0.141	0.185	0.300	0.257	0.001	0.056	0.062	0.052	0.057
114	14	0.090	0.057	0.135	0.152	0.276	0.234	0.001	0.021	0.024	0.020	0.021
114	15	0.091	0.061	0.135	0.161	0.279	0.210	0.001	0.029	0.032	0.026	0.028
114	16	0.092	0.062	0.137	0.168	0.283	0.205	0.001	0.035	0.039	0.032	0.035
114	17	0.113	0.076	0.137	0.200	0.307	0.220	0.001	0.043	0.047	0.039	0.043
114	18	0.097	0.073	0.141	0.191	0.302	0.255	0.001	0.055	0.060	0.049	0.056

Table C46a. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -60 deg, pitch = -10 to 10 deg, RPM = 2,800 to 4,200 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
115	5	19.95	0.48	0.00241	-60	-9.91	2800	2800	2800	2800
115	6	19.87	0.47	0.00241	-60	-9.91	3200	3200	3200	3200
115	7	20.21	0.49	0.00241	-60	-9.91	3500	3500	3500	3500
115	8	20.09	0.49	0.00241	-60	-9.91	3800	3800	3800	3800
115	9	20.36	0.50	0.00241	-60	-9.91	4200	4200	4200	4200
115	10	20.00	0.48	0.00241	-60	-4.99	2800	2800	2800	2800
115	11	20.15	0.49	0.00241	-60	-4.98	3200	3200	3200	3200
115	12	20.32	0.50	0.00241	-60	-4.99	3500	3500	3500	3500
115	13	19.98	0.48	0.00241	-60	-4.98	3800	3800	3800	3800
115	14	19.98	0.48	0.00241	-60	-4.98	4200	4200	4200	4200
115	15	19.44	0.45	0.00241	-60	-1.99	2800	2800	2800	2800
115	16	19.70	0.47	0.00241	-60	-1.98	3200	3200	3200	3200
115	17	19.61	0.46	0.00241	-60	-1.99	3500	3500	3500	3500
115	18	19.80	0.47	0.00241	-60	-1.99	3800	3800	3800	3800
115	19	19.93	0.48	0.00241	-60	-1.99	4200	4200	4200	4200
115	20	19.81	0.47	0.00241	-60	-0.05	2800	2800	2800	2800
115	21	20.01	0.48	0.00241	-60	-0.05	3200	3200	3200	3200
115	22	19.89	0.48	0.00241	-60	-0.05	3500	3500	3500	3500
115	23	20.08	0.49	0.00241	-60	-0.05	3800	3800	3800	3800
115	24	20.09	0.49	0.00241	-60	-0.05	4200	4200	4200	4200
115	25	19.79	0.47	0.00241	-60	2.03	2800	2800	2800	2800
115	26	19.77	0.47	0.00241	-60	2.03	3200	3200	3200	3200
115	27	19.98	0.48	0.00241	-60	2.03	3500	3500	3500	3500
115	28	19.67	0.47	0.00241	-60	2.03	3800	3800	3800	3800
115	29	19.89	0.48	0.00241	-60	2.03	4200	4200	4200	4200
115	30	20.05	0.48	0.00241	-60	5.03	2800	2800	2800	2800
115	31	20.22	0.49	0.00241	-60	5.03	3200	3200	3200	3200
115	32	20.31	0.50	0.00241	-60	5.03	3500	3500	3500	3500
115	33	20.13	0.49	0.00241	-60	5.03	3800	3800	3800	3800
115	34	20.06	0.48	0.00241	-60	5.03	4200	4200	4200	4200
115	35	19.83	0.47	0.00241	-60	9.95	2800	2800	2800	2800
115	36	19.72	0.47	0.00241	-60	9.95	3200	3200	3200	3200
115	37	19.59	0.46	0.00241	-60	9.95	3500	3500	3500	3500
115	38	19.65	0.46	0.00241	-60	9.95	3800	3800	3800	3800
115	39	19.57	0.46	0.00241	-60	9.95	4200	4200	4200	4200

Table C46b. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -60 deg, pitch = -10 to 10 deg, RPM = 2,800 to 4,200 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
115	5	0.171	-0.354	3.690	-3.861	3.092	-0.150	16.705	1.636	1.732	1.681	1.589
115	6	0.193	-0.381	4.819	-4.992	3.487	-0.169	16.666	2.340	2.525	2.391	2.356
115	7	0.220	-0.400	5.846	-6.023	4.306	-0.198	16.630	3.002	3.180	3.073	3.034
115	8	0.236	-0.423	6.896	-7.153	4.843	-0.195	16.584	3.860	4.117	3.899	3.922
115	9	0.275	-0.460	8.456	-8.231	5.943	-0.279	16.509	5.208	5.605	5.282	5.344
115	10	0.161	-0.328	3.967	-3.566	3.360	-0.056	16.709	1.549	1.695	1.608	1.568
115	11	0.190	-0.353	5.095	-5.232	4.229	-0.129	16.670	2.248	2.461	2.331	2.304
115	12	0.216	-0.366	6.110	-6.069	5.455	-0.180	16.633	2.887	3.192	2.968	3.014
115	13	0.239	-0.393	7.130	-7.162	6.406	-0.210	16.588	3.722	4.114	3.806	3.858
115	14	0.276	-0.417	8.660	-8.727	7.227	-0.218	16.513	5.054	5.613	5.177	5.268
115	15	0.152	-0.292	4.077	-3.847	3.383	-0.097	16.708	1.548	1.692	1.617	1.555
115	16	0.176	-0.310	5.247	-5.406	5.052	-0.091	16.670	2.272	2.470	2.313	2.283
115	17	0.195	-0.316	6.204	-6.783	5.910	-0.084	16.634	2.935	3.186	2.967	2.986
115	18	0.217	-0.336	7.305	-7.964	7.086	0.005	16.588	3.774	4.075	3.801	3.848
115	19	0.253	-0.380	8.788	-9.684	8.456	-0.079	16.513	5.167	5.600	5.115	5.238
115	20	0.152	-0.287	4.229	-4.434	3.572	-0.095	16.708	1.594	1.716	1.607	1.540
115	21	0.174	-0.308	5.433	-5.637	5.241	-0.029	16.669	2.322	2.514	2.319	2.264
115	22	0.186	-0.312	6.358	-6.957	6.503	0.079	16.634	2.948	3.197	2.940	2.938
115	23	0.214	-0.335	7.404	-8.498	7.451	0.069	16.589	3.780	4.143	3.720	3.775
115	24	0.242	-0.365	8.936	-10.005	9.026	0.142	16.514	5.180	5.598	5.027	5.214
115	25	0.122	-0.260	4.451	-4.339	4.946	0.123	16.707	1.618	1.770	1.584	1.521
115	26	0.151	-0.291	5.537	-5.871	5.521	0.069	16.671	2.283	2.509	2.242	2.236
115	27	0.166	-0.296	6.521	-6.829	7.371	0.176	16.635	2.933	3.268	2.842	2.914
115	28	0.187	-0.305	7.525	-8.122	8.613	0.252	16.590	3.779	4.154	3.630	3.798
115	29	0.235	-0.341	8.992	-10.358	9.313	0.179	16.516	5.194	5.615	4.936	5.208
115	30	0.128	-0.251	4.648	-4.532	4.749	0.176	16.709	1.578	1.741	1.530	1.491
115	31	0.130	-0.262	5.817	-6.378	6.653	0.325	16.673	2.247	2.515	2.150	2.179
115	32	0.159	-0.290	6.714	-7.368	7.982	0.217	16.638	2.887	3.262	2.733	2.833
115	33	0.172	-0.283	7.745	-8.754	9.568	0.316	16.593	3.744	4.146	3.467	3.714
115	34	0.210	-0.296	9.208	-10.456	11.039	0.328	16.521	5.128	5.574	4.727	5.123
115	35	0.111	-0.217	4.778	-5.674	5.376	0.094	16.713	1.538	1.640	1.428	1.403
115	36	0.128	-0.229	5.983	-6.056	7.256	0.285	16.678	2.179	2.457	2.031	2.072
115	37	0.127	-0.236	6.923	-6.695	8.790	0.355	16.642	2.817	3.247	2.587	2.803
115	38	0.124	-0.254	7.978	-7.726	10.774	0.447	16.598	3.626	4.157	3.271	3.679
115	39	0.151	-0.245	9.381	-9.831	12.710	0.525	16.529	4.952	5.567	4.393	5.020

Table C46c. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -60 deg, pitch = -10 to 10 deg, RPM = 2,800 to 4,200 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
115	5	0.089	0.057	0.134	0.151	0.275	0.238	0.001	0.022	0.024	0.023	0.022
115	6	0.089	0.060	0.135	0.160	0.275	0.204	0.001	0.031	0.033	0.031	0.031
115	7	0.090	0.059	0.136	0.156	0.279	0.201	0.001	0.037	0.040	0.038	0.038
115	8	0.107	0.065	0.136	0.170	0.307	0.207	0.001	0.045	0.048	0.046	0.046
115	9	0.096	0.073	0.140	0.190	0.291	0.250	0.001	0.057	0.062	0.058	0.058
115	10	0.089	0.057	0.134	0.151	0.275	0.235	0.001	0.021	0.023	0.022	0.022
115	11	0.090	0.060	0.135	0.159	0.277	0.207	0.001	0.029	0.032	0.031	0.030
115	12	0.092	0.060	0.136	0.161	0.282	0.201	0.001	0.036	0.040	0.037	0.037
115	13	0.113	0.066	0.136	0.174	0.316	0.210	0.001	0.044	0.048	0.045	0.045
115	14	0.097	0.079	0.140	0.206	0.287	0.273	0.001	0.056	0.062	0.057	0.058
115	15	0.090	0.057	0.134	0.152	0.276	0.249	0.001	0.021	0.023	0.022	0.021
115	16	0.089	0.061	0.135	0.163	0.275	0.214	0.001	0.030	0.032	0.030	0.030
115	17	0.092	0.061	0.136	0.163	0.284	0.201	0.001	0.037	0.040	0.037	0.037
115	18	0.105	0.065	0.136	0.170	0.303	0.218	0.001	0.044	0.048	0.045	0.045
115	19	0.095	0.071	0.139	0.185	0.285	0.271	0.001	0.057	0.062	0.057	0.057
115	20	0.090	0.058	0.134	0.153	0.276	0.237	0.001	0.022	0.024	0.022	0.021
115	21	0.090	0.062	0.135	0.164	0.278	0.216	0.001	0.030	0.033	0.030	0.030
115	22	0.091	0.061	0.136	0.164	0.281	0.205	0.001	0.037	0.040	0.037	0.036
115	23	0.109	0.066	0.137	0.174	0.310	0.217	0.001	0.044	0.048	0.044	0.044
115	24	0.096	0.071	0.141	0.187	0.295	0.249	0.001	0.057	0.062	0.056	0.057
115	25	0.090	0.057	0.135	0.153	0.276	0.232	0.001	0.022	0.024	0.022	0.021
115	26	0.090	0.062	0.135	0.163	0.277	0.210	0.001	0.030	0.033	0.030	0.029
115	27	0.092	0.061	0.136	0.165	0.283	0.204	0.001	0.037	0.040	0.036	0.036
115	28	0.119	0.069	0.137	0.182	0.328	0.226	0.001	0.044	0.049	0.043	0.045
115	29	0.098	0.073	0.141	0.192	0.298	0.254	0.001	0.057	0.062	0.055	0.057
115	30	0.090	0.058	0.134	0.155	0.275	0.238	0.001	0.022	0.024	0.021	0.021
115	31	0.090	0.063	0.135	0.167	0.278	0.211	0.001	0.029	0.033	0.029	0.029
115	32	0.092	0.062	0.136	0.167	0.283	0.205	0.001	0.036	0.040	0.035	0.035
115	33	0.107	0.066	0.137	0.173	0.305	0.233	0.001	0.044	0.048	0.041	0.044
115	34	0.100	0.077	0.139	0.201	0.295	0.255	0.001	0.057	0.061	0.053	0.056
115	35	0.089	0.058	0.135	0.154	0.275	0.229	0.001	0.021	0.023	0.020	0.020
115	36	0.090	0.062	0.136	0.167	0.278	0.213	0.001	0.028	0.032	0.027	0.027
115	37	0.092	0.062	0.137	0.168	0.284	0.205	0.001	0.035	0.040	0.033	0.035
115	38	0.118	0.069	0.138	0.182	0.328	0.220	0.001	0.043	0.048	0.039	0.043
115	39	0.102	0.079	0.141	0.207	0.300	0.265	0.001	0.055	0.061	0.050	0.055

Table C47a. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 2,800 to 4,200 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
116	5	20.25	0.49	0.00240	-90	-9.91	2800	2800	2800	2800
116	6	20.45	0.50	0.00240	-90	-9.91	3200	3200	3200	3200
116	7	20.35	0.50	0.00240	-90	-9.91	3500	3500	3500	3500
116	8	20.71	0.52	0.00240	-90	-9.91	3800	3800	3800	3800
116	9	20.21	0.49	0.00240	-90	-9.91	4200	4200	4200	4200
116	14	19.89	0.47	0.00240	-90	-4.99	2800	2800	2800	2800
116	15	19.64	0.46	0.00240	-90	-4.99	3200	3200	3200	3200
116	16	20.11	0.49	0.00240	-90	-4.99	3500	3500	3500	3500
116	17	20.47	0.50	0.00240	-90	-4.99	3800	3800	3800	3800
116	18	20.67	0.51	0.00240	-90	-4.99	4200	4200	4200	4200
116	23	20.16	0.49	0.00240	-90	-1.99	2800	2800	2800	2800
116	24	19.62	0.46	0.00240	-90	-1.99	3200	3200	3200	3200
116	25	19.93	0.48	0.00240	-90	-1.99	3500	3500	3500	3500
116	26	19.85	0.47	0.00240	-90	-1.99	3800	3800	3800	3800
116	27	20.10	0.48	0.00240	-90	-1.99	4200	4200	4200	4200
116	32	19.66	0.46	0.00239	-90	-0.05	2800	2800	2800	2800
116	33	19.99	0.48	0.00239	-90	-0.05	3200	3200	3200	3200
116	34	19.92	0.47	0.00239	-90	-0.05	3500	3500	3500	3500
116	35	20.01	0.48	0.00239	-90	-0.05	3800	3800	3800	3800
116	36	19.85	0.47	0.00239	-90	-0.05	4200	4200	4200	4200
116	41	19.59	0.46	0.00239	-90	2.03	2800	2800	2800	2800
116	42	19.79	0.47	0.00239	-90	2.03	3200	3200	3200	3200
116	43	19.77	0.47	0.00239	-90	2.03	3500	3500	3500	3500
116	44	20.02	0.48	0.00239	-90	2.03	3800	3800	3800	3800
116	45	19.90	0.47	0.00239	-90	2.03	4200	4200	4200	4200
116	50	20.15	0.48	0.00239	-90	5.03	2800	2800	2800	2800
116	51	20.05	0.48	0.00239	-90	5.03	3200	3200	3200	3200
116	52	20.26	0.49	0.00239	-90	5.03	3500	3500	3500	3500
116	53	20.43	0.50	0.00239	-90	5.03	3800	3800	3800	3800
116	54	20.78	0.52	0.00239	-90	5.02	4200	4200	4200	4200
116	59	20.90	0.52	0.00238	-90	9.95	2800	2800	2800	2800
116	60	19.25	0.44	0.00238	-90	9.95	3200	3200	3200	3200
116	61	20.37	0.49	0.00238	-90	9.94	3500	3500	3500	3500
116	62	20.27	0.49	0.00238	-90	9.95	3800	3800	3800	3800
116	63	20.39	0.50	0.00238	-90	9.95	4200	4200	4200	4200

Table C47b. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 2,800 to 4,200 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
116	5	-0.023	-0.417	3.480	-4.890	0.595	0.056	16.702	1.609	1.851	1.702	1.668
116	6	-0.024	-0.461	4.655	-6.286	0.604	0.036	16.661	2.323	2.706	2.491	2.440
116	7	-0.046	-0.467	5.614	-7.717	0.804	-0.027	16.624	3.012	3.478	3.163	3.119
116	8	-0.043	-0.494	6.675	-8.822	0.632	0.012	16.579	3.776	4.417	4.014	3.970
116	9	-0.042	-0.505	8.157	-10.162	1.249	-0.013	16.501	5.116	6.041	5.473	5.384
116	14	-0.024	-0.392	3.643	-5.490	0.439	0.072	16.704	1.571	1.861	1.650	1.695
116	15	-0.028	-0.410	4.743	-6.703	0.399	0.066	16.666	2.242	2.653	2.345	2.436
116	16	-0.032	-0.453	5.698	-7.848	0.516	0.079	16.629	2.853	3.410	2.979	3.129
116	17	-0.045	-0.479	6.769	-8.971	0.637	0.079	16.583	3.657	4.401	3.833	3.962
116	18	-0.046	-0.519	8.261	-10.610	0.987	0.050	16.508	5.031	5.958	5.166	5.390
116	23	-0.024	-0.396	3.688	-6.667	0.379	-0.002	16.706	1.555	1.799	1.613	1.660
116	24	-0.037	-0.408	4.797	-7.757	0.617	0.081	16.666	2.260	2.636	2.336	2.405
116	25	-0.040	-0.431	5.766	-9.271	0.568	0.076	16.628	2.937	3.415	3.055	3.102
116	26	-0.037	-0.441	6.795	-10.353	1.086	0.074	16.583	3.733	4.361	3.821	3.943
116	27	-0.051	-0.484	8.290	-11.697	0.770	0.091	16.509	5.064	5.878	5.166	5.337
116	32	-0.037	-0.370	3.726	-7.667	0.206	-0.029	16.705	1.548	1.794	1.617	1.632
116	33	-0.046	-0.407	4.840	-9.091	0.465	0.013	16.666	2.268	2.633	2.353	2.349
116	34	-0.044	-0.425	5.756	-10.557	0.819	0.032	16.630	2.914	3.385	3.030	3.021
116	35	-0.046	-0.448	6.817	-11.711	0.741	0.092	16.584	3.742	4.341	3.837	3.865
116	36	-0.046	-0.483	8.315	-12.707	0.934	0.149	16.510	5.071	5.875	5.160	5.274
116	41	-0.038	-0.357	3.815	-8.597	0.182	-0.049	16.705	1.588	1.815	1.647	1.601
116	42	-0.046	-0.390	4.896	-10.516	0.345	-0.022	16.667	2.261	2.634	2.340	2.275
116	43	-0.044	-0.416	5.814	-11.683	0.329	0.037	16.630	2.912	3.370	2.976	2.993
116	44	-0.044	-0.450	6.889	-12.880	0.491	0.104	16.585	3.731	4.307	3.809	3.854
116	45	-0.045	-0.492	8.387	-14.186	0.603	0.158	16.511	5.060	5.864	5.154	5.184
116	50	-0.038	-0.371	4.070	-9.490	-0.211	-0.060	16.705	1.567	1.818	1.616	1.645
116	51	-0.043	-0.393	5.103	-10.992	0.327	-0.065	16.668	2.225	2.627	2.260	2.337
116	52	-0.047	-0.414	5.941	-12.782	0.364	-0.062	16.634	2.824	3.361	2.912	2.949
116	53	-0.048	-0.443	6.980	-14.277	0.162	0.016	16.589	3.621	4.292	3.683	3.806
116	54	-0.045	-0.495	8.487	-15.764	0.374	0.043	16.515	4.908	5.841	5.009	5.244
116	59	-0.050	-0.365	4.546	-9.962	0.071	-0.073	16.705	1.515	1.932	1.538	1.722
116	60	-0.032	-0.317	5.302	-11.535	-0.299	-0.049	16.669	2.107	2.706	2.134	2.446
116	61	-0.039	-0.353	6.216	-13.370	-0.190	0.031	16.635	2.680	3.413	2.733	3.075
116	62	-0.049	-0.357	7.137	-14.250	-0.053	0.193	16.593	3.397	4.302	3.448	3.875
116	63	-0.049	-0.393	8.553	-15.613	-0.340	0.338	16.522	4.672	5.840	4.659	5.285

Table C47c. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 2,800 to 4,200 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
116	5	0.089	0.058	0.134	0.152	0.273	0.215	0.001	0.022	0.025	0.023	0.023
116	6	0.088	0.062	0.135	0.165	0.273	0.201	0.001	0.030	0.035	0.032	0.032
116	7	0.090	0.060	0.136	0.161	0.278	0.200	0.001	0.037	0.043	0.039	0.038
116	8	0.108	0.062	0.137	0.161	0.325	0.211	0.001	0.044	0.051	0.047	0.046
116	9	0.094	0.078	0.139	0.210	0.290	0.261	0.001	0.056	0.066	0.060	0.059
116	14	0.089	0.058	0.134	0.153	0.274	0.214	0.001	0.022	0.025	0.023	0.023
116	15	0.089	0.062	0.135	0.166	0.275	0.205	0.001	0.029	0.034	0.031	0.031
116	16	0.090	0.061	0.136	0.165	0.282	0.201	0.001	0.036	0.042	0.037	0.038
116	17	0.113	0.062	0.137	0.160	0.336	0.209	0.001	0.043	0.052	0.045	0.046
116	18	0.095	0.077	0.139	0.212	0.291	0.271	0.001	0.056	0.065	0.057	0.059
116	23	0.089	0.059	0.135	0.155	0.274	0.233	0.001	0.022	0.025	0.022	0.023
116	24	0.089	0.064	0.135	0.171	0.275	0.208	0.001	0.030	0.034	0.031	0.031
116	25	0.091	0.061	0.136	0.163	0.286	0.202	0.001	0.037	0.042	0.038	0.038
116	26	0.114	0.063	0.138	0.164	0.338	0.214	0.001	0.044	0.051	0.045	0.046
116	27	0.094	0.079	0.143	0.213	0.296	0.245	0.001	0.056	0.064	0.057	0.058
116	32	0.089	0.059	0.135	0.157	0.275	0.234	0.001	0.021	0.024	0.022	0.022
116	33	0.089	0.065	0.135	0.175	0.275	0.209	0.001	0.030	0.034	0.031	0.031
116	34	0.090	0.062	0.136	0.169	0.280	0.202	0.001	0.036	0.042	0.038	0.037
116	35	0.106	0.065	0.137	0.169	0.315	0.216	0.001	0.044	0.051	0.045	0.045
116	36	0.097	0.080	0.142	0.217	0.301	0.260	0.001	0.056	0.064	0.057	0.058
116	41	0.089	0.061	0.135	0.160	0.275	0.220	0.001	0.022	0.025	0.023	0.022
116	42	0.089	0.065	0.135	0.177	0.275	0.209	0.001	0.030	0.034	0.031	0.030
116	43	0.091	0.062	0.137	0.171	0.285	0.203	0.001	0.036	0.041	0.037	0.037
116	44	0.112	0.065	0.138	0.169	0.330	0.220	0.001	0.044	0.050	0.045	0.045
116	45	0.098	0.079	0.142	0.219	0.301	0.266	0.001	0.056	0.064	0.057	0.057
116	50	0.089	0.062	0.136	0.161	0.275	0.222	0.001	0.022	0.025	0.022	0.023
116	51	0.089	0.066	0.135	0.180	0.274	0.209	0.001	0.029	0.034	0.030	0.030
116	52	0.090	0.062	0.137	0.173	0.283	0.204	0.001	0.035	0.041	0.036	0.037
116	53	0.117	0.065	0.138	0.171	0.342	0.216	0.001	0.043	0.050	0.044	0.045
116	54	0.108	0.079	0.145	0.215	0.333	0.248	0.001	0.054	0.064	0.056	0.057
116	59	0.090	0.062	0.137	0.162	0.275	0.228	0.001	0.021	0.026	0.022	0.023
116	60	0.089	0.068	0.136	0.185	0.275	0.212	0.001	0.028	0.035	0.028	0.031
116	61	0.091	0.062	0.137	0.174	0.285	0.205	0.001	0.034	0.042	0.035	0.038
116	62	0.114	0.065	0.137	0.169	0.333	0.221	0.001	0.040	0.050	0.041	0.045
116	63	0.099	0.076	0.139	0.210	0.302	0.252	0.001	0.052	0.064	0.052	0.058

Table C48a. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = 0 deg, pitch = -10 to 10 deg, RPM = 3,200 to 3,800 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
104	22	19.29	0.45	0.00240	0	-9.91	3800	3800	3200	3200
104	23	19.59	0.46	0.00240	0	-9.90	3200	3200	3800	3800
104	24	19.37	0.45	0.00240	0	-9.91	3800	3200	3800	3200
104	30	19.90	0.47	0.00240	0	-4.98	3800	3800	3200	3200
104	31	19.75	0.47	0.00240	0	-4.98	3200	3200	3800	3800
104	32	19.73	0.47	0.00240	0	-4.98	3800	3200	3800	3200
104	38	19.63	0.46	0.00240	0	-1.98	3800	3800	3200	3200
104	39	19.31	0.45	0.00240	0	-1.98	3200	3200	3800	3800
104	40	19.52	0.46	0.00240	0	-1.98	3800	3200	3800	3200
105	10	19.91	0.47	0.00239	0	-0.04	3800	3200	3800	3200
105	11	20.18	0.49	0.00239	0	-0.04	3200	3800	3200	3800
105	12	20.35	0.50	0.00239	0	-0.04	3800	3800	3200	3200
105	13	20.22	0.49	0.00239	0	-0.04	3200	3200	3800	3800
105	19	20.47	0.50	0.00239	0	2.04	3800	3800	3200	3200
105	20	20.02	0.48	0.00239	0	2.04	3200	3200	3800	3800
105	21	19.67	0.46	0.00239	0	2.04	3800	3200	3800	3200
105	27	20.18	0.49	0.00239	0	5.03	3800	3800	3200	3200
105	28	20.07	0.48	0.00239	0	5.03	3200	3200	3800	3800
105	29	19.72	0.46	0.00239	0	5.03	3800	3200	3800	3200
105	35	19.89	0.47	0.00239	0	9.95	3800	3800	3200	3200
105	36	20.14	0.48	0.00239	0	9.95	3200	3200	3800	3800
105	37	19.73	0.46	0.00239	0	9.95	3800	3200	3800	3200

Table C48b. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = 0 deg, pitch = -10 to 10 deg, RPM = 3,200 to 3,800 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
104	22	0.359	0.058	6.001	0.016	20.308	0.429	16.733	3.859	4.100	2.560	2.359
104	23	0.513	0.050	5.991	-0.165	-1.402	0.143	16.735	2.306	2.480	4.126	3.813
104	24	0.430	0.128	5.990	-10.116	9.045	0.371	16.734	3.752	2.486	4.144	2.370
104	30	0.384	0.058	6.210	0.089	21.965	0.486	16.735	3.780	4.053	2.513	2.364
104	31	0.534	0.060	6.196	-0.245	0.278	0.188	16.735	2.305	2.470	4.115	3.813
104	32	0.452	0.143	6.241	-10.498	10.767	0.380	16.733	3.783	2.473	4.177	2.394
104	38	0.358	0.067	6.403	-0.317	23.786	0.546	16.732	3.862	4.142	2.553	2.335
104	39	0.510	0.071	6.333	-0.519	1.570	0.221	16.734	2.327	2.485	4.178	3.829
104	40	0.431	0.149	6.358	-10.379	12.170	0.429	16.733	3.792	2.490	4.177	2.398
105	10	0.435	0.154	6.535	-10.395	13.626	0.524	16.732	3.845	2.490	4.159	2.396
105	11	0.451	-0.032	6.488	9.808	13.994	0.217	16.734	2.332	4.103	2.574	3.790
105	12	0.375	0.055	6.488	-0.096	24.804	0.534	16.735	3.821	4.112	2.510	2.324
105	13	0.517	0.058	6.448	-0.455	3.368	0.249	16.734	2.337	2.489	4.120	3.821
105	19	0.366	0.052	6.607	-0.165	26.274	0.557	16.733	3.832	4.161	2.541	2.320
105	20	0.497	0.056	6.483	-0.366	4.736	0.226	16.735	2.298	2.482	4.099	3.790
105	21	0.414	0.148	6.544	-10.446	14.753	0.620	16.734	3.805	2.489	4.109	2.366
105	27	0.338	0.050	6.701	-0.214	27.950	0.555	16.734	3.853	4.150	2.495	2.311
105	28	0.470	0.051	6.577	-0.498	6.880	0.221	16.737	2.282	2.479	4.064	3.746
105	29	0.396	0.149	6.624	-10.447	16.664	0.737	16.734	3.807	2.484	4.129	2.318
105	35	0.304	0.045	6.714	-0.072	30.598	0.575	16.737	3.817	4.072	2.400	2.239
105	36	0.414	0.042	6.636	-0.476	11.557	0.282	16.741	2.270	2.446	3.930	3.600
105	37	0.352	0.156	6.744	-10.164	21.121	0.927	16.737	3.788	2.453	4.060	2.230

**Table C48c. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = 0 deg, pitch = -10 to 10 deg,
RPM = 3,200 to 3,800 (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
104	22	0.091	0.061	0.135	0.164	0.283	0.206	0.001	0.045	0.048	0.034	0.031
104	23	0.090	0.060	0.135	0.157	0.276	0.203	0.001	0.031	0.033	0.048	0.045
104	24	0.091	0.064	0.135	0.173	0.278	0.203	0.001	0.044	0.033	0.048	0.031
104	30	0.091	0.061	0.136	0.161	0.284	0.207	0.001	0.044	0.047	0.033	0.031
104	31	0.091	0.060	0.135	0.157	0.277	0.204	0.001	0.031	0.033	0.048	0.044
104	32	0.092	0.063	0.135	0.172	0.279	0.203	0.001	0.044	0.033	0.049	0.032
104	38	0.091	0.062	0.135	0.166	0.286	0.206	0.001	0.045	0.048	0.034	0.031
104	39	0.091	0.060	0.135	0.157	0.277	0.205	0.001	0.031	0.033	0.049	0.045
104	40	0.092	0.064	0.135	0.174	0.280	0.204	0.001	0.044	0.033	0.049	0.032
105	10	0.092	0.066	0.135	0.178	0.281	0.205	0.001	0.045	0.033	0.048	0.032
105	11	0.091	0.058	0.135	0.160	0.281	0.205	0.001	0.031	0.048	0.034	0.044
105	12	0.092	0.063	0.136	0.168	0.287	0.203	0.001	0.045	0.048	0.033	0.031
105	13	0.091	0.062	0.135	0.159	0.278	0.206	0.001	0.031	0.033	0.048	0.045
105	19	0.092	0.064	0.136	0.172	0.288	0.208	0.001	0.045	0.048	0.034	0.031
105	20	0.091	0.060	0.135	0.157	0.279	0.207	0.001	0.031	0.033	0.048	0.044
105	21	0.092	0.065	0.135	0.176	0.281	0.205	0.001	0.045	0.033	0.048	0.031
105	27	0.093	0.062	0.137	0.164	0.294	0.200	0.001	0.045	0.048	0.033	0.031
105	28	0.091	0.061	0.135	0.160	0.279	0.208	0.001	0.030	0.033	0.047	0.044
105	29	0.092	0.067	0.136	0.181	0.283	0.205	0.001	0.045	0.033	0.048	0.031
105	35	0.093	0.066	0.136	0.175	0.295	0.210	0.001	0.045	0.048	0.032	0.030
105	36	0.092	0.062	0.135	0.163	0.283	0.208	0.001	0.030	0.032	0.046	0.042
105	37	0.093	0.067	0.136	0.182	0.286	0.207	0.001	0.044	0.033	0.047	0.030

Table C49a. Full Vehicle: SUI Endurance, nominal speed 40 ft/s, yaw = 0 deg, pitch = -10 to 10 deg, RPM = 3,200 to 3,800 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
106	23	39.28	1.82	0.00236	0	-9.90	3800	3800	3200	3200
106	24	40.13	1.90	0.00236	0	-9.90	3200	3200	3800	3800
106	25	40.20	1.91	0.00236	0	-9.90	3800	3200	3800	3200
106	31	40.58	1.94	0.00236	0	-4.98	3800	3800	3200	3200
106	32	40.66	1.95	0.00236	0	-4.98	3200	3200	3800	3800
106	33	40.19	1.90	0.00235	0	-4.98	3800	3200	3800	3200
106	39	41.09	1.98	0.00235	0	-1.98	3800	3800	3200	3200
106	40	38.78	1.77	0.00235	0	-1.99	3200	3200	3800	3800
106	41	40.67	1.94	0.00235	0	-1.98	3800	3200	3800	3200
107	10	40.59	1.90	0.00231	0	-0.04	3800	3800	3200	3200
107	11	40.90	1.93	0.00231	0	-0.04	3200	3200	3800	3800
107	12	40.78	1.92	0.00231	0	-0.04	3800	3200	3800	3200
107	19	40.44	1.89	0.00231	0	2.04	3800	3800	3200	3200
107	20	40.80	1.92	0.00231	0	2.03	3200	3200	3800	3800
107	21	40.67	1.91	0.00231	0	2.04	3800	3200	3800	3200
107	27	39.95	1.84	0.00231	0	5.03	3200	3200	3800	3800
107	28	40.93	1.94	0.00231	0	5.03	2800	2800	4200	4200
107	29	40.58	1.90	0.00231	0	5.03	3800	3200	3800	3200
108	10	40.32	1.91	0.00236	0	9.95	3200	3200	3800	3800
108	11	39.91	1.88	0.00236	0	9.95	2800	2800	4200	4200
108	12	40.12	1.90	0.00236	0	9.95	3800	3200	3800	3200

Table C49b. Full Vehicle: SUI Endurance, nominal speed 40 ft/s, yaw = 0 deg, pitch = -10 to 10 deg, RPM = 3,200 to 3,800 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
106	23	1.012	0.032	6.313	-0.944	22.962	0.479	16.726	3.975	4.241	2.643	2.405
106	24	1.157	0.037	6.327	-1.090	-1.718	0.075	16.725	2.409	2.681	4.372	3.908
106	25	1.102	0.103	6.387	-11.864	10.721	0.811	16.723	3.983	2.681	4.389	2.420
106	31	1.027	0.037	7.103	-0.556	26.566	0.452	16.731	3.789	4.129	2.651	2.405
106	32	1.133	0.047	7.061	-1.211	1.403	0.169	16.733	2.346	2.508	4.205	3.760
106	33	1.049	0.079	7.015	-11.371	13.435	0.846	16.733	3.679	2.516	4.226	2.320
106	39	0.981	0.041	7.477	-0.684	29.258	0.601	16.732	3.833	4.023	2.630	2.389
106	40	0.990	0.043	7.237	-0.647	4.740	0.241	16.735	2.353	2.499	4.018	3.714
106	41	1.008	0.074	7.422	-10.279	16.439	1.013	16.734	3.717	2.513	4.077	2.360
107	10	1.002	0.076	7.569	-0.642	31.038	0.525	16.728	3.766	4.065	2.508	2.325
107	11	1.100	0.084	7.525	-0.876	6.925	0.222	16.732	2.352	2.516	3.893	3.597
107	12	1.042	0.099	7.582	-10.797	18.688	1.017	16.728	3.772	2.516	4.042	2.244
107	19	0.989	0.084	7.909	-0.787	33.746	0.421	16.728	3.770	4.079	2.474	2.281
107	20	1.084	0.093	7.831	-0.640	9.421	0.163	16.733	2.361	2.569	3.797	3.522
107	21	1.033	0.097	7.906	-10.384	21.262	1.050	16.729	3.774	2.569	3.964	2.210
107	27	1.001	0.094	8.195	-0.895	11.959	0.182	16.735	2.399	2.623	3.719	3.382
107	28	1.110	0.095	8.474	-0.810	-5.586	0.193	16.723	1.752	1.899	4.959	4.438
107	29	0.965	0.101	8.358	-9.805	24.366	1.074	16.732	3.783	2.616	3.841	2.094
108	10	0.867	0.100	9.456	0.092	10.981	0.410	16.725	2.589	2.753	3.814	3.409
108	11	0.969	0.107	9.634	-0.170	-8.006	0.241	16.717	1.907	2.001	4.922	4.337
108	12	0.800	0.099	9.448	-8.469	26.497	1.227	16.721	4.099	2.784	3.848	2.102

**Table C49c. Full Vehicle: SUI Endurance, nominal speed 40 ft/s, yaw = 0 deg, pitch = -10 to 10 deg,
RPM = 3,200 to 3,800 (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
106	23	0.096	0.067	0.137	0.179	0.292	0.215	0.001	0.046	0.050	0.035	0.032
106	24	0.095	0.064	0.136	0.165	0.284	0.216	0.001	0.032	0.035	0.051	0.046
106	25	0.097	0.073	0.137	0.194	0.286	0.213	0.001	0.046	0.035	0.051	0.032
106	31	0.099	0.068	0.141	0.179	0.308	0.209	0.001	0.044	0.048	0.035	0.032
106	32	0.095	0.065	0.136	0.167	0.284	0.217	0.001	0.031	0.033	0.049	0.044
106	33	0.097	0.076	0.137	0.202	0.286	0.214	0.001	0.043	0.034	0.049	0.031
106	39	0.097	0.071	0.138	0.189	0.299	0.219	0.001	0.045	0.047	0.034	0.032
106	40	0.094	0.066	0.136	0.168	0.284	0.215	0.001	0.031	0.033	0.047	0.044
106	41	0.098	0.076	0.137	0.203	0.287	0.216	0.001	0.044	0.033	0.048	0.031
107	10	0.098	0.071	0.140	0.189	0.306	0.220	0.001	0.044	0.047	0.033	0.031
107	11	0.096	0.069	0.137	0.176	0.288	0.216	0.001	0.031	0.033	0.046	0.042
107	12	0.099	0.077	0.137	0.206	0.296	0.219	0.001	0.044	0.033	0.047	0.030
107	19	0.099	0.073	0.138	0.194	0.302	0.226	0.001	0.044	0.049	0.033	0.030
107	20	0.097	0.068	0.137	0.174	0.290	0.224	0.001	0.031	0.034	0.045	0.041
107	21	0.100	0.076	0.138	0.203	0.297	0.222	0.001	0.044	0.034	0.046	0.030
107	27	0.098	0.069	0.137	0.175	0.294	0.219	0.001	0.032	0.034	0.044	0.040
107	28	0.095	0.065	0.138	0.165	0.292	0.266	0.001	0.025	0.027	0.055	0.049
107	29	0.103	0.090	0.138	0.230	0.305	0.228	0.001	0.044	0.034	0.045	0.028
108	10	0.100	0.066	0.136	0.173	0.294	0.217	0.001	0.034	0.036	0.045	0.041
108	11	0.094	0.066	0.137	0.168	0.287	0.260	0.001	0.027	0.028	0.055	0.048
108	12	0.099	0.074	0.139	0.198	0.296	0.216	0.001	0.048	0.036	0.045	0.029

Table C50a. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -5 deg, pitch = -10 to 10 deg, RPM = 3,200 to 3,800 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
110	21	19.48	0.45	0.00237	-5	-9.90	3800	3800	3200	3200
110	22	20.20	0.48	0.00237	-5	-9.90	3200	3200	3800	3800
110	23	20.26	0.49	0.00237	-5	-9.90	3800	3200	3800	3200
110	24	20.33	0.49	0.00237	-5	-9.90	3200	3800	3200	3800
110	30	20.61	0.50	0.00237	-5	-4.98	3800	3800	3200	3200
110	31	20.16	0.48	0.00237	-5	-4.98	3200	3200	3800	3800
110	32	20.27	0.49	0.00237	-5	-4.98	3800	3200	3800	3200
110	33	20.14	0.48	0.00237	-5	-4.98	3200	3800	3200	3800
110	39	20.10	0.48	0.00237	-5	-1.98	3800	3800	3200	3200
110	40	19.97	0.47	0.00237	-5	-1.98	3200	3200	3800	3800
110	41	20.12	0.48	0.00237	-5	-1.98	3800	3200	3800	3200
110	42	19.91	0.47	0.00237	-5	-1.98	3200	3800	3200	3800
110	48	20.46	0.50	0.00237	-5	0.05	3800	3800	3200	3200
110	49	20.30	0.49	0.00237	-5	-0.02	3200	3200	3800	3800
110	50	20.23	0.48	0.00237	-5	0.12	3800	3200	3800	3200
110	51	20.09	0.48	0.00237	-5	-0.04	3200	3800	3200	3800
111	10	19.86	0.47	0.00237	-5	2.03	3800	3800	3200	3200
111	11	20.09	0.48	0.00236	-5	2.03	3200	3200	3800	3800
111	12	20.06	0.48	0.00236	-5	2.03	3800	3200	3800	3200
111	13	19.78	0.46	0.00236	-5	2.03	3200	3800	3200	3800
111	19	20.57	0.50	0.00237	-5	5.03	3800	3800	3200	3200
111	20	20.63	0.50	0.00237	-5	5.03	3200	3200	3800	3800
111	21	20.29	0.49	0.00237	-5	5.03	3800	3200	3800	3200
111	22	20.23	0.48	0.00237	-5	5.03	3200	3800	3200	3800
111	28	20.39	0.49	0.00236	-5	9.95	3800	3800	3200	3200
111	29	19.96	0.47	0.00236	-5	9.95	3200	3200	3800	3800
111	30	20.03	0.47	0.00236	-5	9.95	3800	3200	3800	3200
111	31	20.02	0.47	0.00236	-5	9.95	3200	3800	3200	3800

Table C50b. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -5 deg, pitch = -10 to 10 deg, RPM = 3,200 to 3,800 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
110	21	0.385	0.006	6.028	-0.777	20.150	0.480	16.721	3.820	4.109	2.573	2.321
110	22	0.537	0.015	5.998	-0.590	-1.426	0.430	16.724	2.304	2.434	4.041	3.811
110	23	0.467	0.087	5.983	-10.399	8.600	0.593	16.723	3.717	2.447	4.059	2.400
110	24	0.481	-0.061	5.977	8.642	9.306	0.324	16.725	2.321	3.940	2.587	3.722
110	30	0.422	0.019	6.307	-1.538	22.021	0.622	16.723	3.889	3.971	2.577	2.245
110	31	0.549	0.023	6.287	-0.310	0.179	0.348	16.722	2.243	2.515	4.173	3.798
110	32	0.489	0.096	6.280	-10.695	10.643	0.448	16.723	3.697	2.522	4.162	2.268
110	33	0.474	-0.066	6.256	9.683	11.210	0.427	16.723	2.243	4.099	2.589	3.799
110	39	0.395	0.019	6.442	-1.284	22.944	0.734	16.722	3.825	4.017	2.578	2.309
110	40	0.546	0.034	6.344	-1.154	1.286	0.349	16.725	2.257	2.425	4.121	3.714
110	41	0.469	0.104	6.434	-11.207	11.915	0.619	16.721	3.849	2.446	4.152	2.360
110	42	0.465	-0.050	6.358	8.537	12.461	0.530	16.725	2.318	3.997	2.574	3.694
110	48	0.408	0.026	6.519	-1.056	24.404	0.765	16.724	3.841	4.025	2.457	2.303
110	49	0.543	0.037	6.522	-1.287	3.868	0.444	16.723	2.404	2.533	4.011	3.722
110	50	0.467	0.107	6.506	-10.340	13.412	0.680	16.723	3.732	2.546	4.030	2.357
110	51	0.466	-0.056	6.441	8.713	13.787	0.507	16.726	2.315	4.017	2.459	3.685
111	10	0.376	0.018	6.551	-1.671	24.945	0.755	16.722	3.825	4.136	2.558	2.225
111	11	0.521	0.022	6.437	-1.179	3.778	0.433	16.728	2.242	2.438	3.873	3.685
111	12	0.440	0.093	6.463	-11.093	14.217	0.763	16.726	3.725	2.442	3.896	2.280
111	13	0.450	-0.069	6.469	8.679	14.010	0.483	16.727	2.249	4.014	2.450	3.681
111	19	0.383	0.027	6.812	-1.611	27.588	0.790	16.720	3.919	4.131	2.559	2.284
111	20	0.515	0.026	6.708	-1.010	6.995	0.528	16.726	2.304	2.529	3.941	3.688
111	21	0.427	0.105	6.703	-10.689	17.288	0.878	16.723	3.846	2.536	4.000	2.272
111	22	0.449	-0.064	6.743	7.795	16.641	0.245	16.725	2.303	4.017	2.536	3.679
111	28	0.349	0.023	6.942	-1.308	30.268	0.868	16.723	3.792	4.105	2.498	2.254
111	29	0.443	0.017	6.789	-0.868	10.999	0.505	16.730	2.282	2.509	3.741	3.648
111	30	0.377	0.109	6.855	-9.754	20.620	1.088	16.727	3.713	2.514	3.823	2.292
111	31	0.403	-0.063	6.805	7.296	20.453	0.051	16.730	2.292	3.872	2.363	3.658

**Table C50c. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -5 deg, pitch = -10 to 10 deg,
RPM = 3,200 to 3,800 (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
110	21	0.091	0.064	0.135	0.169	0.283	0.205	0.001	0.046	0.048	0.034	0.031
110	22	0.090	0.062	0.135	0.160	0.276	0.204	0.001	0.031	0.032	0.047	0.044
110	23	0.092	0.068	0.135	0.181	0.277	0.204	0.001	0.044	0.033	0.048	0.031
110	24	0.090	0.059	0.135	0.159	0.278	0.205	0.001	0.031	0.046	0.034	0.044
110	30	0.092	0.064	0.136	0.169	0.285	0.206	0.001	0.045	0.047	0.034	0.030
110	31	0.091	0.062	0.135	0.161	0.277	0.205	0.001	0.030	0.033	0.049	0.044
110	32	0.093	0.069	0.135	0.184	0.279	0.206	0.001	0.044	0.033	0.049	0.031
110	33	0.090	0.058	0.135	0.159	0.279	0.206	0.001	0.030	0.048	0.034	0.044
110	39	0.092	0.065	0.135	0.174	0.285	0.207	0.001	0.045	0.047	0.034	0.031
110	40	0.090	0.062	0.135	0.161	0.277	0.206	0.001	0.030	0.032	0.048	0.043
110	41	0.092	0.068	0.135	0.183	0.279	0.205	0.001	0.046	0.033	0.049	0.031
110	42	0.091	0.059	0.135	0.160	0.281	0.206	0.001	0.031	0.047	0.034	0.043
110	48	0.092	0.066	0.136	0.174	0.286	0.207	0.001	0.045	0.047	0.033	0.031
110	49	0.091	0.063	0.135	0.162	0.278	0.207	0.001	0.032	0.033	0.047	0.044
110	50	0.094	0.076	0.135	0.200	0.279	0.208	0.001	0.044	0.034	0.047	0.031
110	51	0.091	0.058	0.135	0.159	0.281	0.206	0.001	0.031	0.047	0.033	0.043
111	10	0.092	0.063	0.136	0.170	0.288	0.208	0.001	0.045	0.048	0.034	0.030
111	11	0.091	0.063	0.135	0.163	0.277	0.207	0.001	0.030	0.032	0.046	0.043
111	12	0.093	0.070	0.135	0.189	0.280	0.207	0.001	0.044	0.033	0.046	0.030
111	13	0.091	0.058	0.135	0.159	0.281	0.207	0.001	0.030	0.047	0.033	0.043
111	19	0.093	0.065	0.136	0.174	0.291	0.209	0.001	0.045	0.048	0.034	0.030
111	20	0.092	0.064	0.135	0.165	0.280	0.209	0.001	0.030	0.033	0.046	0.043
111	21	0.093	0.070	0.136	0.187	0.283	0.208	0.001	0.046	0.034	0.047	0.031
111	22	0.091	0.059	0.136	0.159	0.283	0.208	0.001	0.031	0.047	0.033	0.043
111	28	0.093	0.070	0.136	0.185	0.293	0.215	0.001	0.044	0.048	0.033	0.030
111	29	0.092	0.066	0.135	0.169	0.282	0.211	0.001	0.030	0.033	0.044	0.043
111	30	0.094	0.074	0.136	0.197	0.285	0.211	0.001	0.044	0.033	0.045	0.030
111	31	0.092	0.060	0.136	0.162	0.287	0.210	0.001	0.030	0.046	0.032	0.043

Table C51a. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 3,200 to 3,800 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
113	10	20.76	0.50	0.00233	-45	-9.90	3800	3800	3200	3200
113	11	20.59	0.49	0.00233	-45	-9.91	3200	3200	3800	3800
113	12	20.43	0.49	0.00232	-45	-9.90	3800	3200	3800	3200
113	13	20.68	0.50	0.00232	-45	-9.90	3200	3800	3200	3800
113	19	20.60	0.49	0.00232	-45	-4.98	3800	3800	3200	3200
113	20	20.25	0.48	0.00232	-45	-4.98	3200	3200	3800	3800
113	21	19.94	0.46	0.00232	-45	-4.98	3800	3200	3800	3200
113	22	20.45	0.49	0.00232	-45	-4.98	3200	3800	3200	3800
113	28	20.61	0.49	0.00232	-45	-1.98	3800	3800	3200	3200
113	29	20.59	0.49	0.00232	-45	-1.98	3200	3200	3800	3800
113	30	20.49	0.49	0.00232	-45	-1.98	3800	3200	3800	3200
113	31	20.63	0.49	0.00232	-45	-1.98	3200	3800	3200	3800
113	37	20.40	0.48	0.00233	-45	-0.04	3800	3800	3200	3200
113	38	20.21	0.48	0.00233	-45	-0.04	3200	3200	3800	3800
113	39	20.29	0.48	0.00233	-45	-0.04	3800	3200	3800	3200
113	40	20.28	0.48	0.00233	-45	-0.04	3200	3800	3200	3800
113	46	20.18	0.47	0.00233	-45	2.03	3800	3800	3200	3200
113	47	20.16	0.47	0.00233	-45	2.03	3200	3200	3800	3800
113	48	20.15	0.47	0.00233	-45	2.04	3800	3200	3800	3200
113	49	19.98	0.46	0.00233	-45	2.03	3200	3800	3200	3800
114	10	20.39	0.50	0.00240	-45	5.03	3800	3800	3200	3200
114	11	20.31	0.50	0.00240	-45	5.03	3200	3200	3800	3800
114	12	20.43	0.50	0.00240	-45	5.03	3800	3200	3800	3200
114	13	20.32	0.50	0.00240	-45	5.03	3200	3800	3200	3800
114	19	20.11	0.49	0.00241	-45	9.95	3800	3800	3200	3200
114	20	20.26	0.49	0.00241	-45	9.95	3200	3200	3800	3800
114	21	20.27	0.49	0.00241	-45	9.95	3800	3200	3800	3200
114	22	20.17	0.49	0.00241	-45	9.95	3200	3800	3200	3800

Table C51b. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg, RPM = 3,200 to 3,800 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
113	10	0.281	-0.349	5.813	-4.958	16.549	-0.336	16.728	3.720	3.977	2.305	2.272
113	11	0.371	-0.319	5.886	-4.385	-3.840	0.232	16.730	2.254	2.460	3.689	3.723
113	12	0.335	-0.274	5.749	-14.950	6.456	0.038	16.730	3.671	2.436	3.726	2.287
113	13	0.310	-0.388	5.880	5.641	6.352	-0.147	16.730	2.258	3.989	2.289	3.661
113	19	0.226	-0.317	6.112	-4.759	16.581	-0.494	16.730	3.610	3.994	2.309	2.273
113	20	0.331	-0.300	6.116	-4.424	-3.613	0.181	16.733	2.192	2.450	3.638	3.698
113	21	0.274	-0.241	6.048	-15.192	6.612	-0.028	16.732	3.565	2.415	3.701	2.299
113	22	0.276	-0.377	6.183	5.749	6.079	-0.151	16.731	2.197	3.978	2.287	3.650
113	28	0.187	-0.286	6.395	-4.993	17.118	-0.329	16.729	3.711	4.035	2.231	2.263
113	29	0.318	-0.291	6.318	-5.066	-3.317	0.202	16.734	2.262	2.427	3.510	3.666
113	30	0.244	-0.207	6.302	-15.705	7.020	0.025	16.732	3.674	2.417	3.577	2.287
113	31	0.262	-0.362	6.397	5.246	6.717	-0.143	16.732	2.264	3.998	2.187	3.629
113	37	0.160	-0.256	6.537	-5.366	17.652	-0.385	16.730	3.728	4.023	2.096	2.258
113	38	0.295	-0.266	6.460	-4.899	-2.641	0.188	16.736	2.259	2.456	3.369	3.655
113	39	0.213	-0.179	6.458	-15.583	7.806	0.046	16.733	3.693	2.467	3.443	2.289
113	40	0.238	-0.344	6.491	4.897	7.205	-0.211	16.734	2.236	3.982	2.079	3.571
113	46	0.137	-0.238	6.620	-5.345	18.056	-0.443	16.731	3.680	4.051	2.046	2.264
113	47	0.280	-0.250	6.536	-4.740	-2.206	0.125	16.738	2.215	2.469	3.261	3.642
113	48	0.187	-0.163	6.560	-15.303	8.351	0.045	16.735	3.673	2.489	3.331	2.296
113	49	0.211	-0.326	6.562	4.794	7.844	-0.326	16.736	2.217	3.991	2.007	3.538
114	10	0.170	-0.260	6.992	-5.060	19.662	-0.499	16.630	3.778	4.181	2.086	2.304
114	11	0.317	-0.266	6.887	-4.817	-1.301	0.128	16.637	2.285	2.513	3.367	3.672
114	12	0.223	-0.185	6.896	-15.202	9.779	0.159	16.634	3.794	2.577	3.398	2.338
114	13	0.255	-0.347	6.944	5.223	9.521	-0.462	16.635	2.284	4.097	2.045	3.599
114	19	0.117	-0.236	7.136	-6.169	19.724	-0.701	16.636	3.681	4.045	1.989	2.235
114	20	0.263	-0.243	7.068	-5.755	-0.017	-0.159	16.641	2.253	2.465	3.223	3.587
114	21	0.179	-0.143	7.116	-15.771	9.747	0.026	16.637	3.687	2.530	3.247	2.354
114	22	0.216	-0.318	7.144	3.667	9.904	-0.894	16.639	2.221	3.986	1.979	3.556

**Table C51c. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg,
RPM = 3,200 to 3,800 (differential) - Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
113	10	0.101	0.066	0.135	0.173	0.294	0.215	0.001	0.044	0.048	0.031	0.030
113	11	0.097	0.068	0.135	0.178	0.283	0.213	0.001	0.030	0.033	0.043	0.044
113	12	0.110	0.072	0.135	0.202	0.301	0.222	0.001	0.043	0.032	0.044	0.030
113	13	0.094	0.061	0.135	0.161	0.282	0.209	0.001	0.030	0.048	0.031	0.043
113	19	0.104	0.068	0.135	0.180	0.299	0.216	0.001	0.042	0.048	0.031	0.030
113	20	0.099	0.068	0.135	0.178	0.285	0.210	0.001	0.029	0.032	0.043	0.043
113	21	0.104	0.073	0.136	0.197	0.295	0.213	0.001	0.042	0.032	0.044	0.030
113	22	0.095	0.062	0.135	0.164	0.284	0.211	0.001	0.030	0.047	0.031	0.043
113	28	0.105	0.070	0.136	0.184	0.301	0.221	0.001	0.043	0.047	0.030	0.030
113	29	0.098	0.068	0.136	0.176	0.284	0.211	0.001	0.030	0.032	0.042	0.043
113	30	0.106	0.074	0.136	0.202	0.297	0.215	0.001	0.043	0.032	0.042	0.030
113	31	0.095	0.062	0.135	0.163	0.284	0.212	0.001	0.030	0.048	0.030	0.043
113	37	0.104	0.069	0.136	0.182	0.299	0.219	0.001	0.044	0.047	0.029	0.030
113	38	0.096	0.067	0.135	0.174	0.282	0.213	0.001	0.030	0.032	0.040	0.043
113	39	0.104	0.072	0.136	0.197	0.294	0.213	0.001	0.043	0.033	0.041	0.030
113	40	0.095	0.062	0.136	0.165	0.286	0.212	0.001	0.030	0.048	0.029	0.042
113	46	0.106	0.070	0.136	0.185	0.304	0.216	0.001	0.043	0.047	0.028	0.030
113	47	0.098	0.068	0.136	0.177	0.284	0.211	0.001	0.030	0.033	0.039	0.043
113	48	0.107	0.074	0.136	0.201	0.298	0.219	0.001	0.043	0.033	0.040	0.030
113	49	0.095	0.062	0.136	0.165	0.285	0.211	0.001	0.030	0.048	0.028	0.042
114	10	0.102	0.068	0.136	0.178	0.300	0.218	0.001	0.044	0.049	0.029	0.030
114	11	0.098	0.068	0.136	0.177	0.285	0.210	0.001	0.030	0.033	0.040	0.043
114	12	0.105	0.072	0.136	0.199	0.297	0.216	0.001	0.044	0.034	0.040	0.031
114	13	0.094	0.062	0.136	0.163	0.285	0.211	0.001	0.030	0.048	0.028	0.042
114	19	0.101	0.067	0.136	0.177	0.296	0.223	0.001	0.043	0.047	0.027	0.030
114	20	0.097	0.068	0.136	0.179	0.285	0.213	0.001	0.030	0.032	0.039	0.042
114	21	0.107	0.074	0.136	0.204	0.300	0.217	0.001	0.043	0.033	0.039	0.031
114	22	0.095	0.062	0.136	0.164	0.287	0.211	0.001	0.029	0.047	0.027	0.042

Table C52a. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 3,200 to 3,800 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	RPM 1	RPM 2	RPM 3	RPM 4
116	10	19.50	0.46	0.00240	-90	-9.91	3800	3800	3200	3200
116	11	19.79	0.47	0.00240	-90	-9.91	3200	3200	3800	3800
116	12	19.70	0.47	0.00240	-90	-9.91	3800	3200	3800	3200
116	13	19.60	0.46	0.00240	-90	-9.91	3200	3800	3200	3800
116	19	20.11	0.48	0.00240	-90	-4.99	3800	3800	3200	3200
116	20	20.35	0.50	0.00240	-90	-4.99	3200	3200	3800	3800
116	21	20.17	0.49	0.00240	-90	-4.99	3800	3200	3800	3200
116	22	20.26	0.49	0.00240	-90	-4.99	3200	3800	3200	3800
116	28	20.35	0.50	0.00240	-90	-1.99	3800	3800	3200	3200
116	29	20.39	0.50	0.00240	-90	-1.99	3200	3200	3800	3800
116	30	19.68	0.46	0.00240	-90	-1.99	3800	3200	3800	3200
116	31	19.98	0.48	0.00239	-90	-1.99	3200	3800	3200	3800
116	37	20.31	0.49	0.00239	-90	-0.05	3800	3800	3200	3200
116	38	19.94	0.48	0.00239	-90	-0.05	3200	3200	3800	3800
116	39	19.98	0.48	0.00239	-90	-0.05	3800	3200	3800	3200
116	40	19.61	0.46	0.00239	-90	-0.05	3200	3800	3200	3800
116	46	20.10	0.48	0.00239	-90	2.03	3800	3800	3200	3200
116	47	19.28	0.44	0.00239	-90	2.03	3200	3200	3800	3800
116	48	19.71	0.46	0.00239	-90	2.03	3800	3200	3800	3200
116	49	19.68	0.46	0.00239	-90	2.03	3200	3800	3200	3800
116	55	20.51	0.50	0.00239	-90	5.03	3800	3800	3200	3200
116	56	20.28	0.49	0.00239	-90	5.02	3200	3200	3800	3800
116	57	20.24	0.49	0.00239	-90	5.02	3800	3200	3800	3200
116	58	20.02	0.48	0.00239	-90	5.02	3200	3800	3200	3800
116	64	20.55	0.50	0.00238	-90	9.95	3800	3800	3200	3200
116	65	20.52	0.50	0.00238	-90	9.95	3200	3200	3800	3800
116	66	20.60	0.51	0.00238	-90	9.95	3800	3200	3800	3200
116	67	20.55	0.50	0.00238	-90	9.95	3200	3800	3200	3800

Table C52b. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 3,200 to 3,800 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
116	10	-0.091	-0.430	5.696	-7.647	11.256	-0.283	16.618	3.870	4.439	2.457	2.415
116	11	0.040	-0.434	5.718	-7.921	-10.329	0.475	16.620	2.300	2.680	4.045	4.005
116	12	-0.033	-0.359	5.661	-18.628	0.464	-0.226	16.622	3.766	2.693	4.024	2.416
116	13	-0.017	-0.496	5.725	3.125	0.164	0.260	16.620	2.302	4.356	2.454	4.002
116	19	-0.112	-0.451	5.773	-7.851	10.998	-0.454	16.623	3.661	4.434	2.366	2.408
116	20	0.032	-0.477	5.811	-8.302	-10.227	0.469	16.624	2.267	2.656	3.819	4.012
116	21	-0.044	-0.382	5.758	-18.721	0.253	-0.197	16.626	3.669	2.679	3.819	2.456
116	22	-0.035	-0.524	5.759	2.792	0.723	0.266	16.622	2.269	4.359	2.346	3.982
116	28	-0.117	-0.438	5.854	-8.973	11.163	-0.340	16.622	3.736	4.413	2.374	2.392
116	29	0.024	-0.462	5.812	-9.595	-9.611	0.483	16.626	2.300	2.612	3.807	3.909
116	30	-0.048	-0.333	5.764	-19.688	0.481	-0.140	16.627	3.705	2.641	3.845	2.393
116	31	-0.043	-0.512	5.817	0.999	1.102	0.226	16.623	2.293	4.302	2.368	3.882
116	37	-0.116	-0.421	5.903	-10.400	10.749	-0.328	16.623	3.746	4.389	2.381	2.315
116	38	0.031	-0.442	5.853	-10.364	-9.698	0.422	16.626	2.300	2.606	3.806	3.897
116	39	-0.051	-0.351	5.827	-20.636	0.329	-0.121	16.626	3.703	2.661	3.817	2.356
116	40	-0.048	-0.494	5.822	-0.256	0.769	0.213	16.625	2.293	4.285	2.382	3.788
116	46	-0.114	-0.399	5.946	-11.618	10.184	-0.343	16.624	3.744	4.320	2.356	2.293
116	47	0.025	-0.411	5.847	-11.409	-9.835	0.382	16.627	2.279	2.592	3.801	3.809
116	48	-0.050	-0.337	5.863	-21.751	0.336	-0.129	16.628	3.677	2.624	3.805	2.332
116	49	-0.048	-0.481	5.872	-1.904	0.544	0.193	16.627	2.285	4.255	2.363	3.706
116	55	-0.105	-0.404	6.187	-12.076	9.523	-0.366	16.627	3.662	4.324	2.264	2.336
116	56	0.017	-0.417	5.992	-13.164	-9.325	0.324	16.630	2.199	2.594	3.689	3.777
116	57	-0.048	-0.339	5.962	-23.067	0.038	-0.184	16.631	3.581	2.611	3.708	2.324
116	58	-0.044	-0.483	6.075	-2.391	0.159	0.157	16.627	2.210	4.235	2.285	3.819
116	64	-0.083	-0.359	6.302	-13.416	7.484	-0.103	16.632	3.443	4.153	2.108	2.439
116	65	-0.015	-0.373	6.293	-13.772	-7.812	0.305	16.632	2.107	2.746	3.492	3.799
116	66	-0.042	-0.285	6.139	-23.924	-0.228	-0.013	16.636	3.409	2.607	3.441	2.325
116	67	-0.034	-0.436	6.522	-2.876	0.221	0.170	16.624	2.112	4.496	2.121	4.035

Table C52c. Full Vehicle: SUI Endurance, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg, RPM = 3,200 to 3,800 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
116	10	0.097	0.063	0.136	0.164	0.299	0.211	0.001	0.046	0.052	0.033	0.032
116	11	0.096	0.060	0.135	0.160	0.290	0.205	0.001	0.031	0.035	0.048	0.047
116	12	0.098	0.061	0.136	0.175	0.298	0.207	0.001	0.044	0.035	0.047	0.032
116	13	0.095	0.061	0.135	0.160	0.290	0.208	0.001	0.031	0.051	0.033	0.047
116	19	0.100	0.063	0.136	0.166	0.307	0.211	0.001	0.043	0.052	0.032	0.032
116	20	0.098	0.061	0.136	0.162	0.294	0.206	0.001	0.030	0.035	0.045	0.047
116	21	0.101	0.063	0.136	0.177	0.302	0.210	0.001	0.043	0.035	0.045	0.032
116	22	0.097	0.061	0.135	0.161	0.295	0.209	0.001	0.030	0.051	0.032	0.047
116	28	0.101	0.066	0.136	0.172	0.309	0.217	0.001	0.044	0.051	0.032	0.032
116	29	0.097	0.061	0.136	0.164	0.295	0.206	0.001	0.030	0.034	0.045	0.045
116	30	0.103	0.064	0.137	0.181	0.311	0.212	0.001	0.043	0.034	0.045	0.031
116	31	0.097	0.062	0.136	0.162	0.294	0.208	0.001	0.030	0.050	0.032	0.045
116	37	0.103	0.068	0.137	0.179	0.313	0.219	0.001	0.044	0.051	0.032	0.031
116	38	0.099	0.062	0.136	0.165	0.299	0.205	0.001	0.031	0.034	0.045	0.046
116	39	0.102	0.065	0.137	0.184	0.308	0.211	0.001	0.043	0.035	0.045	0.031
116	40	0.098	0.063	0.136	0.165	0.297	0.211	0.001	0.030	0.050	0.032	0.044
116	46	0.103	0.068	0.137	0.178	0.313	0.218	0.001	0.044	0.050	0.031	0.030
116	47	0.099	0.062	0.136	0.168	0.297	0.208	0.001	0.030	0.034	0.045	0.044
116	48	0.102	0.066	0.137	0.187	0.308	0.212	0.001	0.043	0.034	0.045	0.031
116	49	0.097	0.064	0.136	0.167	0.295	0.214	0.001	0.030	0.049	0.031	0.043
116	55	0.108	0.069	0.137	0.183	0.327	0.218	0.001	0.043	0.050	0.030	0.031
116	56	0.100	0.063	0.136	0.170	0.298	0.209	0.001	0.029	0.034	0.043	0.044
116	57	0.104	0.066	0.138	0.191	0.313	0.213	0.001	0.042	0.034	0.043	0.031
116	58	0.097	0.063	0.136	0.166	0.295	0.211	0.001	0.029	0.049	0.031	0.044
116	64	0.104	0.068	0.137	0.180	0.315	0.219	0.001	0.041	0.048	0.029	0.032
116	65	0.099	0.064	0.136	0.174	0.296	0.210	0.001	0.028	0.036	0.041	0.044
116	66	0.107	0.067	0.136	0.194	0.311	0.217	0.001	0.040	0.034	0.041	0.030
116	67	0.100	0.063	0.136	0.165	0.303	0.213	0.001	0.028	0.052	0.029	0.047

Wind Tunnel Data - 3DR SOLO Bare Airframe

Table C53a. Bare Airframe: 3DR Solo, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
55	5	19.60	0.47	0.00243	0	-39.95	0.090	-0.005	-0.196	-0.007	-0.422	0.060
55	6	19.99	0.49	0.00243	0	-19.92	0.134	-0.019	-0.111	0.064	-0.336	0.032
55	7	19.97	0.48	0.00243	0	-9.91	0.132	-0.019	-0.089	0.083	-0.356	0.025
55	8	19.81	0.48	0.00243	0	-4.99	0.123	-0.015	-0.072	0.058	-0.304	0.037
55	9	19.64	0.47	0.00243	0	-1.99	0.116	-0.015	-0.061	0.055	-0.287	0.044
55	10	19.89	0.48	0.00243	0	-0.05	0.117	-0.021	-0.053	0.068	-0.261	0.031
55	11	19.84	0.48	0.00243	0	2.03	0.122	-0.024	-0.046	0.098	-0.289	0.018
55	12	19.63	0.47	0.00243	0	5.03	0.111	-0.017	-0.057	0.052	-0.309	0.052
55	13	19.61	0.47	0.00243	0	10.12	0.108	-0.023	-0.042	0.078	-0.296	0.052
55	14	19.67	0.47	0.00242	0	19.95	0.105	-0.021	-0.013	0.080	-0.281	0.059
55	15	19.83	0.48	0.00242	0	39.98	0.119	-0.029	0.037	0.123	-0.354	0.023

Table C53b. Bare Airframe: 3DR Solo, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
55	5	0.088	0.056	0.134	0.148	0.271	0.192
55	6	0.088	0.056	0.134	0.148	0.271	0.192
55	7	0.088	0.056	0.134	0.148	0.271	0.192
55	8	0.088	0.056	0.134	0.148	0.271	0.192
55	9	0.088	0.056	0.134	0.148	0.271	0.192
55	10	0.088	0.056	0.134	0.148	0.271	0.192
55	11	0.088	0.056	0.134	0.148	0.271	0.192
55	12	0.088	0.056	0.134	0.148	0.271	0.192
55	13	0.088	0.056	0.134	0.148	0.271	0.192
55	14	0.088	0.056	0.134	0.148	0.271	0.192
55	15	0.088	0.056	0.134	0.148	0.271	0.192

Table C54a. Bare Airframe: 3DR Solo, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
56	5	40.08	1.94	0.00241	0	-39.95	0.366	-0.023	-0.619	0.066	-1.370	0.017
56	6	39.85	1.91	0.00241	0	-19.92	0.504	-0.038	-0.258	0.126	-0.919	-0.011
56	7	39.74	1.90	0.00240	0	-9.91	0.489	-0.052	-0.083	0.168	-0.810	-0.070
56	8	39.97	1.92	0.00240	0	-4.98	0.478	-0.051	-0.029	0.185	-0.775	-0.062
56	9	39.74	1.90	0.00240	0	-1.99	0.475	-0.049	0.018	0.191	-0.849	-0.072
56	10	39.56	1.88	0.00240	0	-0.05	0.472	-0.038	0.059	0.168	-0.900	-0.064
56	11	40.17	1.94	0.00240	0	2.03	0.481	-0.041	0.062	0.193	-0.867	-0.071
56	12	40.32	1.95	0.00240	0	5.03	0.476	-0.043	0.069	0.208	-0.787	-0.019
56	15	39.71	1.89	0.00240	0	19.95	0.397	-0.032	0.159	0.119	-0.765	0.046
56	16	39.92	1.91	0.00239	0	39.98	0.456	-0.043	0.365	0.211	-0.939	-0.029
56	17	40.18	1.93	0.00239	0	-0.03	0.491	-0.070	0.047	0.328	-0.971	-0.135

Table C54b. Bare Airframe: 3DR Solo, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
56	5	0.088	0.056	0.134	0.148	0.271	0.192
56	6	0.088	0.056	0.134	0.148	0.271	0.192
56	7	0.088	0.056	0.134	0.148	0.271	0.192
56	8	0.088	0.056	0.134	0.148	0.271	0.192
56	9	0.088	0.056	0.134	0.148	0.271	0.192
56	10	0.088	0.056	0.134	0.148	0.271	0.192
56	11	0.088	0.056	0.134	0.149	0.271	0.192
56	12	0.088	0.056	0.134	0.149	0.271	0.192
56	15	0.088	0.056	0.134	0.149	0.271	0.192
56	16	0.088	0.056	0.134	0.149	0.271	0.192
56	17	0.088	0.056	0.134	0.148	0.271	0.192

Table C55a. Bare Airframe: 3DR Solo, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
54	5	19.55	0.47	0.00244	-90	-9.91	-0.009	-0.127	0.003	0.241	0.190	0.076
54	6	19.98	0.49	0.00244	-90	-4.99	-0.004	-0.140	-0.012	0.346	0.140	0.020
54	7	19.73	0.48	0.00244	-90	-1.99	-0.002	-0.138	0.000	0.335	0.137	0.029
54	8	19.78	0.48	0.00244	-90	0.11	-0.004	-0.127	0.014	0.259	0.148	0.097
54	9	19.89	0.48	0.00244	-90	2.03	-0.002	-0.128	0.007	0.276	0.115	0.084
54	10	19.79	0.48	0.00244	-90	5.02	-0.002	-0.126	0.037	0.249	0.148	0.087
54	11	19.86	0.48	0.00244	-90	9.95	-0.001	-0.122	0.052	0.231	0.148	0.112

Table C55b. Bare Airframe: 3DR Solo, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
54	5	0.088	0.056	0.134	0.148	0.271	0.192
54	6	0.088	0.056	0.134	0.148	0.271	0.192
54	7	0.088	0.056	0.134	0.148	0.271	0.192
54	8	0.088	0.056	0.134	0.148	0.271	0.192
54	9	0.088	0.056	0.134	0.148	0.271	0.192
54	10	0.088	0.056	0.134	0.148	0.271	0.192
54	11	0.088	0.056	0.134	0.148	0.271	0.192

Table C56a. Bare Airframe: 3DR Solo, nominal speed 40 ft/s, yaw = -90 deg, pitch = -10 to 10 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
54	13	39.44	1.90	0.00244	-90	-9.91	-0.011	-0.590	-0.083	1.475	0.283	-0.036
54	14	39.38	1.89	0.00244	-90	-4.99	-0.012	-0.596	-0.030	1.493	0.339	0.020
54	15	39.43	1.90	0.00244	-90	-1.99	-0.001	-0.599	0.016	1.538	0.307	0.030
54	16	39.37	1.89	0.00244	-90	-0.05	0.008	-0.581	0.029	1.486	0.259	0.097
54	17	39.83	1.93	0.00244	-90	2.03	0.010	-0.595	0.041	1.510	0.204	0.117
54	18	39.63	1.92	0.00244	-90	5.03	0.008	-0.581	0.072	1.395	0.176	0.162
54	19	39.42	1.89	0.00244	-90	9.94	0.010	-0.573	0.116	1.321	0.111	0.072

Table C56b. Bare Airframe: 3DR Solo, nominal speed 40 ft/s, yaw = -90 deg, pitch = -10 to 10 deg - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
54	13	0.088	0.057	0.134	0.149	0.271	0.192
54	14	0.088	0.057	0.134	0.149	0.271	0.192
54	15	0.088	0.057	0.134	0.149	0.271	0.192
54	16	0.088	0.057	0.134	0.149	0.271	0.192
54	17	0.088	0.057	0.134	0.149	0.271	0.192
54	18	0.088	0.057	0.134	0.149	0.271	0.192
54	19	0.088	0.057	0.134	0.149	0.271	0.192

Wind Tunnel Data - DJI Phantom 3 Bare Airframe

Table C57a. Bare Airframe: DJI Phantom 3, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
21	5	42.18	1.93	0.00216	0	-39.94	0.307	-0.021	-0.264	0.095	-0.544	0.029
21	6	42.05	1.91	0.00216	0	-29.94	0.350	-0.018	-0.197	0.087	-0.802	0.051
21	7	41.79	1.89	0.00216	0	-19.91	0.399	-0.007	-0.102	0.060	-0.860	0.047
21	8	42.19	1.93	0.00216	0	-9.90	0.437	-0.028	0.065	0.101	-0.827	0.035
21	9	41.72	1.88	0.00216	0	-4.98	0.420	-0.029	0.128	0.084	-0.777	0.031
21	10	42.19	1.92	0.00216	0	-1.98	0.421	-0.030	0.185	0.045	-0.697	0.032
21	11	41.98	1.91	0.00216	0	-0.04	0.404	-0.043	0.230	0.001	-0.555	0.048
21	12	41.99	1.91	0.00216	0	2.04	0.391	-0.044	0.256	0.002	-0.498	0.055
21	13	41.88	1.90	0.00216	0	5.03	0.390	-0.029	0.267	0.044	-0.428	0.059
21	14	42.03	1.91	0.00216	0	9.95	0.380	-0.022	0.292	0.014	-0.370	0.044
21	15	42.40	1.94	0.00216	0	19.96	0.350	-0.015	0.308	0.096	-0.268	0.018
21	16	42.46	1.95	0.00216	0	29.97	0.326	-0.009	0.351	0.119	-0.222	0.026
21	17	42.50	1.95	0.00216	0	39.99	0.296	-0.015	0.437	0.148	-0.171	0.058

Table C57b. Bare Airframe: DJI Phantom 3, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
21	5	0.088	0.056	0.134	0.148	0.271	0.192
21	6	0.088	0.056	0.134	0.148	0.271	0.192
21	7	0.088	0.056	0.134	0.148	0.271	0.192
21	8	0.088	0.056	0.134	0.148	0.271	0.192
21	9	0.088	0.056	0.134	0.148	0.271	0.192
21	10	0.088	0.056	0.134	0.148	0.271	0.192
21	11	0.088	0.056	0.134	0.148	0.271	0.192
21	12	0.088	0.056	0.134	0.148	0.271	0.192
21	13	0.088	0.056	0.134	0.148	0.271	0.192
21	14	0.088	0.056	0.134	0.148	0.271	0.192
21	15	0.088	0.056	0.134	0.148	0.271	0.192
21	16	0.088	0.056	0.134	0.148	0.271	0.192
21	17	0.088	0.056	0.134	0.148	0.271	0.192

Wind Tunnel Data - 3DR Iris+ Bare Airframe

Table C58a. Bare Airframe: 3DR Iris+, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
64	5	20.34	0.48	0.00233	0	-39.95	0.085	-0.001	-0.237	-0.041	-0.403	0.005
64	6	19.64	0.45	0.00233	0	-19.92	0.114	-0.010	-0.144	0.025	-0.278	-0.016
64	7	20.34	0.48	0.00233	0	-9.90	0.115	-0.000	-0.078	-0.024	-0.209	-0.006
64	8	20.58	0.49	0.00233	0	-4.98	0.117	0.008	-0.040	-0.059	-0.220	0.006
64	9	19.99	0.47	0.00233	0	-1.98	0.109	0.011	-0.024	-0.074	-0.229	0.009
64	10	20.52	0.49	0.00233	0	-0.04	0.114	0.005	-0.002	-0.046	-0.242	-0.006
64	11	19.94	0.46	0.00233	0	2.03	0.107	-0.001	0.006	-0.012	-0.241	-0.035
64	12	20.27	0.48	0.00233	0	5.03	0.115	-0.001	0.018	-0.016	-0.260	-0.031
64	13	20.25	0.48	0.00233	0	9.95	0.117	0.018	0.036	-0.103	-0.230	0.006
64	14	20.08	0.47	0.00233	0	19.96	0.121	0.012	0.042	-0.065	-0.224	-0.005
64	15	20.34	0.48	0.00233	0	39.99	0.118	0.003	0.098	-0.032	-0.200	-0.015

Table C58b. Bare Airframe: 3DR Iris+, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
64	5	0.088	0.056	0.134	0.148	0.271	0.192
64	6	0.088	0.056	0.134	0.149	0.271	0.192
64	7	0.088	0.056	0.134	0.149	0.271	0.192
64	8	0.088	0.056	0.134	0.149	0.271	0.192
64	9	0.088	0.056	0.134	0.149	0.271	0.192
64	10	0.088	0.056	0.134	0.149	0.271	0.192
64	11	0.088	0.056	0.134	0.148	0.271	0.192
64	12	0.088	0.056	0.134	0.148	0.271	0.192
64	13	0.088	0.056	0.134	0.148	0.271	0.192
64	14	0.088	0.056	0.134	0.148	0.271	0.192
64	15	0.088	0.056	0.134	0.148	0.271	0.192

Table C59a. Bare Airframe: 3DR Iris+, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
65	5	40.42	1.90	0.00232	0	-39.95	0.256	-0.010	-0.690	-0.100	-0.695	0.084
65	6	40.51	1.90	0.00232	0	-19.91	0.392	-0.008	-0.343	-0.061	-0.255	0.054
65	7	40.54	1.91	0.00232	0	-9.90	0.374	-0.009	-0.058	-0.058	0.075	0.031
65	8	40.30	1.88	0.00232	0	-4.98	0.349	-0.001	0.083	-0.052	0.164	0.028
65	9	40.29	1.88	0.00232	0	-1.98	0.347	-0.002	0.127	-0.042	0.023	0.013
65	10	40.67	1.92	0.00232	0	-0.04	0.357	-0.001	0.159	-0.041	-0.060	0.013
65	11	40.43	1.90	0.00232	0	2.03	0.351	0.003	0.183	-0.074	-0.108	0.015
65	12	40.31	1.89	0.00232	0	5.03	0.353	0.012	0.223	-0.114	-0.086	0.047
65	13	40.55	1.91	0.00232	0	9.95	0.366	0.020	0.265	-0.125	0.029	0.052
65	14	41.19	1.97	0.00232	0	19.96	0.376	0.021	0.343	-0.123	0.248	0.065
65	15	40.70	1.92	0.00232	0	39.99	0.365	0.001	0.524	-0.070	0.350	0.050

Table C59b. Bare Airframe: 3DR Iris+, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
65	5	0.088	0.056	0.134	0.149	0.271	0.192
65	6	0.088	0.056	0.134	0.149	0.271	0.192
65	7	0.088	0.056	0.134	0.149	0.271	0.192
65	8	0.088	0.056	0.134	0.149	0.271	0.192
65	9	0.088	0.056	0.134	0.149	0.271	0.192
65	10	0.088	0.056	0.134	0.149	0.271	0.192
65	11	0.088	0.056	0.134	0.149	0.271	0.192
65	12	0.088	0.056	0.134	0.148	0.271	0.192
65	13	0.088	0.056	0.134	0.149	0.271	0.192
65	14	0.088	0.056	0.134	0.149	0.271	0.192
65	15	0.088	0.056	0.134	0.148	0.271	0.192

Table C60a. Bare Airframe: 3DR Iris+ (tall landing gear), nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
66	5	41.13	1.97	0.00232	0	-9.90	0.460	-0.011	-0.018	-0.028	-0.217	0.011
66	6	40.43	1.90	0.00232	0	-4.98	0.421	-0.011	0.120	0.005	-0.148	-0.021
66	7	40.22	1.88	0.00232	0	-0.04	0.411	-0.004	0.180	0.009	-0.321	0.002
66	8	40.19	1.88	0.00232	0	5.03	0.417	0.003	0.239	-0.016	-0.343	0.020
66	9	40.51	1.91	0.00232	0	9.95	0.428	0.004	0.310	-0.027	-0.230	0.020

**Table C60b. Bare Airframe: 3DR Iris+ (tall landing gear), nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg -
Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
66	5	0.088	0.056	0.134	0.148	0.271	0.192
66	6	0.088	0.056	0.134	0.148	0.271	0.192
66	7	0.088	0.056	0.134	0.148	0.271	0.192
66	8	0.088	0.056	0.134	0.148	0.271	0.192
66	9	0.088	0.056	0.134	0.148	0.271	0.192

Wind Tunnel Data - Drone America x8 Bare Airframe

Table C61a. Bare Airframe: Drone America x8, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
101	5	20.18	0.49	0.00241	0	-39.95	0.913	-0.017	-2.690	0.112	-11.505	0.210
101	6	19.71	0.47	0.00240	0	-19.92	1.056	-0.025	-1.124	-0.200	-6.677	0.177
101	7	19.93	0.48	0.00240	0	-9.91	0.924	-0.031	-0.524	-0.014	-3.761	0.068
101	8	19.61	0.46	0.00240	0	-4.98	0.760	-0.029	-0.212	-0.046	-1.806	0.184
101	9	19.48	0.46	0.00240	0	-1.98	0.736	-0.027	-0.017	-0.110	-0.205	0.180
101	10	20.23	0.49	0.00240	0	0.12	0.745	-0.025	0.133	-0.146	0.963	0.269
101	11	20.05	0.48	0.00240	0	2.03	0.728	-0.021	0.243	-0.065	1.716	0.408
101	12	19.65	0.46	0.00240	0	5.03	0.770	-0.019	0.378	-0.182	2.446	0.511
101	13	19.89	0.48	0.00240	0	9.95	0.867	-0.012	0.645	-0.025	4.568	0.585
101	14	20.13	0.49	0.00240	0	19.96	1.004	-0.031	1.211	0.306	8.528	0.456
101	15	20.50	0.50	0.00240	0	39.99	0.998	-0.010	2.439	0.196	12.538	-0.241

Table C61b. Bare Airframe: Drone America x8, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
101	5	0.089	0.056	0.134	0.150	0.274	0.193
101	6	0.090	0.056	0.134	0.150	0.272	0.193
101	7	0.090	0.056	0.134	0.153	0.273	0.194
101	8	0.089	0.056	0.134	0.153	0.272	0.193
101	9	0.089	0.056	0.134	0.154	0.272	0.193
101	10	0.089	0.056	0.134	0.155	0.272	0.193
101	11	0.089	0.056	0.134	0.154	0.272	0.193
101	12	0.089	0.056	0.134	0.156	0.273	0.194
101	13	0.089	0.056	0.134	0.151	0.273	0.193
101	14	0.090	0.056	0.134	0.150	0.273	0.193
101	15	0.090	0.056	0.134	0.150	0.274	0.193

Table C62a. Bare Airframe: Drone America x8, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
101	18	39.78	1.89	0.00239	0	-39.95	3.381	-0.057	-10.630	-1.047	-45.942	0.302
101	19	39.38	1.85	0.00239	0	-19.92	4.047	-0.036	-4.516	-1.253	-25.850	0.224
101	20	40.19	1.93	0.00239	0	-9.91	3.589	-0.037	-1.969	-0.512	-14.468	0.083
101	21	39.65	1.88	0.00239	0	-4.98	2.916	-0.050	-0.749	-0.420	-6.157	0.104
101	22	39.86	1.90	0.00239	0	-1.98	2.870	-0.039	0.074	-0.287	0.445	0.590
101	23	39.66	1.88	0.00239	0	-0.04	2.669	-0.039	0.631	-0.222	4.313	0.334
101	24	39.59	1.87	0.00239	0	2.03	2.634	-0.030	1.065	-0.364	7.393	0.854
101	25	39.98	1.91	0.00239	0	5.03	2.966	-0.000	1.688	-0.257	10.692	0.984
101	26	40.39	1.95	0.00239	0	9.95	3.411	-0.011	2.815	0.274	19.951	0.855
101	27	40.10	1.92	0.00239	0	19.95	3.742	-0.029	4.904	2.037	34.411	1.268
101	28	40.03	1.91	0.00239	0	39.99	3.644	0.034	9.343	1.728	47.229	0.408

Table C62b. Bare Airframe: Drone America x8, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
101	18	0.111	0.056	0.135	0.153	0.306	0.200
101	19	0.119	0.056	0.134	0.157	0.287	0.198
101	20	0.113	0.056	0.134	0.172	0.280	0.202
101	21	0.105	0.056	0.134	0.199	0.276	0.209
101	22	0.105	0.056	0.134	0.217	0.277	0.218
101	23	0.103	0.056	0.134	0.183	0.276	0.208
101	24	0.102	0.056	0.134	0.170	0.275	0.201
101	25	0.106	0.056	0.134	0.168	0.278	0.200
101	26	0.111	0.056	0.134	0.166	0.284	0.200
101	27	0.115	0.056	0.134	0.163	0.293	0.199
101	28	0.114	0.056	0.135	0.153	0.308	0.196

Table C63a. Bare Airframe: Drone America x8, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
100	5	19.98	0.48	0.00241	-45	-9.94	0.604	-0.668	-0.408	1.785	-2.574	-0.041
100	6	20.32	0.50	0.00241	-45	-4.98	0.479	-0.572	-0.086	1.168	-0.687	0.015
100	7	19.58	0.46	0.00241	-45	-1.98	0.399	-0.496	0.118	0.582	0.642	0.184
100	8	19.97	0.48	0.00241	-45	-0.04	0.416	-0.520	0.251	0.236	1.516	-0.020
100	9	19.63	0.46	0.00241	-45	2.04	0.407	-0.505	0.348	-0.153	2.103	-0.154
100	10	19.85	0.47	0.00241	-45	5.03	0.437	-0.558	0.521	-0.665	3.013	-0.228
100	11	19.62	0.46	0.00241	-45	9.95	0.504	-0.614	0.767	-1.533	5.011	0.188

**Table C63b. Bare Airframe: Drone America x8, nominal speed 20 ft/s, yaw = -45 deg, pitch = -10 to 10 deg -
Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
100	5	0.088	0.057	0.134	0.151	0.273	0.193
100	6	0.088	0.057	0.134	0.153	0.272	0.193
100	7	0.088	0.056	0.134	0.151	0.273	0.192
100	8	0.088	0.056	0.134	0.154	0.272	0.193
100	9	0.088	0.056	0.134	0.151	0.272	0.193
100	10	0.088	0.057	0.134	0.151	0.273	0.193
100	11	0.088	0.057	0.134	0.151	0.272	0.193

Table C64a. Bare Airframe: Drone America x8, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
99	5	20.09	0.49	0.00241	-90	-10.08	0.033	-0.915	-0.472	2.952	-1.064	-0.137
99	6	19.85	0.48	0.00241	-90	-4.98	0.012	-0.745	-0.162	1.576	-0.244	-0.073
99	7	19.77	0.47	0.00241	-90	-1.98	-0.000	-0.692	0.065	0.178	0.173	-0.202
99	8	19.79	0.47	0.00241	-90	-0.04	-0.005	-0.709	0.222	-0.598	0.287	-0.065
99	9	20.24	0.49	0.00241	-90	2.03	-0.005	-0.762	0.396	-1.105	0.511	-0.147
99	10	19.65	0.47	0.00241	-90	5.03	-0.006	-0.770	0.552	-1.749	0.817	-0.206
99	11	20.28	0.50	0.00241	-90	9.95	-0.019	-0.931	0.827	-3.376	1.527	-0.349

**Table C64b. Bare Airframe: Drone America x8, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg -
Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
99	5	0.088	0.057	0.134	0.151	0.272	0.193
99	6	0.088	0.057	0.134	0.150	0.272	0.192
99	7	0.088	0.057	0.134	0.150	0.275	0.193
99	8	0.088	0.057	0.134	0.152	0.273	0.192
99	9	0.088	0.057	0.134	0.150	0.272	0.193
99	10	0.088	0.057	0.134	0.150	0.272	0.193
99	11	0.088	0.057	0.134	0.151	0.272	0.193

Wind Tunnel Data - SUI Endurance Bare Airframe

Table C65a. Bare Airframe: SUI Endurance, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
118	5	19.82	0.46	0.00235	0	-39.95	0.093	-0.021	-0.356	0.035	-0.268	0.057
118	6	20.46	0.49	0.00235	0	-19.92	0.143	-0.023	-0.229	0.036	-0.071	0.057
118	7	20.07	0.47	0.00235	0	-9.91	0.148	-0.026	-0.139	0.066	-0.076	0.056
118	8	19.91	0.47	0.00235	0	-4.99	0.138	-0.026	-0.081	0.056	-0.147	0.055
118	9	19.67	0.45	0.00235	0	-1.99	0.137	-0.027	-0.052	0.057	-0.109	0.053
118	10	20.12	0.48	0.00235	0	0.04	0.147	-0.027	-0.021	0.059	-0.121	0.057
118	11	20.22	0.48	0.00235	0	2.03	0.148	-0.026	-0.001	0.056	-0.116	0.057
118	12	20.23	0.48	0.00235	0	5.03	0.145	-0.027	0.040	0.059	-0.086	0.066
118	13	20.15	0.48	0.00235	0	9.95	0.143	-0.026	0.073	0.065	0.060	0.073
118	14	20.02	0.47	0.00235	0	20.11	0.138	-0.028	0.167	0.068	0.284	0.082
118	15	20.43	0.49	0.00235	0	39.98	0.116	-0.025	0.357	0.060	0.591	0.080

Table C65b. Bare Airframe: SUI Endurance, nominal speed 20 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
118	5	0.088	0.056	0.134	0.148	0.271	0.192
118	6	0.088	0.056	0.134	0.148	0.271	0.192
118	7	0.088	0.056	0.134	0.148	0.271	0.192
118	8	0.088	0.056	0.134	0.148	0.271	0.192
118	9	0.088	0.056	0.134	0.148	0.271	0.192
118	10	0.088	0.056	0.134	0.148	0.271	0.192
118	11	0.088	0.056	0.134	0.148	0.271	0.192
118	12	0.088	0.056	0.134	0.148	0.271	0.192
118	13	0.088	0.056	0.134	0.148	0.271	0.192
118	14	0.088	0.056	0.134	0.148	0.271	0.192
118	15	0.088	0.056	0.134	0.148	0.271	0.192

Table C66a. Bare Airframe: SUI Endurance, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
118	18	40.28	1.90	0.00235	0	-39.95	0.428	-0.045	-1.332	0.109	-1.639	0.076
118	19	40.64	1.94	0.00234	0	-19.92	0.581	-0.037	-0.791	0.049	-0.767	0.073
118	20	40.42	1.91	0.00234	0	-10.08	0.609	-0.032	-0.412	0.057	-0.781	0.066
118	21	40.39	1.91	0.00234	0	-4.98	0.576	-0.048	-0.192	0.055	-0.883	0.056
118	22	40.48	1.92	0.00234	0	-1.99	0.575	-0.048	-0.047	0.058	-0.839	0.070
118	23	40.00	1.88	0.00234	0	-0.04	0.568	-0.044	0.033	-0.033	-0.689	0.109
118	24	39.37	1.82	0.00234	0	2.03	0.553	-0.034	0.177	0.038	-0.662	0.075
118	25	40.93	1.96	0.00234	0	5.03	0.598	-0.038	0.348	0.080	-0.596	0.075
118	26	40.12	1.89	0.00234	0	9.95	0.563	-0.024	0.449	0.053	-0.012	0.097
118	27	39.98	1.87	0.00234	0	19.95	0.553	-0.035	0.783	0.052	0.807	0.103
118	28	40.08	1.88	0.00234	0	39.99	0.437	-0.010	1.611	0.033	1.752	0.037

Table C66b. Bare Airframe: SUI Endurance, nominal speed 40 ft/s, yaw = 0 deg, pitch = -40 to 40 deg - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
118	18	0.088	0.056	0.134	0.148	0.271	0.192
118	19	0.088	0.056	0.134	0.148	0.271	0.192
118	20	0.088	0.056	0.134	0.148	0.271	0.192
118	21	0.088	0.056	0.134	0.148	0.271	0.192
118	22	0.088	0.056	0.134	0.148	0.271	0.192
118	23	0.088	0.056	0.134	0.148	0.271	0.192
118	24	0.088	0.056	0.134	0.148	0.271	0.192
118	25	0.088	0.056	0.134	0.148	0.271	0.192
118	26	0.088	0.056	0.134	0.148	0.271	0.192
118	27	0.088	0.056	0.134	0.148	0.271	0.192
118	28	0.088	0.056	0.134	0.148	0.271	0.192

Table C67a. Bare Airframe: SUI Endurance, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Yaw (deg)	Pitch (deg)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)
117	5	20.13	0.48	0.00238	-90	-9.91	-0.015	-0.207	-0.091	0.559	0.044	-0.031
117	6	19.97	0.47	0.00238	-90	-4.99	-0.016	-0.209	-0.080	0.596	-0.011	-0.023
117	7	19.56	0.45	0.00237	-90	-1.99	-0.019	-0.201	-0.030	0.541	-0.022	-0.015
117	8	20.30	0.49	0.00237	-90	0.05	-0.016	-0.219	-0.019	0.578	-0.035	-0.016
117	9	20.38	0.49	0.00237	-90	2.03	-0.016	-0.222	-0.005	0.566	-0.033	-0.021
117	10	20.21	0.48	0.00237	-90	5.03	-0.018	-0.216	0.035	0.507	-0.028	-0.006
117	11	19.94	0.47	0.00237	-90	9.95	-0.015	-0.214	0.098	0.474	-0.043	-0.005

Table C67b. Bare Airframe: SUI Endurance, nominal speed 20 ft/s, yaw = -90 deg, pitch = -10 to 10 deg - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
117	5	0.088	0.056	0.134	0.148	0.271	0.192
117	6	0.088	0.056	0.134	0.148	0.271	0.192
117	7	0.088	0.056	0.134	0.148	0.271	0.192
117	8	0.088	0.056	0.134	0.148	0.271	0.192
117	9	0.088	0.056	0.134	0.148	0.271	0.192
117	10	0.088	0.056	0.134	0.148	0.271	0.192
117	11	0.088	0.056	0.134	0.148	0.271	0.192

Wind Tunnel Data - 3DR SOLO Isolated Rotor

Table C68a. Isolated Rotor: 3DR SOLO, nominal speed 20 ft/s, pitch = -40 to 40 deg, RPM = 4,600 to 6,800 - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Pitch (deg)	RPM	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)
132	6	19.33	0.46	0.00246	-39.95	4600	0.024	-0.014	0.554	-0.143	0.185	0.354	16.844	1.663
132	7	19.57	0.47	0.00246	-39.95	5100	0.028	-0.016	0.685	-0.178	0.251	0.433	16.837	2.164
132	5	20.07	0.50	0.00246	-39.95	5700	0.039	-0.013	0.831	-0.171	0.277	0.540	16.827	2.921
132	8	19.80	0.48	0.00246	-39.95	6300	0.041	-0.022	1.067	-0.132	0.384	0.668	16.814	3.854
132	9	19.58	0.47	0.00246	-39.95	6800	0.047	-0.024	1.250	-0.124	0.445	0.780	16.802	4.781
132	10	19.58	0.47	0.00246	-19.92	4600	0.040	-0.013	0.706	-0.226	0.381	0.365	16.844	1.703
132	11	19.53	0.47	0.00246	-19.92	5100	0.052	-0.014	0.840	-0.278	0.425	0.446	16.837	2.209
132	12	19.59	0.47	0.00246	-19.92	5700	0.064	-0.025	1.010	-0.218	0.507	0.551	16.827	2.941
132	13	19.55	0.47	0.00246	-19.92	6300	0.072	-0.028	1.222	-0.222	0.561	0.673	16.814	3.867
132	14	19.39	0.46	0.00246	-19.92	6800	0.087	-0.030	1.408	-0.208	0.630	0.784	16.802	4.782
132	15	19.30	0.46	0.00246	-9.91	4600	0.033	-0.016	0.750	-0.265	0.514	0.354	16.844	1.668
132	16	19.70	0.48	0.00246	-9.90	5100	0.051	-0.019	0.870	-0.325	0.540	0.433	16.838	2.174
132	17	19.70	0.48	0.00246	-9.90	5700	0.064	-0.021	1.038	-0.315	0.649	0.538	16.826	2.885
132	18	19.62	0.47	0.00246	-9.90	6300	0.078	-0.026	1.239	-0.328	0.685	0.662	16.816	3.797
132	19	19.22	0.45	0.00246	-9.90	6800	0.094	-0.033	1.429	-0.284	0.741	0.772	16.803	4.711
132	20	19.87	0.49	0.00246	-4.98	4600	0.030	-0.013	0.737	-0.306	0.580	0.358	16.844	1.685
132	21	20.24	0.50	0.00246	-4.98	5100	0.046	-0.022	0.863	-0.380	0.620	0.435	16.837	2.167
132	22	20.14	0.50	0.00246	-4.98	5700	0.064	-0.024	1.042	-0.357	0.724	0.542	16.827	2.899
132	23	20.01	0.49	0.00246	-4.98	6300	0.081	-0.025	1.249	-0.361	0.777	0.662	16.815	3.801
132	24	19.95	0.49	0.00246	-4.98	6800	0.096	-0.026	1.431	-0.364	0.885	0.768	16.803	4.681
132	25	19.89	0.49	0.00246	-1.98	4600	0.027	-0.011	0.739	-0.306	0.673	0.382	16.842	1.791
132	26	20.05	0.49	0.00246	-1.98	5100	0.034	-0.021	0.864	-0.386	0.726	0.443	16.837	2.218
132	27	19.97	0.49	0.00246	-1.98	5700	0.053	-0.022	1.044	-0.361	0.829	0.547	16.826	2.943
132	28	19.86	0.49	0.00246	-1.98	6300	0.067	-0.023	1.233	-0.390	0.874	0.665	16.815	3.810
132	29	19.97	0.49	0.00246	-1.98	6800	0.088	-0.025	1.417	-0.394	0.971	0.771	16.803	4.709
132	30	19.52	0.47	0.00246	0.07	4600	0.025	-0.015	0.731	-0.288	0.657	0.381	16.842	1.775
132	31	19.34	0.46	0.00246	-0.04	5700	0.048	-0.020	1.032	-0.317	0.875	0.553	16.825	2.967
132	32	19.11	0.45	0.00246	-0.04	6300	0.063	-0.021	1.251	-0.376	0.918	0.676	16.814	3.873
132	33	19.35	0.46	0.00246	0.09	6800	0.086	-0.023	1.412	-0.382	0.970	0.781	16.802	4.763
132	34	19.52	0.47	0.00246	2.03	4600	0.021	-0.011	0.744	-0.293	0.726	0.383	16.842	1.797
132	35	19.49	0.47	0.00246	2.03	5700	0.050	-0.018	1.031	-0.342	0.882	0.559	16.826	2.992
132	36	19.38	0.46	0.00246	2.03	6300	0.064	-0.019	1.247	-0.371	0.952	0.683	16.813	3.932
132	37	19.62	0.47	0.00246	2.03	6800	0.083	-0.017	1.405	-0.372	1.043	0.779	16.802	4.729
132	38	19.59	0.47	0.00246	5.03	4600	0.024	-0.009	0.746	-0.276	0.739	0.390	16.842	1.799
132	39	19.82	0.48	0.00246	5.03	5700	0.049	-0.015	1.049	-0.337	0.946	0.565	16.826	3.007
132	40	19.61	0.47	0.00246	5.03	6300	0.060	-0.017	1.244	-0.327	1.022	0.688	16.813	3.933
132	41	19.61	0.47	0.00246	5.03	6800	0.084	-0.013	1.422	-0.349	1.089	0.791	16.800	4.842
132	42	20.36	0.51	0.00246	9.95	5700	0.050	-0.009	1.066	-0.265	1.050	0.565	16.825	3.017
132	43	20.44	0.51	0.00246	9.95	6300	0.064	-0.017	1.282	-0.276	1.116	0.696	16.812	3.993
132	44	20.48	0.52	0.00246	9.95	6800	0.079	-0.014	1.463	-0.287	1.267	0.793	16.801	4.825
132	45	19.67	0.48	0.00246	19.95	5700	0.042	-0.009	1.094	-0.203	1.198	0.574	16.824	3.075
132	46	19.41	0.46	0.00246	19.95	6300	0.053	-0.009	1.308	-0.244	1.331	0.697	16.812	4.001
132	47	19.56	0.47	0.00246	19.95	6800	0.073	-0.004	1.484	-0.245	1.448	0.808	16.800	4.929
132	48	20.04	0.49	0.00246	39.98	5700	-0.008	0.005	1.139	0.130	1.095	0.564	16.826	3.005
132	49	19.95	0.49	0.00246	39.98	6300	0.007	-0.005	1.303	0.147	1.180	0.661	16.815	3.774
132	50	19.62	0.47	0.00246	39.98	6800	0.018	-0.008	1.469	0.254	1.229	0.765	16.803	4.697

Table C68b. Isolated Rotor: 3DR SOLO, nominal speed 20 ft/s, pitch = -40 to 40 deg, RPM = 4,600 to 6,800 - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]
132	6	0.088	0.066	0.134	0.198	0.274	0.192	0.002	0.017
132	7	0.092	0.058	0.134	0.151	0.310	0.192	0.002	0.022
132	5	0.088	0.057	0.134	0.151	0.275	0.192	0.003	0.030
132	8	0.089	0.061	0.134	0.155	0.275	0.192	0.003	0.040
132	9	0.089	0.057	0.134	0.154	0.275	0.192	0.004	0.049
132	10	0.088	0.079	0.134	0.259	0.278	0.192	0.002	0.018
132	11	0.103	0.060	0.134	0.155	0.384	0.192	0.002	0.023
132	12	0.089	0.059	0.134	0.152	0.279	0.192	0.003	0.030
132	13	0.090	0.066	0.134	0.162	0.278	0.192	0.003	0.040
132	14	0.090	0.057	0.134	0.158	0.277	0.192	0.004	0.049
132	15	0.088	0.086	0.134	0.291	0.282	0.192	0.002	0.017
132	16	0.107	0.060	0.134	0.156	0.411	0.192	0.002	0.022
132	17	0.089	0.060	0.134	0.153	0.283	0.192	0.003	0.030
132	18	0.091	0.066	0.134	0.169	0.282	0.192	0.003	0.039
132	19	0.091	0.057	0.134	0.160	0.279	0.192	0.004	0.048
132	20	0.088	0.099	0.134	0.354	0.282	0.192	0.002	0.018
132	21	0.123	0.062	0.134	0.160	0.519	0.192	0.002	0.022
132	22	0.090	0.061	0.134	0.154	0.286	0.192	0.003	0.030
132	23	0.092	0.067	0.134	0.173	0.285	0.192	0.003	0.039
132	24	0.092	0.057	0.134	0.163	0.282	0.192	0.004	0.048
132	25	0.090	0.082	0.134	0.271	0.297	0.192	0.002	0.019
132	26	0.114	0.061	0.134	0.156	0.460	0.192	0.002	0.023
132	27	0.090	0.062	0.134	0.154	0.286	0.192	0.003	0.030
132	28	0.092	0.070	0.134	0.176	0.286	0.192	0.003	0.039
132	29	0.092	0.057	0.134	0.164	0.282	0.192	0.004	0.048
132	30	0.090	0.088	0.134	0.300	0.293	0.192	0.002	0.018
132	31	0.090	0.062	0.134	0.155	0.287	0.192	0.003	0.030
132	32	0.092	0.068	0.134	0.176	0.286	0.192	0.003	0.040
132	33	0.092	0.057	0.134	0.164	0.282	0.192	0.004	0.049
132	34	0.089	0.091	0.134	0.310	0.291	0.192	0.002	0.019
132	35	0.090	0.062	0.134	0.155	0.288	0.192	0.003	0.031
132	36	0.093	0.071	0.134	0.175	0.287	0.192	0.003	0.040
132	37	0.093	0.057	0.134	0.166	0.283	0.192	0.004	0.048
132	38	0.089	0.094	0.134	0.324	0.292	0.192	0.002	0.019
132	39	0.090	0.063	0.134	0.156	0.290	0.192	0.003	0.031
132	40	0.093	0.072	0.134	0.178	0.288	0.192	0.003	0.040
132	41	0.092	0.057	0.134	0.166	0.283	0.192	0.004	0.050
132	42	0.091	0.063	0.134	0.157	0.293	0.192	0.003	0.031
132	43	0.095	0.074	0.134	0.185	0.291	0.192	0.003	0.041
132	44	0.092	0.057	0.134	0.171	0.285	0.192	0.004	0.049
132	45	0.092	0.065	0.134	0.160	0.299	0.192	0.003	0.032
132	46	0.095	0.075	0.134	0.190	0.293	0.192	0.003	0.041
132	47	0.092	0.058	0.134	0.176	0.287	0.192	0.004	0.050
132	48	0.090	0.064	0.134	0.157	0.289	0.192	0.003	0.031
132	49	0.094	0.080	0.134	0.186	0.289	0.192	0.003	0.039
132	50	0.091	0.059	0.134	0.168	0.282	0.192	0.004	0.048

Table C69a. Isolated Rotor: 3DR SOLO, nominal speed 40 ft/s, pitch = -40 to 0 deg, RPM = 5,700 to 6,800 - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Pitch (deg)	RPM 1	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)
133	6	39.72	1.93	0.00245	-39.95	5700	0.056	-0.020	0.515	-0.339	0.288	0.463	16.831	2.522
133	7	39.67	1.93	0.00245	-39.95	6300	0.064	-0.017	0.692	-0.370	0.373	0.575	16.821	3.338
133	8	39.66	1.92	0.00245	-39.95	6800	0.079	-0.022	0.848	-0.365	0.446	0.686	16.809	4.208
133	9	39.50	1.91	0.00245	-19.92	5700	0.068	-0.031	0.913	-0.496	0.851	0.542	16.826	2.940
133	10	39.41	1.90	0.00244	-19.92	6300	0.075	-0.022	1.122	-0.558	1.009	0.659	16.814	3.810
133	11	39.41	1.90	0.00244	-19.92	6800	0.094	-0.036	1.303	-0.491	1.149	0.756	16.803	4.603
133	12	39.74	1.93	0.00244	-9.91	5700	0.075	-0.042	1.060	-0.617	1.107	0.534	16.826	2.892
133	13	39.59	1.91	0.00244	-9.91	6300	0.085	-0.044	1.268	-0.643	1.265	0.653	16.814	3.809
133	14	38.62	1.82	0.00244	-9.91	6800	0.098	-0.044	1.449	-0.626	1.499	0.751	16.803	4.634
133	15	39.35	1.89	0.00244	-4.98	5700	0.071	-0.039	1.122	-0.632	1.252	0.568	16.824	3.070
133	16	38.82	1.84	0.00244	-4.99	6300	0.082	-0.043	1.304	-0.638	1.423	0.688	16.812	4.002
133	17	40.14	1.97	0.00244	-4.99	6800	0.098	-0.043	1.494	-0.657	1.705	0.797	16.799	4.909
133	18	39.59	1.91	0.00244	-0.05	5700	0.067	-0.021	1.218	-0.626	1.358	0.621	16.820	3.367
133	19	39.26	1.88	0.00244	-0.04	6300	0.078	-0.026	1.419	-0.637	1.560	0.748	16.806	4.349
133	20	39.22	1.88	0.00244	-0.05	6800	0.094	-0.023	1.599	-0.561	1.819	0.842	16.796	5.201

Table C69b. Isolated Rotor: 3DR SOLO, nominal speed 40 ft/s, pitch = -40 to 0 deg, RPM = 5,700 to 6,800 - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]
133	6	0.088	0.058	0.134	0.151	0.277	0.192	0.002	0.026
133	7	0.090	0.062	0.134	0.156	0.277	0.192	0.003	0.034
133	8	0.089	0.057	0.134	0.158	0.275	0.192	0.004	0.043
133	9	0.090	0.063	0.134	0.156	0.291	0.192	0.003	0.030
133	10	0.093	0.075	0.134	0.181	0.288	0.192	0.003	0.039
133	11	0.092	0.058	0.134	0.172	0.283	0.192	0.004	0.047
133	12	0.092	0.065	0.134	0.159	0.304	0.192	0.003	0.030
133	13	0.097	0.077	0.134	0.204	0.301	0.192	0.003	0.039
133	14	0.096	0.059	0.134	0.179	0.292	0.192	0.004	0.047
133	15	0.094	0.068	0.134	0.161	0.309	0.192	0.003	0.031
133	16	0.098	0.076	0.134	0.206	0.305	0.192	0.003	0.041
133	17	0.099	0.058	0.134	0.185	0.299	0.192	0.004	0.050
133	18	0.094	0.069	0.134	0.162	0.313	0.192	0.003	0.034
133	19	0.100	0.077	0.134	0.209	0.311	0.192	0.004	0.045
133	20	0.101	0.058	0.134	0.184	0.302	0.192	0.004	0.053

Table C70a. Isolated Rotor: 3DR SOLO, nominal speed 80 ft/s, pitch = -40 to -20 deg, RPM = 5,700 to 8,600 - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Pitch (deg)	RPM 1	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)
134	12	79.59	7.65	0.00242	-39.95	5700	0.037	-0.018	-0.259	-0.430	0.351	0.108	16.856	0.717
134	13	79.54	7.64	0.00242	-39.95	6300	0.043	-0.016	-0.140	-0.534	0.472	0.210	16.848	1.306
134	14	79.80	7.69	0.00242	-39.95	6800	0.053	-0.016	-0.049	-0.603	0.575	0.302	16.840	1.881
134	15	79.72	7.67	0.00241	-39.95	7400	0.058	-0.021	0.075	-0.608	0.708	0.414	16.829	2.686
134	16	79.76	7.68	0.00241	-39.95	8000	0.069	-0.018	0.216	-0.619	0.815	0.534	16.816	3.630
134	17	79.68	7.66	0.00241	-39.95	8600	0.078	-0.011	0.355	-0.636	0.882	0.664	16.802	4.730
134	18	79.86	7.69	0.00241	-29.95	5700	0.066	-0.025	0.218	-0.660	0.764	0.331	16.841	1.806
134	19	79.89	7.69	0.00241	-29.95	6300	0.075	-0.021	0.365	-0.759	0.893	0.448	16.831	2.565
134	20	80.02	7.72	0.00241	-29.95	6800	0.084	-0.023	0.497	-0.799	1.074	0.541	16.821	3.292
134	21	79.93	7.70	0.00241	-29.95	7400	0.095	-0.024	0.690	-0.790	1.244	0.666	16.806	4.324
134	22	80.09	7.73	0.00241	-29.95	8000	0.107	-0.024	0.872	-0.761	1.412	0.792	16.792	5.433
134	23	80.17	7.74	0.00241	-29.95	8600	0.122	-0.023	1.078	-0.717	1.559	0.925	16.777	6.691
134	24	80.01	7.71	0.00241	-19.92	5700	0.090	-0.041	0.690	-0.989	1.221	0.518	16.828	2.788
134	25	80.12	7.73	0.00241	-19.92	6300	0.107	-0.056	0.886	-1.015	1.358	0.634	16.815	3.678
134	26	80.08	7.72	0.00241	-19.92	6800	0.127	-0.064	1.074	-1.031	1.659	0.728	16.805	4.463
134	27	79.65	7.64	0.00241	-19.92	7400	0.145	-0.072	1.302	-0.957	1.915	0.846	16.791	5.545
134	29	80.13	7.72	0.00241	-19.92	8000	0.169	-0.077	1.521	-0.850	2.151	0.972	16.772	6.767
134	30	80.12	7.72	0.00241	-19.92	8600	0.197	-0.092	1.786	-0.692	2.362	1.110	16.755	8.154

**Table C70b. Isolated Rotor: 3DR SOLO, nominal speed 80 ft/s, pitch = -40 to -20 deg, RPM = 5,700 to 8,600 -
Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]
134	12	0.088	0.058	0.134	0.151	0.277	0.192	0.001	0.008
134	13	0.090	0.063	0.134	0.159	0.278	0.192	0.002	0.014
134	14	0.089	0.057	0.134	0.159	0.276	0.192	0.002	0.020
134	15	0.090	0.057	0.134	0.158	0.277	0.192	0.003	0.028
134	16	0.091	0.063	0.134	0.186	0.277	0.192	0.003	0.038
134	17	0.088	0.064	0.134	0.196	0.280	0.192	0.003	0.049
134	18	0.090	0.062	0.134	0.155	0.290	0.192	0.002	0.019
134	19	0.093	0.071	0.134	0.181	0.289	0.192	0.003	0.026
134	20	0.093	0.061	0.134	0.174	0.284	0.192	0.003	0.034
134	21	0.091	0.058	0.134	0.169	0.282	0.192	0.004	0.044
134	22	0.095	0.063	0.134	0.190	0.285	0.192	0.004	0.056
134	23	0.089	0.064	0.134	0.195	0.282	0.192	0.004	0.068
134	24	0.095	0.070	0.134	0.163	0.319	0.192	0.003	0.029
134	25	0.099	0.083	0.134	0.213	0.309	0.192	0.003	0.038
134	26	0.096	0.059	0.134	0.193	0.298	0.192	0.004	0.046
134	27	0.096	0.060	0.134	0.186	0.295	0.192	0.004	0.057
134	29	0.106	0.067	0.134	0.208	0.301	0.192	0.004	0.069
134	30	0.090	0.071	0.134	0.222	0.290	0.192	0.004	0.083

Wind Tunnel Data - Drone America x8 Isolated Rotor

Table C71a. Isolated Rotor: Drone America x8, nominal speed 20 ft/s, pitch = -10 to 0 deg, RPM = 6,200 to 8,400 - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Pitch (deg)	RPM	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)
135	5	19.52	0.46	0.00241	-9.91	6200	0.096	-0.020	1.428	-0.548	0.652	0.808	16.801	4.700
135	6	19.56	0.46	0.00241	-9.91	7000	0.105	-0.028	1.828	-0.648	0.759	1.037	16.776	6.683
135	7	19.64	0.46	0.00241	-9.91	7700	0.116	-0.037	2.216	-0.667	0.866	1.264	16.744	8.958
135	8	19.61	0.46	0.00241	-9.91	8400	0.125	-0.045	2.648	-0.702	0.921	1.507	16.705	11.810
135	9	20.35	0.50	0.00241	-4.99	6200	0.100	-0.022	1.451	-0.577	0.777	0.794	16.800	4.672
135	10	20.47	0.50	0.00241	-4.99	7000	0.115	-0.028	1.833	-0.720	0.872	1.013	16.776	6.564
135	11	20.42	0.50	0.00241	-4.99	7700	0.126	-0.035	2.240	-0.747	1.013	1.235	16.746	8.745
135	12	20.47	0.50	0.00241	-4.99	8400	0.136	-0.046	2.646	-0.779	1.060	1.475	16.709	11.513
135	13	20.47	0.50	0.00241	0.11	6200	0.095	-0.025	1.477	-0.604	0.932	0.775	16.804	4.532
135	14	20.94	0.53	0.00241	0.11	7000	0.118	-0.031	1.844	-0.738	1.013	0.985	16.780	6.348
135	15	21.00	0.53	0.00240	0.11	7700	0.128	-0.038	2.233	-0.786	1.160	1.202	16.750	8.449
135	16	19.84	0.47	0.00240	0.11	8400	0.129	-0.049	2.675	-0.758	1.164	1.457	16.710	11.409

**Table C71b. Isolated Rotor: Drone America x8, nominal speed 20 ft/s, pitch = -10 to 0 deg, RPM = 6,200 to 8,400 -
Uncertainty**

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]
135	5	0.093	0.059	0.134	0.152	0.298	0.192	0.004	0.048
135	6	0.090	0.057	0.134	0.168	0.277	0.192	0.004	0.068
135	7	0.090	0.058	0.134	0.159	0.277	0.192	0.005	0.091
135	8	0.095	0.060	0.134	0.158	0.276	0.192	0.004	0.119
135	9	0.095	0.059	0.134	0.153	0.304	0.192	0.004	0.048
135	10	0.090	0.057	0.134	0.174	0.278	0.192	0.004	0.067
135	11	0.091	0.059	0.134	0.162	0.278	0.192	0.005	0.089
135	12	0.097	0.061	0.134	0.160	0.277	0.192	0.004	0.116
135	13	0.096	0.059	0.134	0.153	0.308	0.192	0.004	0.046
135	14	0.091	0.058	0.134	0.179	0.280	0.192	0.004	0.065
135	15	0.092	0.060	0.134	0.164	0.280	0.192	0.005	0.086
135	16	0.094	0.060	0.134	0.160	0.277	0.192	0.004	0.115

Table C72a. Isolated Rotor: Drone America x8, nominal speed 40 ft/s, pitch = -20 to 0 deg, RPM = 6,200 to 8,400 - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Pitch (deg)	RPM	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)
138	5	39.79	1.88	0.00237	-19.93	6200	0.098	-0.002	1.313	-1.028	0.902	0.818	16.798	4.858
138	6	39.56	1.86	0.00237	-19.92	7000	0.121	-0.007	1.710	-1.191	1.090	1.038	16.771	6.792
138	7	39.83	1.88	0.00237	-19.93	7700	0.150	-0.012	2.088	-1.289	1.281	1.261	16.742	8.993
138	8	40.00	1.90	0.00237	-19.93	8400	0.177	-0.025	2.490	-1.353	1.374	1.500	16.705	11.752
138	9	40.29	1.93	0.00237	-9.91	6200	0.103	-0.020	1.559	-1.126	1.228	0.800	16.801	4.722
138	10	40.02	1.90	0.00237	-9.91	7000	0.127	-0.029	1.939	-1.318	1.478	1.007	16.775	6.548
138	11	40.31	1.93	0.00237	-9.91	7700	0.147	-0.028	2.336	-1.430	1.777	1.217	16.747	8.622
138	12	39.87	1.89	0.00237	-9.91	8400	0.172	-0.034	2.729	-1.514	1.910	1.455	16.712	11.280
138	13	39.44	1.85	0.00237	-4.99	6200	0.093	-0.020	1.629	-1.134	1.428	0.767	16.803	4.555
138	14	39.40	1.84	0.00237	-4.99	7000	0.118	-0.024	2.020	-1.378	1.692	0.976	16.778	6.361
138	15	39.40	1.84	0.00237	-4.99	7700	0.141	-0.027	2.434	-1.490	2.038	1.182	16.750	8.397
138	16	40.09	1.91	0.00237	-4.99	8400	0.167	-0.043	2.848	-1.587	2.267	1.408	16.716	10.896
138	17	40.16	1.91	0.00237	-0.05	6200	0.083	-0.019	1.731	-1.134	1.695	0.767	16.803	4.525
138	18	39.93	1.89	0.00237	-0.05	7000	0.112	-0.012	2.117	-1.441	2.060	0.977	16.778	6.378
138	19	39.81	1.88	0.00237	-0.05	7700	0.123	-0.019	2.519	-1.530	2.468	1.168	16.752	8.290
138	20	39.73	1.87	0.00237	-0.05	8400	0.146	-0.037	2.901	-1.625	2.702	1.377	16.720	10.512

Table C72b. Isolated Rotor: Drone America x8, nominal speed 40 ft/s, pitch = -20 to 0 deg, RPM = 6,200 to 8,400 - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]
138	5	0.098	0.062	0.134	0.156	0.319	0.192	0.004	0.050
138	6	0.091	0.057	0.134	0.184	0.283	0.192	0.004	0.069
138	7	0.094	0.060	0.134	0.171	0.284	0.192	0.005	0.092
138	8	0.102	0.065	0.134	0.171	0.282	0.192	0.004	0.118
138	9	0.103	0.064	0.134	0.159	0.338	0.192	0.004	0.048
138	10	0.093	0.058	0.135	0.196	0.288	0.192	0.004	0.067
138	11	0.096	0.064	0.134	0.178	0.289	0.192	0.005	0.088
138	12	0.102	0.063	0.134	0.175	0.285	0.192	0.004	0.114
138	13	0.105	0.065	0.134	0.161	0.347	0.192	0.004	0.047
138	14	0.094	0.059	0.135	0.198	0.291	0.192	0.004	0.065
138	15	0.098	0.064	0.134	0.183	0.292	0.192	0.005	0.086
138	16	0.103	0.065	0.134	0.179	0.288	0.192	0.004	0.110
138	17	0.109	0.067	0.135	0.164	0.365	0.192	0.004	0.046
138	18	0.096	0.059	0.135	0.206	0.298	0.192	0.004	0.065
138	19	0.101	0.065	0.134	0.186	0.299	0.192	0.005	0.085
138	20	0.108	0.069	0.134	0.185	0.294	0.192	0.004	0.106

Wind Tunnel Data - SUI Endurance Isolated Rotor

Table C73a. Isolated Rotor: SUI Endurance, nominal speed 20 ft/s, pitch = -20 to 0 deg, RPM = 2,800 to 4,200 - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	Pitch (deg)	RPM 1	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)
139	5	19.98	0.47	0.00238	-19.93	2800	0.041	0.024	0.897	-0.750	0.847	0.683	16.831	2.484
139	6	19.76	0.46	0.00238	-19.93	3200	0.050	0.020	1.179	-0.875	1.034	0.888	16.815	3.595
139	7	19.91	0.47	0.00238	-19.92	3500	0.057	0.016	1.413	-0.923	1.176	1.067	16.799	4.772
139	8	19.84	0.47	0.00238	-19.93	3800	0.067	0.013	1.681	-0.987	1.272	1.256	16.780	6.207
139	9	19.89	0.47	0.00238	-19.92	4200	0.076	0.005	2.083	-0.968	1.359	1.562	16.737	9.284
139	10	19.91	0.47	0.00238	-9.91	2800	0.047	0.024	0.997	-0.866	1.015	0.661	16.832	2.431
139	11	19.93	0.47	0.00238	-9.91	3200	0.062	0.021	1.262	-0.980	1.220	0.874	16.816	3.549
139	12	19.84	0.47	0.00238	-9.91	3500	0.068	0.017	1.486	-1.044	1.370	1.043	16.801	4.630
139	13	19.83	0.47	0.00238	-9.91	3800	0.074	0.013	1.745	-1.100	1.510	1.232	16.783	6.000
139	14	19.81	0.47	0.00238	-9.91	4200	0.086	0.004	2.137	-1.101	1.563	1.517	16.746	8.689
139	15	19.77	0.46	0.00238	-4.99	2800	0.041	0.020	1.021	-0.867	1.159	0.654	16.833	2.360
139	16	19.80	0.47	0.00238	-4.99	3200	0.054	0.022	1.282	-0.998	1.398	0.846	16.819	3.362
139	17	19.89	0.47	0.00238	-4.99	3500	0.060	0.018	1.515	-1.091	1.579	1.011	16.804	4.434
139	18	19.80	0.47	0.00238	-4.99	3800	0.071	0.012	1.780	-1.147	1.717	1.198	16.787	5.766
139	19	19.81	0.47	0.00238	-4.99	4200	0.083	0.002	2.173	-1.136	1.796	1.484	16.751	8.373
139	20	19.53	0.45	0.00238	0.11	2800	0.033	0.024	1.063	-0.865	1.348	0.645	16.833	2.313
139	21	19.44	0.45	0.00238	0.11	3200	0.050	0.022	1.302	-1.003	1.575	0.830	16.820	3.278
139	22	19.42	0.45	0.00238	0.11	3500	0.054	0.018	1.545	-1.077	1.805	1.004	16.805	4.361
139	23	20.78	0.51	0.00238	0.11	3800	0.061	0.015	1.810	-1.201	2.114	1.171	16.789	5.581
139	24	19.79	0.47	0.00238	0.11	4200	0.078	0.006	2.188	-1.195	2.106	1.473	16.752	8.351

Table C73b. Isolated Rotor: SUI Endurance, nominal speed 20 ft/s, pitch = -20 to 0 deg, RPM = 2,800 to 4,200 - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]
139	5	0.088	0.056	0.134	0.150	0.276	0.192	0.002	0.026
139	6	0.088	0.057	0.134	0.154	0.274	0.193	0.003	0.037
139	7	0.089	0.057	0.134	0.159	0.281	0.193	0.004	0.050
139	8	0.089	0.059	0.134	0.174	0.279	0.192	0.005	0.065
139	9	0.091	0.074	0.134	0.252	0.304	0.192	0.007	0.097
139	10	0.089	0.057	0.134	0.150	0.279	0.192	0.002	0.025
139	11	0.088	0.057	0.134	0.156	0.276	0.193	0.003	0.037
139	12	0.089	0.057	0.134	0.163	0.284	0.193	0.004	0.048
139	13	0.089	0.061	0.134	0.183	0.280	0.192	0.005	0.063
139	14	0.092	0.083	0.134	0.276	0.306	0.192	0.006	0.091
139	15	0.090	0.057	0.134	0.150	0.283	0.192	0.002	0.024
139	16	0.088	0.057	0.134	0.156	0.276	0.193	0.003	0.035
139	17	0.089	0.058	0.134	0.165	0.286	0.193	0.004	0.046
139	18	0.089	0.061	0.134	0.189	0.282	0.192	0.005	0.061
139	19	0.092	0.086	0.134	0.293	0.314	0.192	0.006	0.088
139	20	0.091	0.057	0.134	0.151	0.291	0.192	0.002	0.024
139	21	0.088	0.057	0.134	0.157	0.278	0.193	0.003	0.034
139	22	0.090	0.058	0.134	0.168	0.290	0.193	0.004	0.045
139	23	0.089	0.062	0.134	0.194	0.284	0.192	0.005	0.059
139	24	0.092	0.091	0.134	0.315	0.327	0.192	0.006	0.087

Hover Data - 3DR SOLO Full Vehicle

Table C74a. Full Vehicle: 3DR SOLO, hover, RPM = 3,500 to 8,000 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	RPM 2	RPM 3	RPM 4
28	4	0.00	0.00	0.00231	3500	3500	3500	3500
28	5	0.00	0.00	0.00231	4000	4000	4000	4000
28	6	0.00	0.00	0.00231	4500	4500	4500	4500
28	7	0.00	0.00	0.00231	4600	4600	4600	4600
28	8	0.00	0.00	0.00231	5000	5000	5000	5000
28	9	0.00	0.00	0.00231	5100	5100	5100	5100
28	10	0.00	0.00	0.00231	5500	5500	5500	5500
28	11	0.00	0.00	0.00231	5700	5700	5700	5700
28	12	0.00	0.00	0.00231	6000	6000	6000	6000
28	13	0.00	0.00	0.00231	6300	6300	6300	6300
28	14	0.00	0.00	0.00231	6500	6500	6500	6500
28	15	0.00	0.00	0.00231	6800	6800	6800	6800
28	16	0.00	0.00	0.00231	7000	7000	7000	7000
28	17	0.00	0.00	0.00231	7500	7500	7500	7500
28	18	0.00	0.00	0.00231	8000	8000	8000	8000

Table C74b. Full Vehicle: 3DR SOLO, hover, RPM = 3,500 to 8,000 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
28	4	0.056	-0.001	1.233	0.052	-0.368	-0.044	16.703	0.568	0.775	0.760	0.704
28	5	0.071	-0.007	1.589	0.006	-0.514	-0.065	16.686	0.962	1.121	1.012	1.157
28	6	0.080	0.004	2.052	0.419	-0.622	-0.117	16.663	1.371	1.567	1.516	1.452
28	7	0.088	-0.004	2.111	0.237	-0.671	-0.105	16.659	1.393	1.620	1.494	1.485
28	8	0.108	-0.006	2.516	0.323	-0.613	-0.144	16.638	1.755	2.008	2.044	1.784
28	9	0.098	-0.006	2.644	0.055	-0.717	-0.166	16.632	1.984	2.217	2.080	2.039
28	10	0.118	-0.004	3.083	0.104	-1.044	-0.090	16.609	2.383	2.631	2.581	2.445
28	11	0.117	-0.005	3.330	0.406	-1.074	-0.154	16.594	2.590	2.941	2.821	2.763
28	12	0.150	0.007	3.625	0.584	-1.119	-0.229	16.574	2.969	3.204	3.211	3.013
28	13	0.160	-0.015	4.037	0.089	-1.040	-0.246	16.548	3.512	3.911	3.748	3.515
28	14	0.158	0.004	4.343	0.511	-1.355	-0.165	16.528	3.859	4.170	4.114	3.922
28	15	0.191	-0.001	4.744	0.658	-1.294	-0.221	16.498	4.352	4.810	4.676	4.502
28	16	0.173	-0.010	5.045	-0.090	-1.382	-0.182	16.477	4.713	5.243	5.020	4.755
28	17	0.205	-0.003	5.825	0.637	-1.742	-0.299	16.418	5.721	6.310	6.160	5.997
28	18	0.215	-0.012	6.693	0.510	-1.954	-0.104	16.346	7.126	7.715	7.399	7.298

Table C74c. Full Vehicle: 3DR SOLO, hover, RPM = 3,500 to 8,000 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
28	4	0.088	0.056	0.134	0.149	0.271	0.192	0.001	0.006	0.008	0.008	0.007
28	5	0.088	0.056	0.134	0.149	0.271	0.192	0.001	0.010	0.011	0.010	0.012
28	6	0.088	0.056	0.134	0.149	0.273	0.192	0.001	0.014	0.016	0.015	0.015
28	7	0.088	0.056	0.134	0.149	0.273	0.192	0.001	0.014	0.016	0.015	0.015
28	8	0.088	0.057	0.134	0.151	0.274	0.196	0.001	0.018	0.020	0.020	0.018
28	9	0.088	0.057	0.134	0.150	0.274	0.195	0.001	0.020	0.022	0.021	0.020
28	10	0.088	0.056	0.134	0.149	0.274	0.193	0.001	0.024	0.026	0.026	0.024
28	11	0.088	0.056	0.134	0.149	0.274	0.193	0.001	0.026	0.029	0.028	0.028
28	12	0.088	0.056	0.134	0.149	0.274	0.193	0.001	0.030	0.032	0.032	0.030
28	13	0.089	0.056	0.134	0.149	0.276	0.193	0.001	0.035	0.039	0.037	0.035
28	14	0.093	0.056	0.134	0.149	0.283	0.193	0.001	0.039	0.042	0.041	0.039
28	15	0.093	0.056	0.134	0.150	0.283	0.193	0.001	0.044	0.048	0.047	0.045
28	16	0.095	0.057	0.134	0.152	0.286	0.193	0.001	0.047	0.052	0.050	0.048
28	17	0.092	0.059	0.136	0.157	0.280	0.201	0.001	0.057	0.063	0.062	0.060
28	18	0.092	0.058	0.137	0.151	0.280	0.202	0.001	0.071	0.077	0.074	0.073

Table C75a. Full Vehicle: 3DR SOLO, hover, RPM = 4,600 to 6,800 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	RPM 2	RPM 3	RPM 4
28	20	0.00	0.00	0.00231	6800	6800	4600	4600
28	21	0.00	0.00	0.00231	6300	6300	5100	5100
28	22	0.00	0.00	0.00231	5100	5100	6300	6300
28	23	0.00	0.00	0.00231	4600	4600	6800	6800
28	24	0.00	0.00	0.00231	6800	4600	6800	4600
28	25	0.00	0.00	0.00231	6300	5100	6300	5100
28	26	0.00	0.00	0.00231	5100	6300	5100	6300
28	27	0.00	0.00	0.00231	4600	6800	4600	6800
28	29	0.00	0.00	0.00231	5700	0	0	0
28	30	0.00	0.00	0.00231	0	5700	0	0
28	31	0.00	0.00	0.00231	0	0	5700	0
28	32	0.00	0.00	0.00231	0	0	0	5700

Table C75b. Full Vehicle: 3DR SOLO, hover, RPM = 4,600 to 6,800 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
28	20	0.049	-0.006	3.457	0.280	7.389	-0.198	16.578	4.274	4.796	1.606	1.519
28	21	0.089	0.002	3.363	0.561	3.359	-0.190	16.588	3.497	3.907	2.108	2.111
28	22	0.181	-0.023	3.308	-0.127	-5.807	-0.138	16.592	2.018	2.161	3.717	3.535
28	23	0.254	-0.012	3.382	0.559	-9.520	-0.215	16.578	1.450	1.664	4.570	4.403
28	24	0.150	0.073	3.407	-7.861	-1.000	0.063	16.581	4.224	1.663	4.594	1.525
28	25	0.136	0.043	3.317	-3.719	-1.098	-0.097	16.590	3.466	2.265	3.642	2.033
28	26	0.132	-0.046	3.340	4.952	-1.096	-0.329	16.590	1.873	3.865	2.091	3.616
28	27	0.143	-0.088	3.407	8.720	-1.062	-0.418	16.581	1.543	4.640	1.567	4.329
28	29	-0.007	0.058	0.861	-5.339	4.898	0.700	16.705	2.623	0.016	-0.017	0.029
28	30	-0.006	-0.058	0.885	5.525	4.984	-0.809	16.705	0.006	2.957	0.017	0.020
28	31	0.123	0.040	0.803	-5.335	-5.963	-0.494	16.706	-0.042	-0.010	2.807	0.102
28	32	0.122	-0.059	0.852	5.501	-5.990	0.371	16.704	0.014	0.012	-0.041	2.791

Table C75c. Full Vehicle: 3DR SOLO, hover, RPM = 4,600 to 6,800 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
28	20	0.089	0.056	0.134	0.149	0.275	0.193	0.001	0.043	0.048	0.016	0.015
28	21	0.088	0.057	0.134	0.149	0.273	0.194	0.001	0.035	0.039	0.021	0.021
28	22	0.090	0.056	0.134	0.150	0.279	0.194	0.001	0.020	0.022	0.037	0.035
28	23	0.091	0.056	0.134	0.149	0.282	0.193	0.001	0.015	0.017	0.046	0.044
28	24	0.089	0.056	0.134	0.152	0.276	0.193	0.001	0.042	0.017	0.046	0.015
28	25	0.088	0.056	0.134	0.150	0.275	0.194	0.001	0.035	0.023	0.036	0.020
28	26	0.089	0.056	0.134	0.151	0.276	0.195	0.001	0.019	0.039	0.021	0.036
28	27	0.090	0.056	0.134	0.153	0.278	0.192	0.001	0.015	0.046	0.016	0.043
28	29	0.088	0.056	0.134	0.150	0.271	0.192	0.001	0.026	0.001	0.001	0.001
28	30	0.088	0.056	0.134	0.150	0.271	0.192	0.001	0.000	0.030	0.000	0.000
28	31	0.088	0.056	0.134	0.150	0.272	0.192	0.001	0.001	0.000	0.028	0.001
28	32	0.088	0.056	0.134	0.150	0.272	0.192	0.001	0.000	0.000	0.001	0.028

Hover Data - DJI Phantom 3 Full Vehicle

Table C76a. Full Vehicle: DJI Phantom 3, hover, RPM = 3,500 to 7,500 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	RPM 2	RPM 3	RPM 4
27	4	0.00	0.00	0.00238	3500	3500	3500	3500
27	5	0.00	0.00	0.00238	4000	4000	4000	4000
27	6	0.00	0.00	0.00238	4200	4200	4200	4200
27	7	0.00	0.00	0.00238	4500	4500	4500	4500
27	8	0.00	0.00	0.00238	4800	4800	4800	4800
27	9	0.00	0.00	0.00238	5000	5000	5000	5000
27	10	0.00	0.00	0.00238	5300	5300	5300	5300
27	11	0.00	0.00	0.00238	5500	5500	5500	5500
27	12	0.00	0.00	0.00238	5800	5800	5800	5800
27	13	0.00	0.00	0.00238	6000	6000	6000	6000
27	14	0.00	0.00	0.00238	6400	6400	6400	6400
27	15	0.00	0.00	0.00238	6500	6500	6500	6500
27	16	0.00	0.00	0.00238	7000	7000	7000	7000
27	17	0.00	0.00	0.00238	7500	7500	7500	7500

Table C76b. Full Vehicle: DJI Phantom 3, hover, RPM = 3,500 to 7,500 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
27	4	0.011	0.012	1.247	0.081	-0.122	-0.161	16.690	0.865	0.979	0.963	0.920
27	5	-0.006	-0.001	1.692	-0.154	-0.070	-0.203	16.668	1.289	1.440	1.362	1.302
27	6	0.004	0.014	1.873	-0.018	-0.117	-0.319	16.657	1.447	1.687	1.562	1.496
27	7	-0.005	-0.005	2.168	-0.242	-0.152	-0.285	16.641	1.758	2.052	1.903	1.779
27	8	-0.004	0.018	2.483	0.050	-0.173	-0.343	16.618	2.135	2.515	2.315	2.189
27	9	0.002	0.008	2.697	-0.051	-0.158	-0.359	16.601	2.404	2.830	2.625	2.506
27	10	-0.000	0.006	3.040	-0.091	-0.179	-0.398	16.573	2.885	3.453	3.190	2.995
27	11	0.021	0.017	3.305	0.006	-0.055	-0.354	16.546	3.383	4.017	3.633	3.514
27	12	0.014	0.025	3.671	0.012	-0.243	-0.524	16.513	3.877	4.778	4.337	4.136
27	13	0.003	0.013	3.925	-0.093	-0.149	-0.459	16.487	4.292	5.410	4.756	4.594
27	14	0.017	0.036	4.485	0.108	-0.310	-0.582	16.443	5.081	6.046	5.689	5.445
27	15	0.023	0.021	4.637	0.044	-0.111	-0.571	16.432	5.400	6.185	5.854	5.622
27	16	0.024	0.029	5.376	-0.070	-0.260	-0.782	16.375	6.438	7.291	6.927	6.564
27	17	0.001	0.038	6.185	-0.020	-0.291	-0.705	16.288	7.985	9.122	8.558	8.009

Table C76c. Full Vehicle: DJI Phantom 3, hover, RPM = 3,500 to 7,500 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
27	4	0.088	0.057	0.134	0.151	0.271	0.192	0.001	0.009	0.010	0.010	0.009
27	5	0.088	0.056	0.134	0.150	0.272	0.193	0.001	0.013	0.014	0.014	0.013
27	6	0.088	0.056	0.134	0.150	0.272	0.192	0.001	0.014	0.017	0.016	0.015
27	7	0.088	0.056	0.134	0.150	0.271	0.192	0.001	0.018	0.021	0.019	0.018
27	8	0.088	0.056	0.134	0.150	0.271	0.193	0.002	0.021	0.025	0.023	0.022
27	9	0.088	0.056	0.134	0.149	0.271	0.193	0.002	0.024	0.028	0.026	0.025
27	10	0.088	0.057	0.134	0.150	0.272	0.193	0.002	0.029	0.035	0.032	0.030
27	11	0.088	0.057	0.134	0.149	0.272	0.192	0.002	0.034	0.040	0.036	0.035
27	12	0.088	0.057	0.134	0.149	0.272	0.192	0.002	0.039	0.048	0.043	0.041
27	13	0.089	0.056	0.134	0.149	0.273	0.192	0.003	0.043	0.054	0.048	0.046
27	14	0.088	0.056	0.134	0.150	0.273	0.192	0.003	0.051	0.060	0.057	0.054
27	15	0.089	0.056	0.134	0.150	0.273	0.192	0.003	0.054	0.062	0.059	0.056
27	16	0.088	0.057	0.134	0.151	0.272	0.192	0.002	0.064	0.073	0.069	0.066
27	17	0.088	0.058	0.134	0.154	0.272	0.193	0.002	0.080	0.091	0.086	0.080

Table C77a. Full Vehicle: DJI Phantom 3, hover, RPM = 4,200 to 6,400 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	RPM 2	RPM 3	RPM 4
27	19	0.00	0.00	0.00238	6400	6400	4200	4200
27	20	0.00	0.00	0.00238	5800	5800	4800	4800
27	21	0.00	0.00	0.00238	4800	4800	5800	5800
27	22	0.00	0.00	0.00238	4200	4200	6400	6400
27	23	0.00	0.00	0.00238	6400	4200	6400	4200
27	24	0.00	0.00	0.00238	5800	4800	5800	4800
27	25	0.00	0.00	0.00238	4800	5800	4800	5800
27	26	0.00	0.00	0.00238	4200	6400	4200	6400
27	28	0.00	0.00	0.00238	5300	0	0	0
27	29	0.00	0.00	0.00238	0	5300	0	0
27	30	0.00	0.00	0.00238	0	0	5300	0
27	31	0.00	0.00	0.00238	0	0	0	5300

Table C77b. Full Vehicle: DJI Phantom 3, hover, RPM = 4,200 to 6,400 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
27	19	-0.007	0.012	3.208	-0.106	6.555	-0.401	16.543	5.294	6.234	1.673	1.619
27	20	-0.008	0.014	3.076	-0.100	2.722	-0.300	16.550	4.192	5.352	2.430	2.335
27	21	0.033	0.028	3.027	-0.006	-3.249	-0.509	16.558	2.310	2.842	4.325	4.175
27	22	0.052	0.035	3.127	0.045	-6.787	-0.318	16.548	1.561	1.755	5.597	5.471
27	23	-0.013	0.129	3.192	-7.266	-0.443	-0.394	16.550	5.013	1.805	5.668	1.630
27	24	-0.009	0.075	3.070	-3.388	-0.381	-0.477	16.560	3.910	2.593	4.551	2.310
27	25	0.028	-0.032	3.057	3.142	-0.142	-0.365	16.562	2.274	4.522	2.544	4.108
27	26	0.019	-0.076	3.182	7.205	-0.116	-0.393	16.547	1.496	6.067	1.651	5.430
27	28	-0.021	0.080	0.813	-4.266	3.961	0.855	16.698	3.022	0.024	-0.009	0.032
27	29	-0.002	-0.069	0.808	4.179	4.047	-0.945	16.694	-0.010	3.605	0.005	0.043
27	30	0.043	0.092	0.761	-4.319	-4.350	-0.949	16.698	0.019	0.014	3.183	0.040
27	31	0.051	-0.072	0.733	4.167	-4.115	0.721	16.698	0.023	0.004	-0.040	3.037

Table C77c. Full Vehicle: DJI Phantom 3, hover, RPM = 4,200 to 6,400 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
27	19	0.088	0.056	0.134	0.150	0.272	0.192	0.002	0.053	0.062	0.017	0.016
27	20	0.088	0.057	0.134	0.149	0.272	0.192	0.002	0.042	0.054	0.024	0.023
27	21	0.088	0.057	0.134	0.150	0.272	0.193	0.002	0.023	0.028	0.043	0.042
27	22	0.088	0.057	0.134	0.151	0.273	0.192	0.002	0.016	0.018	0.056	0.055
27	23	0.088	0.056	0.134	0.152	0.273	0.192	0.002	0.050	0.018	0.057	0.016
27	24	0.088	0.056	0.134	0.150	0.272	0.192	0.002	0.039	0.026	0.046	0.023
27	25	0.088	0.057	0.134	0.150	0.272	0.193	0.002	0.023	0.045	0.025	0.041
27	26	0.088	0.056	0.134	0.153	0.272	0.192	0.002	0.015	0.061	0.017	0.054
27	28	0.088	0.056	0.134	0.149	0.271	0.192	0.001	0.030	0.001	0.001	0.001
27	29	0.088	0.056	0.134	0.149	0.271	0.192	0.001	0.001	0.036	0.001	0.001
27	30	0.088	0.056	0.134	0.149	0.271	0.192	0.001	0.001	0.001	0.032	0.001
27	31	0.088	0.056	0.134	0.149	0.271	0.192	0.001	0.001	0.001	0.001	0.030

Hover Data - 3DR Iris+ Full Vehicle

Table C78a. Full Vehicle: 3DR Iris+, hover, RPM = 2,500 to 8,000 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	RPM 2	RPM 3	RPM 4
29	4	0.00	0.00	0.00230	2500	2500	2500	2500
29	6	0.00	0.00	0.00230	3000	3000	3000	3000
29	5	0.00	0.00	0.00230	3500	3500	3500	3500
29	7	0.00	0.00	0.00230	4000	4000	4000	4000
29	8	0.00	0.00	0.00230	4300	4300	4300	4300
29	9	0.00	0.00	0.00230	4500	4500	4500	4500
29	10	0.00	0.00	0.00230	4900	4900	4900	4900
29	11	0.00	0.00	0.00230	5400	5400	5400	5400
29	12	0.00	0.00	0.00230	5500	5500	5500	5500
29	13	0.00	0.00	0.00230	5900	5900	5900	5900
29	14	0.00	0.00	0.00230	6000	6000	6000	6000
29	15	0.00	0.00	0.00230	6500	6500	6500	6500
29	16	0.00	0.00	0.00230	7000	7000	7000	7000
29	17	0.00	0.00	0.00230	7500	7500	7500	7500
29	18	0.00	0.00	0.00230	8000	8000	8000	8000

Table C78b. Full Vehicle: 3DR Iris+, hover, RPM = 2,500 to 8,000 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
29	4	0.012	0.001	0.524	0.058	-0.088	0.043	12.519	0.366	0.423	0.418	0.418
29	6	0.018	0.005	0.763	0.010	0.015	0.016	12.508	0.550	0.659	0.594	0.611
29	5	0.024	0.002	1.089	0.042	-0.060	0.025	12.493	0.809	0.947	0.927	0.892
29	7	0.028	-0.000	1.422	0.116	-0.117	-0.009	12.475	1.112	1.320	1.243	1.202
29	8	0.031	0.003	1.674	0.191	-0.198	0.037	12.461	1.362	1.588	1.540	1.457
29	9	0.029	0.005	1.858	0.309	-0.166	0.003	12.450	1.574	1.827	1.721	1.669
29	10	0.032	0.007	2.232	0.081	-0.104	0.008	12.428	1.978	2.226	2.128	2.095
29	11	0.034	0.008	2.718	0.559	-0.381	0.132	12.394	2.563	2.886	2.822	2.654
29	12	0.041	-0.001	2.819	0.111	-0.241	-0.018	12.387	2.661	3.075	2.935	2.865
29	13	0.035	-0.001	3.243	-0.045	-0.395	0.013	12.354	3.270	3.720	3.548	3.390
29	14	0.050	0.008	3.351	0.389	-0.484	-0.061	12.347	3.363	3.858	3.773	3.601
29	15	0.044	-0.006	3.995	0.109	-0.330	0.038	12.296	4.297	4.930	4.660	4.416
29	16	0.061	-0.004	4.675	0.417	-0.337	0.176	12.240	5.296	5.995	5.653	5.501
29	17	0.067	0.001	5.357	0.533	-0.560	-0.038	12.176	6.406	7.238	6.928	6.665
29	18	0.064	-0.002	6.090	0.223	-0.833	0.056	12.095	7.793	8.752	8.554	8.127

Table C78c. Full Vehicle: 3DR Iris+, hover, RPM = 2,500 to 8,000 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
29	4	0.088	0.056	0.134	0.149	0.271	0.193	0.000	0.004	0.004	0.004	0.004
29	6	0.088	0.056	0.134	0.148	0.271	0.192	0.000	0.006	0.007	0.006	0.006
29	5	0.088	0.056	0.134	0.150	0.272	0.192	0.001	0.008	0.009	0.009	0.009
29	7	0.088	0.057	0.134	0.151	0.271	0.192	0.001	0.011	0.013	0.012	0.012
29	8	0.088	0.056	0.134	0.149	0.271	0.192	0.001	0.014	0.016	0.015	0.015
29	9	0.088	0.056	0.134	0.149	0.271	0.192	0.001	0.016	0.018	0.017	0.017
29	10	0.088	0.056	0.134	0.150	0.271	0.192	0.001	0.020	0.022	0.021	0.021
29	11	0.088	0.056	0.134	0.149	0.271	0.192	0.001	0.026	0.029	0.028	0.027
29	12	0.088	0.056	0.134	0.149	0.271	0.192	0.001	0.027	0.031	0.029	0.029
29	13	0.088	0.056	0.134	0.149	0.271	0.192	0.001	0.033	0.037	0.035	0.034
29	14	0.088	0.056	0.134	0.149	0.272	0.192	0.001	0.034	0.039	0.038	0.036
29	15	0.088	0.056	0.134	0.149	0.272	0.192	0.001	0.043	0.049	0.047	0.044
29	16	0.088	0.057	0.134	0.150	0.272	0.192	0.001	0.053	0.060	0.057	0.055
29	17	0.088	0.057	0.134	0.152	0.273	0.193	0.001	0.064	0.072	0.069	0.067
29	18	0.089	0.064	0.135	0.163	0.275	0.194	0.001	0.078	0.088	0.086	0.081

Table C79a. Full Vehicle: 3DR Iris+, hover, RPM = 4,300 to 6,500 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	RPM 2	RPM 3	RPM 4
29	20	0.00	0.00	0.00230	6500	6500	4300	4300
29	21	0.00	0.00	0.00230	5900	5900	4900	4900
29	22	0.00	0.00	0.00230	4900	4900	5900	5900
29	23	0.00	0.00	0.00230	4300	4300	6500	6500
29	24	0.00	0.00	0.00230	6500	4300	6500	4300
29	25	0.00	0.00	0.00230	5900	4900	5900	4900
29	26	0.00	0.00	0.00230	4900	5900	4900	5900
29	27	0.00	0.00	0.00230	4300	6500	4300	6500
29	29	0.00	0.00	0.00230	5400	0	0	0
29	30	0.00	0.00	0.00230	0	5400	0	0
29	31	0.00	0.00	0.00230	0	0	5400	0
29	32	0.00	0.00	0.00230	0	0	0	5400

Table C79b. Full Vehicle: 3DR Iris+, hover, RPM = 4,300 to 6,500 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
29	20	-0.015	-0.009	2.890	0.209	5.973	0.038	12.378	4.279	4.841	1.513	1.500
29	21	0.028	-0.004	2.729	0.521	2.446	0.062	12.390	3.289	3.731	2.172	2.103
29	22	0.084	-0.003	2.745	0.118	-3.229	-0.003	12.391	2.020	2.255	3.604	3.394
29	23	0.114	-0.006	2.860	0.063	-6.671	0.184	12.380	1.433	1.621	4.571	4.413
29	24	0.074	0.084	2.853	-10.294	-0.529	0.142	12.379	4.197	1.585	4.662	1.576
29	25	0.058	0.035	2.767	-4.372	-0.509	0.142	12.392	3.256	2.244	3.528	2.116
29	26	0.056	-0.041	2.751	5.089	-0.370	-0.077	12.391	2.023	3.650	2.134	3.377
29	27	0.057	-0.097	2.844	10.399	-0.189	-0.124	12.381	1.378	4.766	1.558	4.318
29	29	-0.002	0.054	0.705	-6.331	3.458	0.520	12.505	2.590	-0.009	0.016	-0.007
29	30	-0.000	-0.074	0.752	6.709	3.656	-0.522	12.504	-0.038	2.911	-0.007	0.033
29	31	0.087	0.056	0.713	-5.878	-4.153	-0.423	12.505	0.011	0.007	2.772	-0.001
29	32	0.072	-0.075	0.701	6.007	-4.023	0.495	12.504	0.008	-0.008	0.007	2.656

Table C79c. Full Vehicle: 3DR Iris+, hover, RPM = 4,300 to 6,500 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
29	20	0.088	0.056	0.134	0.149	0.271	0.192	0.001	0.043	0.048	0.015	0.015
29	21	0.088	0.056	0.134	0.150	0.271	0.192	0.001	0.033	0.037	0.022	0.021
29	22	0.088	0.056	0.134	0.149	0.272	0.192	0.001	0.020	0.023	0.036	0.034
29	23	0.088	0.056	0.134	0.149	0.273	0.192	0.001	0.014	0.016	0.046	0.044
29	24	0.088	0.056	0.134	0.154	0.271	0.192	0.001	0.042	0.016	0.047	0.016
29	25	0.088	0.056	0.134	0.150	0.271	0.192	0.001	0.033	0.022	0.035	0.021
29	26	0.088	0.056	0.134	0.151	0.272	0.192	0.001	0.020	0.037	0.021	0.034
29	27	0.088	0.056	0.134	0.154	0.271	0.192	0.001	0.014	0.048	0.016	0.043
29	29	0.088	0.056	0.134	0.151	0.271	0.192	0.001	0.026	0.000	0.000	0.000
29	30	0.088	0.056	0.134	0.151	0.271	0.192	0.001	0.001	0.029	0.000	0.001
29	31	0.088	0.056	0.134	0.150	0.271	0.192	0.001	0.000	0.000	0.028	0.000
29	32	0.088	0.056	0.134	0.151	0.271	0.192	0.001	0.000	0.000	0.000	0.027

Wind Tunnel Data - Drone America x8 Full Vehicle

Table C80a. Full Vehicle: Drone America x8, hover, RPM = 4,500 to 9,000 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
97	4	0.71	0.00	0.00240	4500	4500	4500	4500	4500	4500	4500	4500
97	5	2.38	0.01	0.00240	5000	5000	5000	5000	5000	5000	5000	5000
97	6	2.87	0.01	0.00240	5500	5500	5500	5500	5500	5500	5500	5500
97	7	3.74	0.02	0.00240	6000	6000	6000	6000	6000	6000	6000	6000
97	8	3.85	0.02	0.00240	6500	6500	6500	6500	6500	6500	6500	6500
97	9	4.02	0.02	0.00240	7000	7000	7000	7000	7000	7000	7000	7000
97	10	4.10	0.02	0.00240	7500	7500	7500	7500	7500	7500	7500	7500
97	11	4.77	0.03	0.00240	8000	8000	8000	8000	8000	8000	8000	8000
97	12	5.76	0.04	0.00240	8500	8500	8500	8500	8500	8500	8500	8500
97	13	6.13	0.05	0.00240	9000	9000	9000	9000	9000	9000	9000	9000

Table C80b. Full Vehicle: Drone America x8, hover, RPM = 4,500 to 9,000 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
97	4	0.032	-0.043	4.924	2.002	0.073	-0.079	16.671	1.926	1.882	1.921	1.899	1.848	2.115	2.007	1.984
97	5	0.015	-0.063	6.152	0.735	-1.070	0.341	16.617	2.419	2.547	2.549	2.496	2.426	2.702	2.621	2.564
97	6	0.100	-0.039	7.508	-2.149	0.278	1.081	16.550	3.210	3.445	3.275	3.218	3.006	3.544	3.229	3.328
97	7	0.107	-0.046	9.033	0.333	-0.553	0.690	16.465	4.133	4.266	4.246	4.110	3.959	4.498	4.282	4.291
97	8	0.061	-0.097	10.759	-0.399	-0.590	-0.081	16.371	5.124	5.357	5.162	5.086	4.995	5.679	5.234	5.330
97	9	0.084	-0.186	12.328	-1.952	-0.516	0.565	16.263	6.189	6.610	6.472	6.143	6.067	6.864	6.521	6.661
97	10	0.146	-0.159	14.431	-0.207	-2.618	0.067	16.131	7.611	8.007	7.929	7.750	7.332	8.253	7.977	7.988
97	11	0.109	-0.183	16.354	0.288	-2.130	1.231	15.987	9.209	9.536	9.572	9.117	8.776	9.849	9.494	9.697
97	12	0.231	-0.094	18.881	1.025	0.139	1.021	15.802	11.333	11.517	11.528	10.859	10.356	11.880	11.456	11.619
97	13	0.256	-0.064	20.963	2.642	-0.295	2.744	15.587	13.254	14.039	13.618	13.256	12.496	14.606	13.514	13.822

Table C80c. Full Vehicle: Drone America x8, hover, RPM = 4,500 to 9,000 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
97	4	0.088	0.057	0.134	0.154	0.274	0.193	0.001	0.045	0.046	0.046	0.045	0.044	0.044	0.045	0.047
97	5	0.088	0.060	0.134	0.165	0.277	0.193	0.001	0.055	0.057	0.058	0.055	0.055	0.053	0.055	0.058
97	6	0.088	0.058	0.134	0.156	0.276	0.194	0.001	0.067	0.068	0.070	0.065	0.065	0.064	0.068	0.070
97	7	0.088	0.056	0.135	0.154	0.275	0.194	0.001	0.079	0.078	0.082	0.076	0.078	0.075	0.082	0.082
97	8	0.089	0.057	0.136	0.159	0.278	0.194	0.002	0.090	0.085	0.094	0.081	0.089	0.087	0.090	0.093
97	9	0.088	0.057	0.136	0.163	0.277	0.194	0.002	0.097	0.105	0.102	0.097	0.094	0.098	0.103	0.105
97	10	0.090	0.057	0.137	0.163	0.281	0.195	0.002	0.109	0.113	0.114	0.109	0.104	0.109	0.109	0.116
97	11	0.089	0.057	0.138	0.167	0.278	0.198	0.002	0.120	0.122	0.125	0.117	0.117	0.117	0.122	0.124
97	12	0.089	0.060	0.140	0.189	0.281	0.199	0.002	0.130	0.135	0.134	0.127	0.122	0.129	0.132	0.133
97	13	0.090	0.060	0.142	0.201	0.293	0.201	0.001	0.140	0.149	0.145	0.140	0.133	0.149	0.142	0.144

Table C81a. Full Vehicle: Drone America x8, hover, RPM = 6,200 to 7,700 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	RPM 2	RPM 3	RPM 4	RPM 5	RPM 6	RPM 7	RPM 8
97	24	3.75	0.02	0.00240	7700	7700	6200	6200	6200	6200	7700	7700
97	25	3.59	0.02	0.00240	6200	6200	7700	7700	7700	7700	6200	6200
97	26	3.97	0.02	0.00240	7700	7700	7700	7700	6200	6200	6200	6200
97	27	3.42	0.01	0.00240	6200	6200	6200	6200	7700	7700	7700	7700
97	15	0.00	0.00	0.00240	7000	0	0	0	0	0	0	0
97	16	0.00	0.00	0.00240	0	7000	0	0	0	0	0	0
97	17	0.00	0.00	0.00240	0	0	7000	0	0	0	0	0
97	18	0.00	0.00	0.00240	0	0	0	7000	0	0	0	0
97	19	0.00	0.00	0.00240	0	0	0	0	7000	0	0	0
97	20	0.00	0.00	0.00240	0	0	0	0	0	7000	0	0
97	21	0.00	0.00	0.00240	0	0	0	0	0	0	7000	0
97	22	0.00	0.00	0.00240	0	0	0	0	0	0	0	7000

Table C81b. Full Vehicle: Drone America x8, hover, RPM = 6,200 to 7,700 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)	I5 (A)	I6 (A)	I7 (A)	I8 (A)
97	24	-0.116	-0.072	12.313	-0.126	34.773	1.116	16.257	8.146	8.513	4.686	4.422	4.280	4.923	8.289	8.486
97	25	0.471	-0.185	12.267	-1.564	-36.832	0.836	16.258	4.427	4.728	8.505	8.161	7.765	8.798	4.640	4.647
97	26	0.184	0.231	12.407	-35.529	-1.662	0.986	16.223	8.217	8.634	8.489	8.347	4.320	4.886	4.655	4.630
97	27	0.161	-0.449	12.638	35.762	-2.821	0.058	16.281	4.557	4.845	4.794	4.400	7.917	8.853	8.459	8.427
97	15	-0.279	0.101	1.578	-10.916	28.310	-0.852	16.760	6.173	0.030	0.011	0.031	0.026	0.061	0.030	0.028
97	16	-0.073	0.317	1.453	-26.420	10.606	1.384	16.767	0.024	6.069	0.003	0.025	0.024	0.054	0.023	0.020
97	17	0.078	0.366	1.540	-28.359	-11.404	-1.588	16.764	0.018	0.038	6.227	0.017	0.023	0.054	0.022	0.019
97	18	0.335	0.100	1.571	-12.645	-28.315	2.207	16.762	0.018	0.027	0.019	6.262	0.025	0.055	0.025	0.021
97	19	0.325	-0.086	1.474	11.508	-27.787	-1.915	16.790	0.018	0.022	0.012	0.029	5.930	0.056	0.026	0.020
97	20	0.117	-0.399	1.574	29.370	-12.511	1.828	16.784	0.021	0.027	0.015	0.030	0.041	6.450	0.027	0.025
97	21	-0.011	-0.352	1.479	27.703	10.205	-1.602	16.787	0.021	0.025	0.015	0.028	0.028	0.061	6.155	0.019
97	22	-0.283	-0.142	1.596	12.347	28.386	1.710	16.786	0.022	0.025	0.016	0.026	0.026	0.055	0.034	6.373

Table C81c. Full Vehicle: Drone America x8, hover, RPM = 6,200 to 7,700 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]	U-I5 [A]	U-I6 [A]	U-I7 [A]	U-I8 [A]
97	24	0.089	0.057	0.136	0.161	0.295	0.195	0.002	0.109	0.118	0.084	0.084	0.083	0.081	0.114	0.117
97	25	0.089	0.057	0.136	0.162	0.298	0.194	0.002	0.083	0.088	0.117	0.111	0.109	0.111	0.086	0.087
97	26	0.089	0.057	0.136	0.214	0.279	0.195	0.002	0.114	0.118	0.118	0.113	0.079	0.080	0.084	0.087
97	27	0.089	0.057	0.136	0.218	0.279	0.195	0.002	0.085	0.081	0.089	0.076	0.112	0.113	0.116	0.118
97	15	0.088	0.056	0.134	0.155	0.284	0.192	0.001	0.090	0.026	0.025	0.025	0.005	0.004	0.005	0.006
97	16	0.088	0.056	0.134	0.183	0.273	0.192	0.001	0.023	0.089	0.024	0.023	0.005	0.004	0.005	0.005
97	17	0.088	0.056	0.134	0.187	0.273	0.192	0.001	0.024	0.025	0.092	0.024	0.005	0.004	0.005	0.005
97	18	0.088	0.056	0.134	0.157	0.284	0.193	0.001	0.024	0.025	0.024	0.090	0.005	0.004	0.005	0.005
97	19	0.088	0.056	0.134	0.156	0.284	0.193	0.000	0.006	0.005	0.005	0.005	0.087	0.019	0.025	0.026
97	20	0.088	0.056	0.134	0.190	0.274	0.193	0.000	0.004	0.004	0.004	0.004	0.023	0.090	0.023	0.023
97	21	0.088	0.056	0.134	0.188	0.273	0.192	0.000	0.005	0.006	0.006	0.006	0.027	0.019	0.090	0.027
97	22	0.088	0.056	0.134	0.157	0.284	0.192	0.000	0.006	0.006	0.006	0.005	0.027	0.020	0.027	0.093

Wind Tunnel Data - SUI Endurance Full Vehicle

Table C82a. Full Vehicle: SUI Endurance, hover, RPM = 1,500 to 4,600 (uniform) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	RPM 2	RPM 3	RPM 4
119	4	0.93	0.00	0.00236	1500	1500	1500	1500
119	5	2.28	0.01	0.00236	2000	2000	2000	2000
119	6	0.00	0.00	0.00236	2500	2500	2500	2500
119	7	1.86	0.00	0.00236	2800	2800	2800	2800
119	8	2.78	0.01	0.00236	3000	3000	3000	3000
119	9	2.66	0.01	0.00236	3200	3200	3200	3200
119	10	1.17	0.00	0.00236	3500	3500	3500	3500
119	11	3.30	0.01	0.00236	3800	3800	3800	3800
119	12	3.46	0.01	0.00236	4000	4000	4000	4000
119	13	3.49	0.01	0.00236	4200	4200	4200	4200
119	14	3.42	0.01	0.00236	4500	4500	4500	4500
119	15	3.78	0.02	0.00236	4600	4600	4600	4600

Table C82b. Full Vehicle: SUI Endurance, hover, RPM = 1,500 to 4,600 (uniform) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
119	4	-0.010	0.002	0.889	0.023	0.161	0.103	16.777	0.387	0.426	0.407	0.391
119	5	-0.008	0.008	1.662	-0.067	-0.078	0.186	16.759	0.709	0.786	0.753	0.724
119	6	-0.013	0.017	2.661	-0.488	-0.176	-0.000	16.730	1.228	1.348	1.329	1.234
119	7	-0.015	0.019	3.428	-1.253	-0.374	0.111	16.704	1.698	1.829	1.841	1.703
119	8	-0.011	0.023	3.954	-0.727	-0.279	0.295	16.684	2.069	2.199	2.187	2.089
119	9	-0.020	0.030	4.476	-1.394	-0.197	0.152	16.662	2.428	2.634	2.709	2.424
119	10	-0.023	0.043	5.390	-0.980	-0.203	0.146	16.621	3.165	3.415	3.478	3.194
119	11	-0.030	0.052	6.423	-0.510	-0.096	0.207	16.571	4.057	4.436	4.399	4.097
119	12	-0.017	0.053	7.226	-0.858	-1.220	0.278	16.528	4.776	5.231	5.324	4.797
119	13	-0.020	0.047	7.934	-1.895	-0.396	0.363	16.485	5.641	6.008	6.093	5.543
119	14	-0.004	0.062	9.044	-1.102	-0.472	0.606	16.405	6.958	7.588	7.602	7.010
119	15	-0.004	0.074	9.454	-2.149	-0.800	0.232	16.368	7.644	8.106	8.446	7.569

Table C82c. Full Vehicle: SUI Endurance, hover, RPM = 1,500 to 4,600 (uniform) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
119	4	0.088	0.056	0.134	0.148	0.271	0.193	0.000	0.006	0.007	0.007	0.006
119	5	0.088	0.056	0.134	0.148	0.271	0.194	0.000	0.011	0.012	0.012	0.011
119	6	0.088	0.056	0.134	0.149	0.273	0.259	0.001	0.018	0.019	0.019	0.018
119	7	0.088	0.056	0.134	0.149	0.271	0.205	0.001	0.023	0.025	0.025	0.023
119	8	0.088	0.056	0.134	0.149	0.272	0.201	0.001	0.028	0.030	0.029	0.028
119	9	0.088	0.056	0.134	0.149	0.272	0.196	0.001	0.032	0.034	0.035	0.032
119	10	0.088	0.056	0.134	0.150	0.272	0.197	0.001	0.039	0.042	0.043	0.039
119	11	0.088	0.057	0.134	0.151	0.272	0.196	0.001	0.048	0.052	0.051	0.048
119	12	0.089	0.058	0.135	0.155	0.275	0.209	0.001	0.054	0.059	0.059	0.054
119	13	0.092	0.061	0.135	0.163	0.283	0.211	0.001	0.061	0.065	0.066	0.060
119	14	0.090	0.060	0.136	0.162	0.279	0.203	0.001	0.073	0.079	0.079	0.073
119	15	0.090	0.059	0.136	0.161	0.280	0.203	0.001	0.079	0.084	0.087	0.078

Table C83a. Full Vehicle: SUI Endurance, hover, RPM = 2,800 to 4,200 (differential) - Conditions

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	RPM 2	RPM 3	RPM 4
119	17	2.30	0.01	0.00236	4200	4200	2800	2800
119	18	2.87	0.01	0.00236	3800	3800	3200	3200
119	19	2.66	0.01	0.00236	3200	3200	3800	3800
119	20	3.28	0.01	0.00236	2800	2800	4200	4200
119	21	2.69	0.01	0.00236	4200	2800	4200	2800
119	22	2.25	0.01	0.00236	3800	3200	3800	3200
119	23	1.03	0.00	0.00236	3200	3800	3200	3800
119	24	2.58	0.01	0.00236	2800	4200	2800	4200
119	25	0.00	0.00	0.00236	3500	0	0	0
119	26	0.00	0.00	0.00236	0	3500	0	0
119	27	0.00	0.00	0.00237	0	0	3500	0
119	28	0.00	0.00	0.00237	0	0	0	3500

Table C83b. Full Vehicle: SUI Endurance, hover, RPM = 2,800 to 4,200 (differential) - Measurements

Run	Point	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)	I2 (A)	I3 (A)	I4 (A)
119	17	-0.150	0.028	5.702	-0.727	24.375	0.498	16.594	5.606	5.941	1.864	1.759
119	18	-0.073	0.025	5.478	-1.204	10.847	0.338	16.614	4.120	4.445	2.674	2.463
119	19	0.048	0.031	5.449	-1.447	-10.795	0.205	16.615	2.516	2.650	4.430	4.068
119	20	0.127	0.040	5.687	-0.859	-24.734	-0.072	16.594	1.742	1.898	6.032	5.510
119	21	-0.024	0.182	5.772	-25.409	-1.356	-0.344	16.593	5.488	1.861	6.144	1.736
119	22	-0.031	0.104	5.475	-11.268	-0.039	0.156	16.614	4.147	2.650	4.438	2.479
119	23	-0.017	-0.036	5.549	9.772	0.122	0.623	16.615	2.528	4.451	2.677	4.047
119	24	-0.009	-0.126	5.673	24.313	-0.184	0.653	16.599	1.699	5.931	1.824	5.552
119	25	-0.105	0.092	1.383	-14.568	14.488	0.923	16.753	3.102	0.056	0.054	0.054
119	26	-0.102	-0.094	1.412	14.944	14.645	-0.460	16.753	0.053	3.376	0.050	0.047
119	27	0.060	0.124	1.391	-14.929	-14.717	-1.298	16.753	0.054	0.058	3.361	0.052
119	28	0.072	-0.114	1.347	14.818	-14.265	1.159	16.754	0.053	0.055	0.057	3.148

Table C83c. Full Vehicle: SUI Endurance, hover, RPM = 2,800 to 4,200 (differential) - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]	U-Vesc [V]	U-I1 [A]	U-I2 [A]	U-I3 [A]	U-I4 [A]
119	17	0.092	0.061	0.135	0.163	0.290	0.225	0.001	0.060	0.064	0.026	0.025
119	18	0.088	0.057	0.134	0.151	0.275	0.202	0.001	0.048	0.051	0.035	0.033
119	19	0.088	0.057	0.134	0.151	0.275	0.199	0.001	0.033	0.035	0.051	0.047
119	20	0.088	0.058	0.134	0.155	0.284	0.212	0.001	0.025	0.027	0.065	0.060
119	21	0.089	0.062	0.135	0.194	0.275	0.219	0.001	0.060	0.027	0.066	0.025
119	22	0.089	0.057	0.134	0.157	0.274	0.214	0.001	0.048	0.035	0.051	0.033
119	23	0.088	0.056	0.134	0.155	0.272	0.198	0.001	0.033	0.052	0.035	0.047
119	24	0.089	0.057	0.134	0.180	0.274	0.211	0.001	0.024	0.064	0.026	0.060
119	25	0.088	0.056	0.134	0.159	0.275	0.193	0.001	0.037	0.008	0.007	0.007
119	26	0.088	0.056	0.134	0.160	0.275	0.192	0.001	0.007	0.040	0.007	0.007
119	27	0.088	0.056	0.134	0.160	0.275	0.192	0.001	0.007	0.007	0.040	0.007
119	28	0.088	0.056	0.134	0.160	0.274	0.192	0.001	0.007	0.007	0.007	0.037

Hover Data - 3DR SOLO Isolated Rotor

Table C84a. Isolated Rotor: 3DR SOLO, hover, RPM = 2,500 to 8,000 - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)
23	4	0.00	0.00	0.00237	2500	-0.012	-0.001	0.167	0.015	0.082	0.099	16.733	0.404
23	5	0.00	0.00	0.00237	3000	-0.015	-0.002	0.243	0.022	0.101	0.144	16.730	0.558
23	6	0.00	0.00	0.00237	3500	-0.017	-0.000	0.333	0.028	0.085	0.194	16.727	0.762
23	7	0.00	0.00	0.00237	4000	-0.022	0.001	0.449	0.009	0.126	0.256	16.722	1.133
23	8	0.00	0.00	0.00237	4500	-0.026	0.002	0.586	0.013	0.095	0.337	16.717	1.541
23	9	0.00	0.00	0.00237	5000	-0.030	0.001	0.722	0.033	0.137	0.407	16.711	1.990
23	10	0.00	0.00	0.00237	5500	-0.033	-0.000	0.879	0.009	0.189	0.495	16.702	2.598
23	11	0.00	0.00	0.00237	5600	-0.029	-0.000	0.936	0.033	0.188	0.522	16.700	2.805
23	12	0.00	0.00	0.00237	6000	-0.032	0.002	1.070	0.026	0.140	0.600	16.692	3.382
23	13	0.00	0.00	0.00237	6500	-0.036	0.003	1.248	0.031	0.233	0.699	16.682	4.158
23	14	0.00	0.00	0.00237	7000	-0.041	-0.004	1.447	0.003	0.281	0.804	16.667	5.151
23	15	0.00	0.00	0.00237	7500	-0.050	0.006	1.687	-0.055	0.228	0.932	16.651	6.332
23	16	0.00	0.00	0.00237	8000	-0.035	0.009	1.898	0.040	0.191	1.046	16.635	7.538

Table C84b. Isolated Rotor: 3DR SOLO, hover, RPM = 2,500 to 8,000 - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
23	4	0.088	0.056	0.134	0.148	0.271	0.192
23	5	0.088	0.056	0.134	0.148	0.271	0.192
23	6	0.088	0.056	0.134	0.149	0.271	0.192
23	7	0.088	0.056	0.134	0.149	0.271	0.192
23	8	0.088	0.057	0.134	0.154	0.271	0.192
23	9	0.088	0.056	0.134	0.149	0.274	0.192
23	10	0.088	0.056	0.134	0.149	0.271	0.192
23	11	0.088	0.056	0.134	0.149	0.271	0.192
23	12	0.088	0.056	0.134	0.149	0.271	0.192
23	13	0.088	0.056	0.134	0.150	0.272	0.192
23	14	0.088	0.056	0.134	0.152	0.273	0.192
23	15	0.089	0.057	0.134	0.154	0.275	0.192
23	16	0.088	0.061	0.134	0.181	0.273	0.192

Hover Data - DJI Phantom 3 Isolated Rotor

Table C85a. Isolated Rotor: DJI Phantom 3, hover, RPM = 2,500 to 8,000 - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)
22	4	0.00	0.00	0.00237	2500	-0.002	-0.001	0.175	0.006	0.012	0.119	16.732	0.417
22	5	0.00	0.00	0.00237	3000	-0.005	-0.003	0.256	0.012	0.026	0.174	16.729	0.614
22	6	0.00	0.00	0.00237	3500	-0.003	0.000	0.350	0.005	0.011	0.231	16.725	0.887
22	7	0.00	0.00	0.00237	4000	-0.006	0.005	0.471	-0.018	0.003	0.306	16.720	1.283
22	8	0.00	0.00	0.00237	4500	-0.006	-0.000	0.603	0.006	0.025	0.381	16.714	1.675
22	9	0.00	0.00	0.00237	5000	-0.002	0.005	0.747	0.000	0.007	0.470	16.707	2.284
22	10	0.00	0.00	0.00237	5300	-0.001	0.005	0.808	-0.021	-0.016	0.506	16.702	2.603
22	11	0.00	0.00	0.00237	5500	-0.008	0.003	0.880	-0.028	0.031	0.555	16.697	2.910
22	12	0.00	0.00	0.00237	6000	-0.006	0.003	1.076	-0.031	0.007	0.672	16.686	3.826
22	13	0.00	0.00	0.00237	6500	-0.006	0.010	1.260	-0.042	-0.004	0.782	16.672	4.738
22	14	0.00	0.00	0.00237	7000	-0.003	0.011	1.448	-0.045	-0.007	0.893	16.658	5.748
22	15	0.00	0.00	0.00237	7500	-0.007	0.001	1.644	-0.050	0.033	1.020	16.642	6.986
22	16	0.00	0.00	0.00237	8000	0.003	0.014	1.896	-0.052	-0.056	1.155	16.621	8.470

Table C85b. Isolated Rotor: DJI Phantom 3, hover, RPM = 2,500 to 8,000 - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
22	4	0.088	0.056	0.134	0.148	0.271	0.192
22	5	0.088	0.056	0.134	0.148	0.271	0.192
22	6	0.088	0.056	0.134	0.149	0.271	0.192
22	7	0.088	0.056	0.134	0.149	0.271	0.192
22	8	0.088	0.056	0.134	0.149	0.271	0.192
22	9	0.088	0.056	0.134	0.148	0.271	0.192
22	10	0.088	0.056	0.134	0.148	0.271	0.192
22	11	0.088	0.056	0.134	0.148	0.271	0.192
22	12	0.088	0.056	0.134	0.148	0.271	0.192
22	13	0.088	0.056	0.134	0.148	0.271	0.193
22	14	0.088	0.056	0.134	0.149	0.271	0.192
22	15	0.088	0.056	0.134	0.149	0.271	0.192
22	16	0.088	0.056	0.134	0.150	0.271	0.192

Hover Data - 3DR Iris+ Isolated Rotor

Table C86a. Isolated Rotor: 3DR Iris+, hover, RPM = 2,500 to 8,000 - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)
24	4	0.00	0.00	0.00237	2500	-0.016	0.001	0.152	-0.011	0.092	0.084	16.732	0.326
24	5	0.00	0.00	0.00237	3000	-0.018	-0.003	0.217	0.034	0.118	0.124	16.730	0.496
24	6	0.00	0.00	0.00237	3500	-0.020	0.000	0.292	0.010	0.100	0.167	16.728	0.725
24	7	0.00	0.00	0.00237	4000	-0.022	-0.001	0.407	0.023	0.116	0.229	16.724	1.001
24	8	0.00	0.00	0.00237	4500	-0.026	-0.000	0.514	0.002	0.150	0.290	16.719	1.347
24	9	0.00	0.00	0.00237	5000	-0.031	0.005	0.652	0.000	0.143	0.357	16.713	1.750
24	10	0.00	0.00	0.00237	5300	-0.034	0.000	0.728	0.016	0.181	0.399	16.710	2.005
24	11	0.00	0.00	0.00237	5500	-0.037	0.003	0.783	-0.015	0.185	0.429	16.707	2.267
24	12	0.00	0.00	0.00237	6000	-0.039	0.004	0.944	-0.003	0.193	0.513	16.699	2.832
24	13	0.00	0.00	0.00237	6500	-0.042	0.002	1.060	0.002	0.219	0.583	16.691	3.411
24	14	0.00	0.00	0.00237	7000	-0.044	0.002	1.274	0.019	0.250	0.681	16.678	4.323
24	15	0.00	0.00	0.00237	7500	-0.043	0.005	1.481	-0.008	0.246	0.792	16.665	5.291
24	16	0.00	0.00	0.00237	8000	-0.046	0.010	1.673	0.033	0.245	0.890	16.651	6.254

Table C86b. Isolated Rotor: 3DR Iris+, hover, RPM = 2,500 to 8,000 - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
24	4	0.088	0.056	0.134	0.148	0.271	0.192
24	5	0.088	0.056	0.134	0.148	0.271	0.192
24	6	0.088	0.056	0.134	0.149	0.271	0.192
24	7	0.088	0.056	0.134	0.149	0.271	0.192
24	8	0.088	0.056	0.134	0.149	0.271	0.192
24	9	0.088	0.056	0.134	0.149	0.272	0.192
24	10	0.088	0.056	0.134	0.149	0.271	0.192
24	11	0.088	0.056	0.134	0.149	0.271	0.192
24	12	0.088	0.056	0.134	0.149	0.271	0.192
24	13	0.088	0.056	0.134	0.149	0.271	0.192
24	14	0.088	0.056	0.134	0.150	0.272	0.192
24	15	0.089	0.056	0.134	0.150	0.274	0.192
24	16	0.088	0.058	0.134	0.161	0.272	0.192

Hover Data - Drone America x8 Isolated Rotor

Table C87a. Isolated Rotor: Drone America x8, hover, RPM = 2,500 to 8,500 - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	Fx (lb)	Fy (lb)	Fz (lb)	Mx (in-lb)	My (in-lb)	Mz (in-lb)	Vesc (V)	I1 (A)
25	4	0.00	0.00	0.00238	2500	-0.001	0.003	0.194	0.003	0.004	0.125	16.733	0.517
25	5	0.00	0.00	0.00238	3000	-0.003	0.002	0.285	0.011	0.010	0.186	16.729	0.725
25	6	0.00	0.00	0.00238	3500	-0.001	0.004	0.401	-0.014	0.003	0.251	16.725	1.010
25	7	0.00	0.00	0.00238	4000	0.001	0.007	0.540	-0.005	-0.030	0.335	16.719	1.478
25	8	0.00	0.00	0.00238	4500	-0.007	0.006	0.692	-0.032	-0.004	0.425	16.712	1.967
25	9	0.00	0.00	0.00238	5000	0.002	0.006	0.880	0.033	-0.000	0.521	16.703	2.637
25	10	0.00	0.00	0.00238	5500	0.000	0.016	1.076	-0.006	-0.036	0.637	16.691	3.458
25	11	0.00	0.00	0.00238	6000	-0.012	0.006	1.258	-0.054	0.015	0.748	16.680	4.329
25	12	0.00	0.00	0.00238	6500	-0.004	0.009	1.515	-0.015	-0.013	0.891	16.663	5.508
25	13	0.00	0.00	0.00238	7000	0.003	0.020	1.776	0.032	-0.062	1.032	16.645	6.875
25	14	0.00	0.00	0.00238	7500	-0.012	0.019	2.020	-0.074	-0.061	1.184	16.623	8.442
25	15	0.00	0.00	0.00238	8000	0.005	0.017	2.346	0.021	-0.066	1.359	16.597	10.470
25	16	0.00	0.00	0.00238	8500	-0.009	0.017	2.624	-0.083	-0.020	1.526	16.564	12.770

Table C87b. Isolated Rotor: Drone America x8, hover, RPM = 2,500 to 8,500 - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
25	4	0.088	0.056	0.134	0.148	0.271	0.192
25	5	0.088	0.056	0.134	0.148	0.271	0.192
25	6	0.088	0.056	0.134	0.149	0.271	0.192
25	7	0.088	0.056	0.134	0.149	0.271	0.192
25	8	0.088	0.056	0.134	0.149	0.271	0.192
25	9	0.088	0.056	0.134	0.149	0.271	0.192
25	10	0.088	0.057	0.134	0.149	0.274	0.192
25	11	0.088	0.056	0.134	0.149	0.271	0.192
25	12	0.088	0.056	0.134	0.149	0.271	0.192
25	13	0.088	0.056	0.134	0.150	0.272	0.192
25	14	0.088	0.056	0.134	0.149	0.273	0.192
25	15	0.088	0.057	0.134	0.153	0.272	0.192
25	16	0.088	0.061	0.134	0.171	0.272	0.192

Hover Data - SUI Endurance Isolated Rotor

Table C88a. Isolated Rotor: SUI Endurance, hover, RPM = 2,000 to 4,500 - Conditions and Measurements

Run	Point	Speed (ft/s)	q (lb/ft ²)	density (slug/ft ³)	RPM 1	F _x (lb)	F _y (lb)	F _z (lb)	M _x (in-lb)	M _y (in-lb)	M _z (in-lb)	V _{esc} (V)	I ₁ (A)
26	4	0.00	0.00	0.00238	2000	-0.014	-0.001	0.459	0.036	0.073	0.358	16.726	0.976
26	5	0.00	0.00	0.00238	2500	-0.013	-0.000	0.720	0.058	0.066	0.558	16.715	1.772
26	6	0.00	0.00	0.00238	3000	-0.014	0.003	1.049	0.015	0.067	0.802	16.698	2.934
26	7	0.00	0.00	0.00238	3500	-0.020	0.006	1.427	-0.008	0.071	1.070	16.676	4.638
26	8	0.00	0.00	0.00238	4000	-0.031	-0.003	1.897	0.024	0.136	1.414	16.633	7.541
26	9	0.00	0.00	0.00238	4500	-0.028	-0.001	2.388	0.028	0.153	1.770	16.574	11.960

Table C88b. Isolated Rotor: SUI Endurance, hover, RPM = 2,000 to 4,500 - Uncertainty

Run	Point	U-Fx [lb]	U-Fy [lb]	U-Fz [lb]	U-Mx [in-lb]	U-My [in-lb]	U-Mz [in-lb]
26	4	0.088	0.056	0.134	0.148	0.271	0.192
26	5	0.088	0.056	0.134	0.148	0.271	0.192
26	6	0.088	0.056	0.134	0.149	0.271	0.192
26	7	0.088	0.056	0.134	0.149	0.271	0.193
26	8	0.088	0.057	0.134	0.149	0.271	0.192
26	9	0.088	0.056	0.134	0.150	0.272	0.192