TYTO ROBOTICS

PRODUCT CATALOG

CONTENTS

About Tyto Robotics

Aerospace, Propulsion testing, Manufacturing

Tyto Robotics is a Canadian aerospace company located in Gatineau, Quebec. Founded in 2014, the company specializes in test equipment for UAV developers. Over 1000 businesses, government research labs, and universities all over the world are using Tyto Robotics' tools for testing and development of aerial vehicles, motors, and propellers.

Since our company's humble beginnings, we have refined the design of our mechanical, electrical, and software products to provide tailored solutions to UAV developers. We are proud to say that we are now the world leader in UAV propulsion testing.

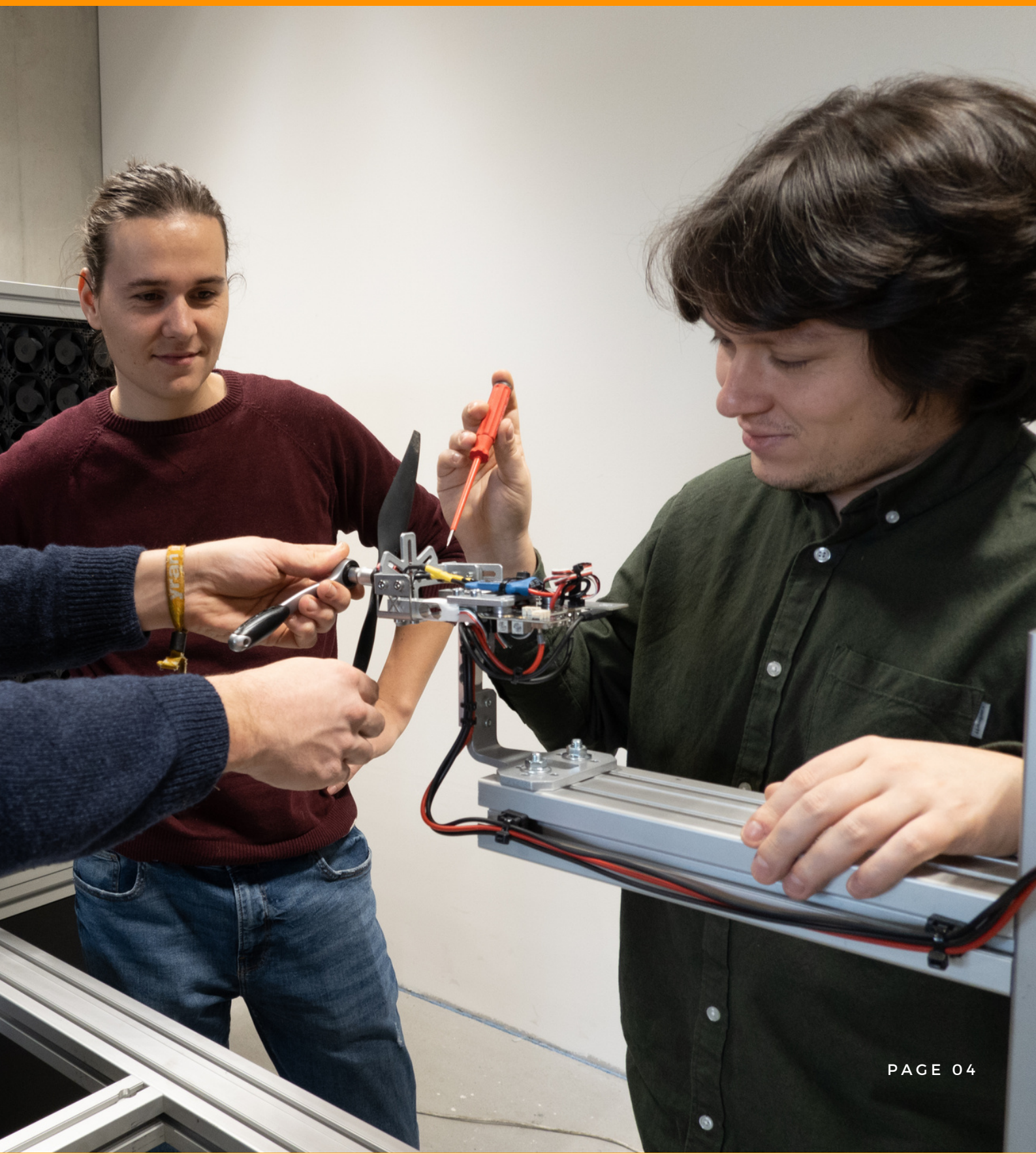
Tyto Robotics serves a variety of customers in both the public and private sectors including the NASA Jet Propulsion Laboratory, Lockheed Martin, Airbus Helicopter and Boeing. We welcome feedback from our clients and are constantly improving our products to meet their testing needs.

Our company continues to grow as we serve our industry with professional testing tools for all sizes of UAVs and excellent customer service.

Charles Blouin
Chief Executive Officer

Dominic Robillard
Chief Technical Officer

OUR MISSION IS TO PROVIDE DRONE DESIGNERS WITH THE BEST PROFESSIONAL TESTING EQUIPMENT FOR OPTIMIZING THEIR PROPULSION SYSTEMS



THRUST STANDS FOR INDUSTRY AND RESEARCH

These products are designed for the optimization of medium to large sized propulsion systems. Ideal for UAV designers, manufacturers, and research facilities.

Test medium and large motors and propellers up to 150 kgf. Paired with a user-friendly USB interface and powerful testing software.

Series 1585

Motors & propellers up to 5 kgf of thrust & 2 Nm of torque

Flight Stand 15 & 50

50 kgf of thrust & 30 Nm of torque at 1,000 Hz sampling rate

Flight Stand 150

150 kgf of thrust & 150 Nm of torque at 1,000 Hz sampling rate

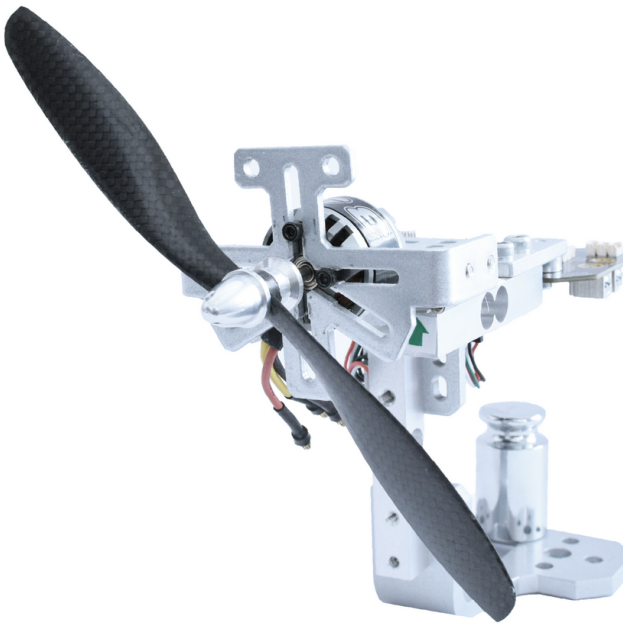
Flight Stand 500

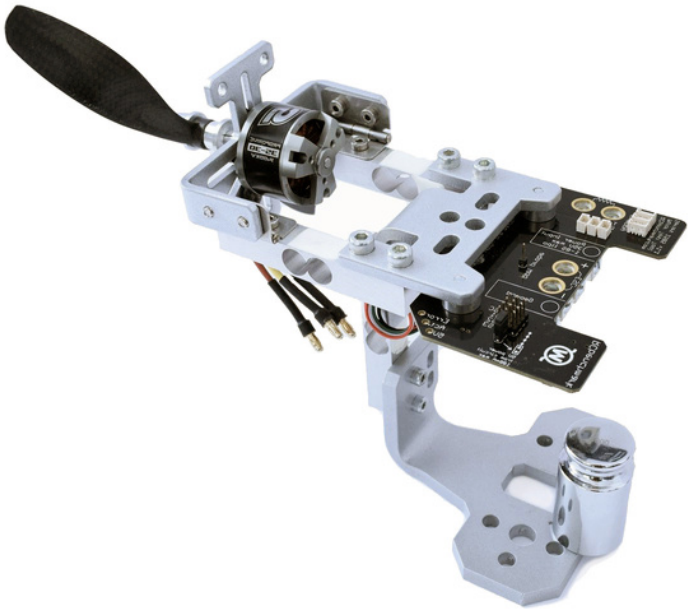
500 kgf of thrust & 1500 Nm of torque at 1,000 Hz sampling rate

SERIES 1585 THRUST STAND

The Series 1585 thrust stand is built for characterizing and optimizing the propulsion systems of small and medium sized drones. Record thrust, torque, voltage, current, and motor rotation speed to derive overall system efficiency.

See page 18 for more data-enhancing add-ons and accessories.





Product information

- The Series 1585 is developed specifically for drone designers with a USB interface and powerful software for automated control and data-logging.

Set-up information

- The Series 1585 includes an electrical RPM sensor, but it may be incompatible with certain motor/ESC/ voltage combinations. We recommend adding the optical RPM probe to enhance motor speed measurements.

TECHNICAL SPECIFICATIONS

Specification	Series 1585 Range	Tolerance	Unit
Thrust	-5 – 5	± 0.5% R.O.*	kgf
Torque	-2 – 2	± 0.5% R.O.	Nm
Voltage	0 – 50	± 0.5% R.O.	V
Current	0 – 55	± 1% R.O.	A
Angular speed	0 – 190,000	± 1% R.O.	eRPM**
Coil resistance	0.003 – 240	± 0.5% R.O.	Ohm
Digital scale	n/a	± 0.5% R.O.	kgf

***R.O. = rated output**

****Electrical RPM (eRPM), divide by the number of motor poles to obtain true mechanical RPM.**

FLIGHT STAND 15/50

The Flight Stand 15/50 thrust stand allows you to precisely characterize your motors and propellers by measuring thrust, torque, RPM, current, voltage, temperature, airspeed, propeller efficiency and motor efficiency.

It offers frictionless measurement with a 1,000 Hz sampling rate and it is calibrated according to ASTM protocols. Flight Stand software is included (page 20).

The Flight Stand contains a solid-state mono-block load cell for measuring thrust and torque, which ensures highly accurate measurements.

Configurations:

- **FS15/50 Standard:** essential performance characteristics for static tests.
- **FS15/50 Pro:** enhanced performance characteristics for dynamic tests over a wider range of values with the highest possible accuracy. Supports 1,000 Hz sampling rate and two extra general purpose analog inputs.
- **FS15/50 Dual Motor (available in Standard or Pro):** Two powertrains tested simultaneously in one of three configurations: back-to-back, face-to-face, or offset.
- **Multipowertrain testing up to 8 motors and propellers:** See DEP testing on page 16.

TECHNICAL SPECIFICATIONS

Specification	15 Standard	**15 Pro**	50 Standard	**50 Pro**
Thrust	±15 kgf with error up to 1.5 kgf	±15 kgf ± 0.5% error on measured value	±50 kgf with error up to ± 5.0 kgf	±50 kgf ± 0.5% error on measured value
Torque	±8 Nm with error up to ± 0.1 Nm	±8 Nm ± 0.75% error on measured value	±30 Nm with error up to 0.375 Nm	±30 Nm ± 0.75% error on measured value
Voltage	0 – 180 V	0 – 180 V	0 – 180 V	0 – 180 V
Current	0 – 150 A	0 – 150 A	0 – 300 A	0 – 300 A

FLIGHT STAND 150

The Flight Stand 150's impressive design and performance mirror that of the Flight Stand 15/50, but with thrust measurement up to 150 kgf & torque up to 150 Nm.

It is designed to meet the needs of companies and institutions building very large drones for various uses.

It comes with an enhanced software with a new data management system with indexes, plots, tables, filtering, resampling capability, and more (see page 20).

Possible applications:

- **Real-time dynamic testing:** dynamic tests are possible thanks to the FS150's 1,000 Hz sampling rate. Perform frequency and step input parameter identification.
- **Efficiency and power characterization:** measure the efficiency of your motor, propeller and overall system and compare electrical power input with mechanical power output.
- **Endurance and reliability testing:** study the endurance of your system's components using automated tests designed by you. Our user-friendly software allows you to easily design and run step tests, ramp tests, flight replay tests, or any protocol you can come up with.

TECHNICAL SPECIFICATIONS

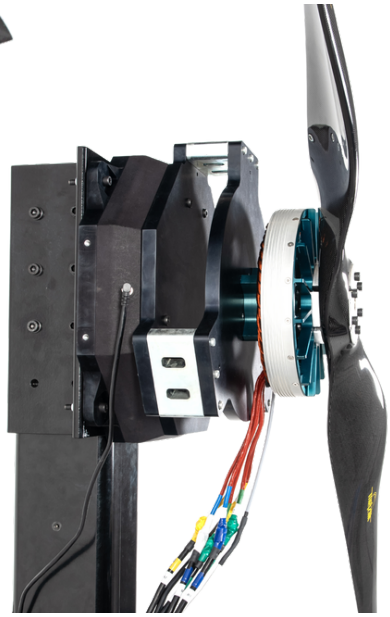
Thrust	Torque	Voltage	Current	RPM	Propeller Diameter
±150 kgf ± 1.0% error on measured value	±150 Nm ± 1.25% error on measured value	0 – 180 V	500 A	30,000	up to 80" (2 meters)

FLIGHT STAND 500

The Flight Stand 500 is our biggest thrust stand to date, offering thrust measurement up to 500 kgf & torque measurement up to 1500 Nm. It can handle voltage up to 1,000 V and has three different options for current capacity.

It is designed to meet the needs of companies and institutions building very large drones, eVTOL aircraft, and electric airplanes.

As with all of our Flight Stands, it comes with the Flight Stand software for motor control and data management (page 20).



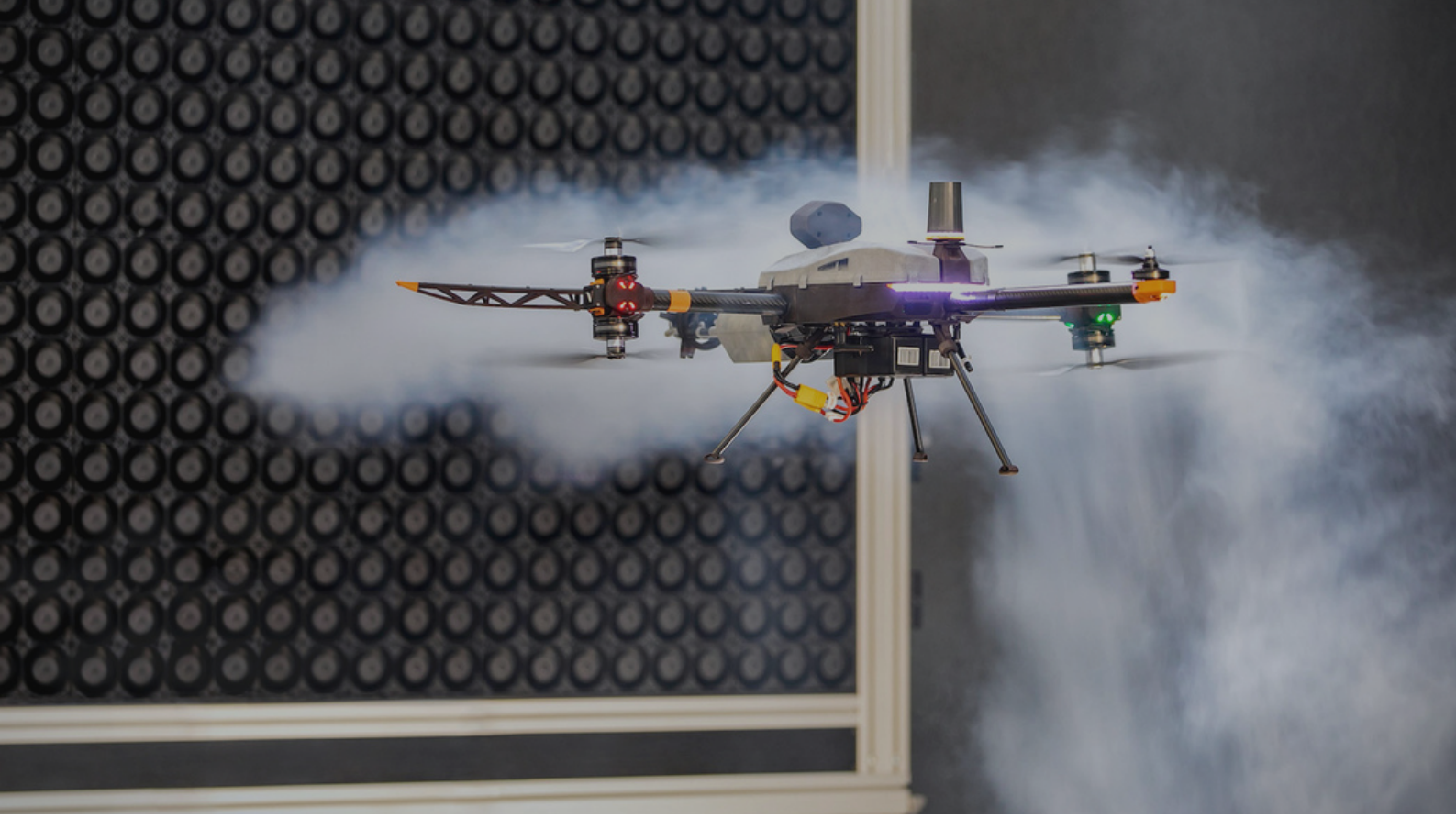
Key features:

- ASTM calibration: load cells are calibrated to ASTM standards up to 300 kgf for thrust and up to 800 Nm for torque.
- CAN ESC support: there is a wide variety of CAN protocols available, which is why we've made it possible to control any CAN ESC as an external input.
- Python control API: users who prefer to program tests in an external text editor can fully control their tests using the Python API. We've created several examples and test templates to help users setup the API and get started.

TECHNICAL SPECIFICATIONS

Thrust	Torque	Voltage	Current
± 500 kgf	± 1500 Nm	0 – 1000 V	0 - 100, 200, or 500 A

OUR THRUST STANDS HELP YOU TO IMPROVE THE PERFORMANCE OF YOUR DRONE THROUGH SAFE AND EFFICIENT PROPULSION TESTING

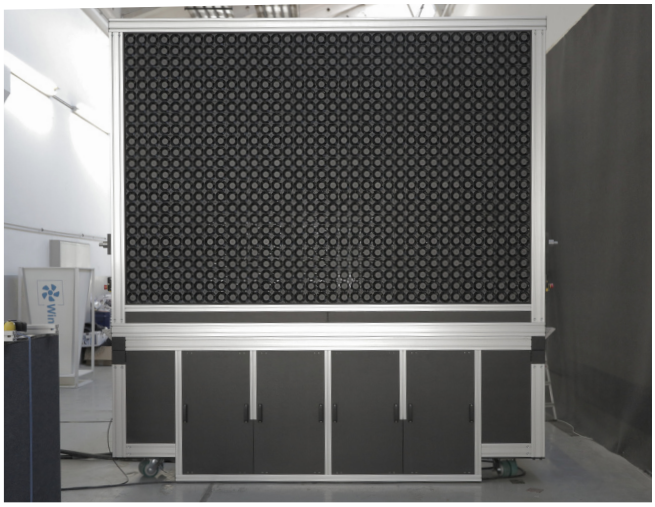


WINDSHAPERS FOR FREE FLIGHT TESTING

We offer Windshapers that are fully customizable to meet your testing needs. With simple commands you can generate any 3D wind profile while controlling the wind speed and working frequency. Run full-length endurance tests or create wind flows and gusts that simulate real flying conditions. Our software lets you control each fan individually, simulating conditions encountered by drones in their work environment.

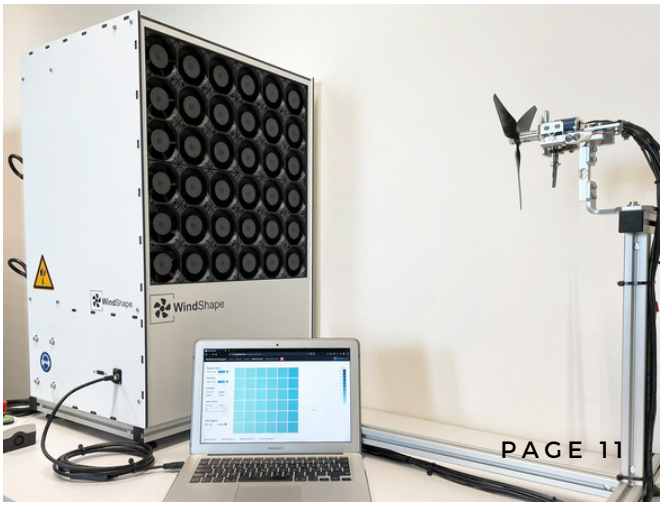
Custom Wind Facilities

Modular construction to fit any facility or laboratory



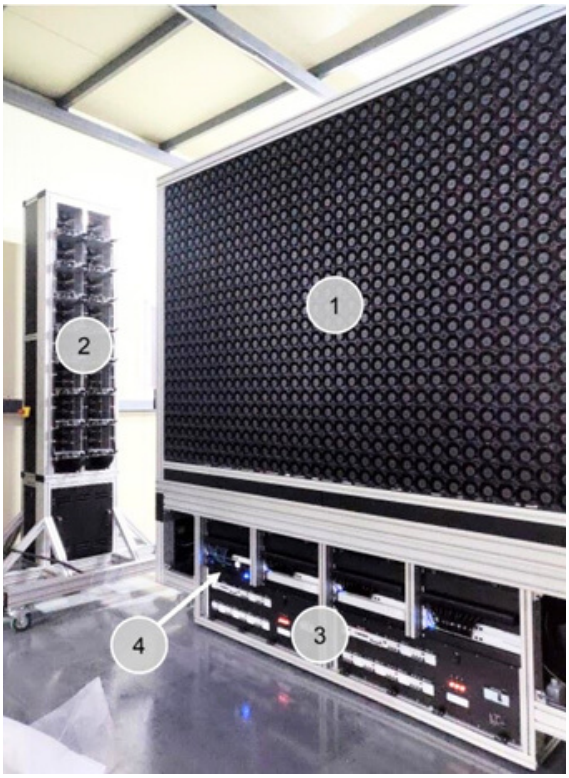
Prop Testing Station

A 50 cm x 50 cm wind generator with a Series 1585 thrust stand



CUSTOM WINDSHAPER FACILITIES

A fully customizable Windshaper has endless possibilities for free flight testing. Clients have full control over Windshaper size, shape and add-ons. Designed to study the effects of unique wind profiles on motors, propellers, drones and electric aircraft.



Windshaper Information

- Custom Windshapers can be built to any size thanks to easily stackable wind modules.
- Individual wind modules are 10 x 10 inches, each containing 9 wind pixel fan units.
- Each wind pixel has 2 counter-rotating fans that can generate a flow speed up to 16 m/s.
- The Windshaper is managed with WindControl software manually or with a Python script.

Windshaper Components

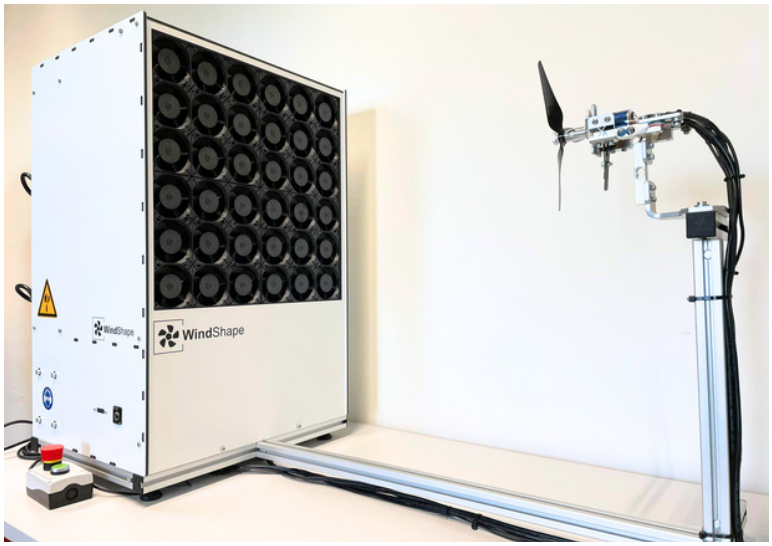
1. The essential wall of fans that generates both horizontal and vertical flows.
2. Side walls can also be installed to generate cross wind profiles.
3. The system is powered by two main distribution boxes that can be adapted to any country's electrical plug requirements.
4. A control network consisting of Ethernet switches, routers, and an onboard computer.

Drone testing with a custom Windshaper*

Check out our YouTube channel for more examples of wind tunnel drone testing in action.

PROP TESTING STATION

This testing set-up is designed to study the effects of different wind profiles on motors, propellers, ESCs and batteries. The kit includes a 50 cm x 50 cm Windshaper and a Series 1585 thrust stand.



WindShaper Information

- The 2 x 2 Windshaper is a 50 x 50 cm open air wind generator.
- The wind generator is composed of 4 modules, each with 9 wind pixel fan units.
- Each wind pixel has 2 counter-rotating fans that can generate a flow speed up to 16 m/s.
- The Windshaper is managed with WindControl software that allows you to input a function u=f(x,y,t) to generate wind flows automatically.
- The Windshaper can also be controlled with a Python script using the Python 3.x control API.

Series 1585 Information

- Measures thrust, torque, RPM, current and voltage.
- System efficiency values are calculated automatically.
- Live recorded data is viewed with our software.
- Additional sensors can be added to measure temperature and airspeed.
- See page 6 for more info about the Series 1585 thrust stand.

WINDSHAPER SPECIFICATIONS

Flow specifications	Value	Unit
Minimum flow speed (without flow manipulator)	2	(m/s)
Maximum flow speed (without flow manipulator)	16	(m/s)
Maximum flow rate	3.8	(m3 /s)
Ramp-up flow acceleration (hot wire at 1m from the fans)	4.0	(m/s^2)
Ramp-down flow deceleration (hot wire at 1m from the fans)	3.6	(m/s^2)

WINDSHAPER ADD-ON FEATURES

Add-on features can enhance your wind flow testing by simulating conditions encountered in nature. Add weather effects, a convergent device or tilting capability to test your drone in every environment.

TURBULENCE FILTER

The Windshaper can be equipped with a flow filter to reduce unwanted turbulence. This feature ensures a laminar flow with turbulence as low as 1% and is a great option for studying ground effect and a multicopter's ability to fly in its own landing-phase turbulence.

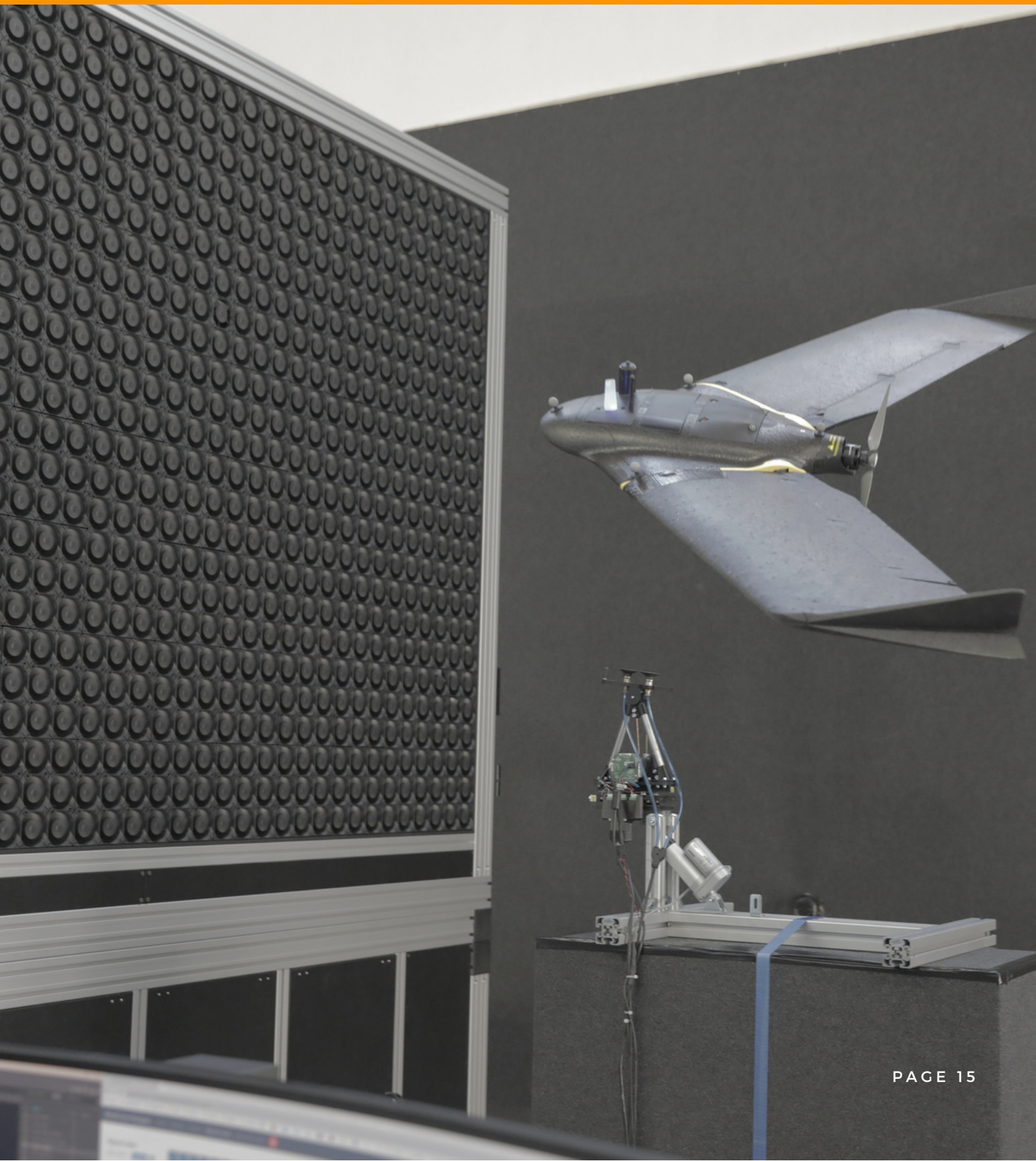
TILTING MECHANISM

The wind generator can be constructed with a tilting mechanism to allow for wind flow in any direction. With tilting capability up to 90°, an entire progression can be simulated from take-off to forward flight and back to landing.

CONVERGENT

A convergent device can be added to your Windshaper to increase the speed of the wind from 16 m/s up to 45 m/s, depending on the test section dimensions. Ask our sales team for more information about this add-on.

ENSURE SUCCESS ON LAUNCH DAY BY TESTING YOUR AIRCRAFT IN REALISTIC CONDITIONS IN THE LABORATORY



DISTRIBUTED ELECTRIC PROPULSION (DEP) TESTING

Test up to 8 motors and propellers simultaneously with our DEP testing platform.

The testing platform is based around our Flight Stand thrust stands and therefore comes in three sizes: 15, 50, and 150 kgf. Watch this video to see how it works.

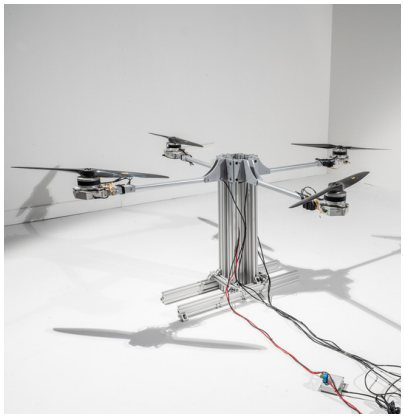
With the Flight Stand software you can control all 8 powertrains simultaneously through manual, automated, or Python-controlled tests.

Recreate the layout of motors and propellers in your drone for realistic testing.

Back-to-back Coaxial

Single File

Quadcopter Style

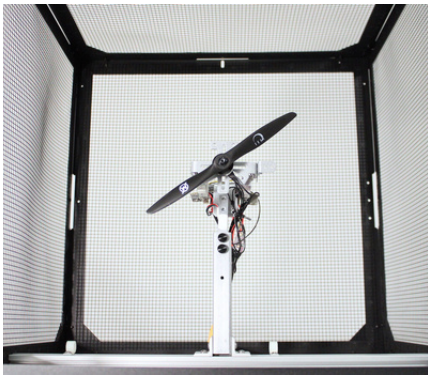


ACCESSORIES AND SOFTWARE

We offer many accessories to help you further characterize your propulsion system and drone. Our thrust stands are complimented by easy-to-use software provided free of charge with all purchases. Optimizing powertrains can be done easily and thoroughly thanks to our complete range of testing solutions.

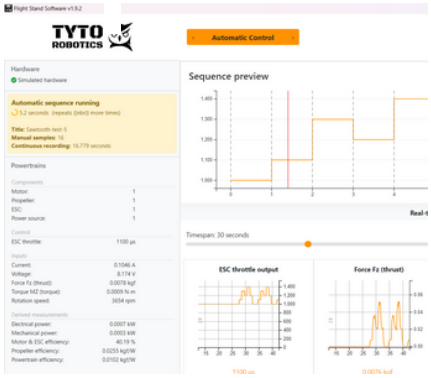
Thrust Stand Accessories

Add-ons to enhance your propulsion testing



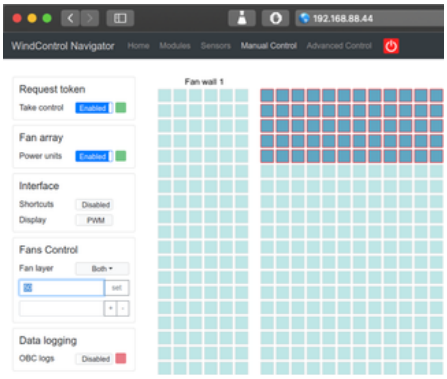
Testing Software

Data recording and control of thrust stands



WindControl Software

Control and manipulate wind speed and shape



THRUST STAND ACCESSORIES

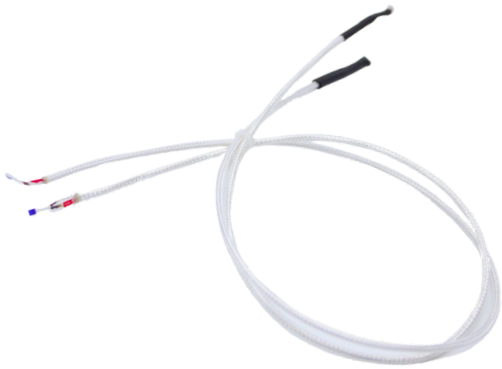
We offer many accessories that can enhance and simplify your testing process. There are unique accessories for the Series 1585 and Flight Stand thrust stands, so be sure to select the appropriate add-ons based on your thrust stand model.

OPTICAL RPM PROBE

Accurately measure motor rotation speed with this optical probe. Use this optical probe if the electrical probe provided with your Series 1585 is not compatible with your motor/ESC/voltage combination. This probe is an alternative for situations where the electric probe does not meet your specific needs.

TEMPERATURE PROBE

Directly connect up to three probes to your thrust stand simultaneously and measure temperatures from -30 °C to 100 °C ±2 °C. Probes can be renamed (ESC, motor, battery, etc.) and configured with cutoff limits. The software can work in Celsius, Fahrenheit, or Kelvin.



AIRSPEED PRESSURE SENSOR

A precision differential pressure sensor fully integrated with the RCbenchmark software. Measurement range of ±6.8 kPa, which covers most airspeeds typically encountered by drones. This pressure sensor is meant to connect to a pitot tube in a wind tunnel installation.

THRUST STAND ACCESSORIES

In addition to the accessories shown here, we offer replacement parts, support plates and hinges. Check out our online store for a full selection of add-ons.

NO SOLDER BOARD

Save time and improve your work efficiency with a no-solder board. This component can be installed directly onto the side of your Series 1585 thrust stand, allowing the installation of various types of ESCs and motors without any soldering.

MOTOR MOUNTING PLATE

The motor mounting plate is a major mechanical component of our thrust stands, used to mount the motor onto the stand. You may want to purchase extra motor mounting plates in order to reduce the time required to change motors or setups between tests. This product is the metal part only, for replacement or spare.

GROUND RAILING SYSTEM

The ground railing system makes it easier to install your Flight Stand on the ground. Depending on the system tested, it can also simplify adjustment of the axial and radial distances between two motors.

FLIGHT STAND SOFTWARE

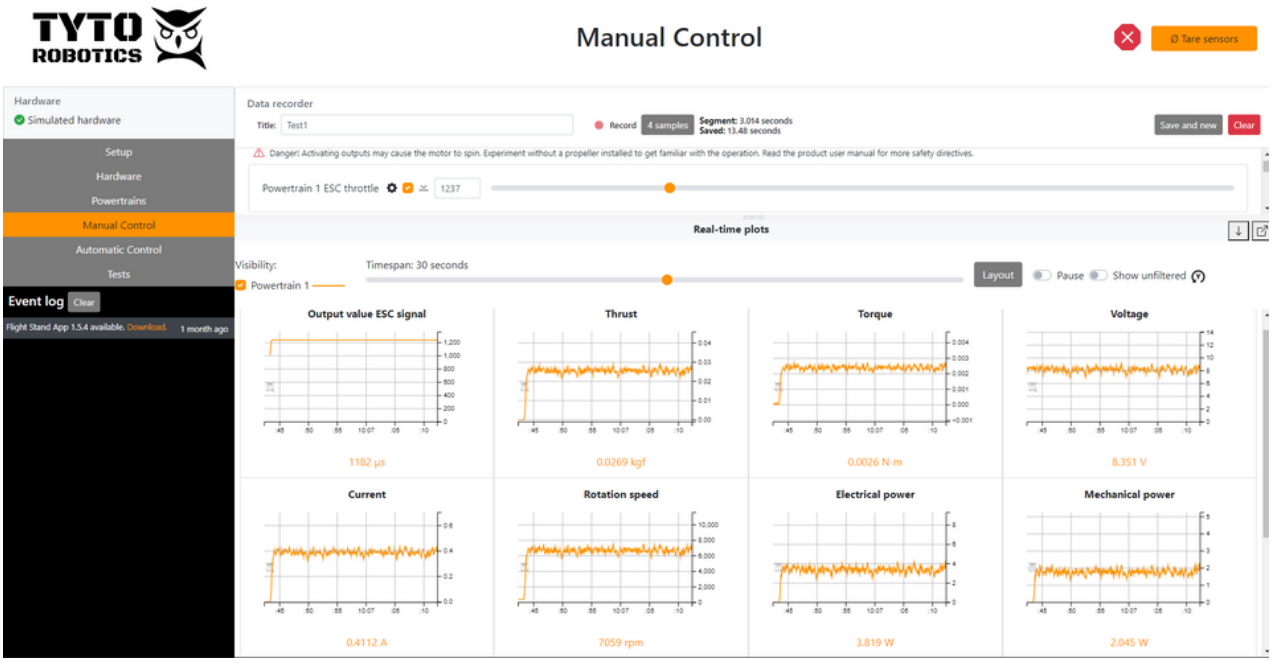
The Flight Stand Software is used to control your Flight Stand 15, 50, or 150 and record your data. It allows you to precisely program your test scripts manually or automatically. If you prefer to manually control your tests, you can enter values in a front-end table. If you prefer to code your tests, you can configure the script directly in the user interface or use the Python API to fully control the software.

With the Flight Stand Software you can:

- Control the thrust stand manually and view data live as it is recorded Automate tests with an easy-to-use interface that requires no programming Control the whole system from Python API
- Upload .CSV files from your flight controller to perform flight replay tests.
- Save tests directly in the software or export them as .CSV files
- Re-sample data before export for smaller files

The software supports multi-powertrain testing for up to eight powertrains and you can name each powertrain for easy analysis. The stand connects automatically to the software and allows the user to adjust sensor noise filtering options.

Graphical User Interface



RCBENCHMARK SOFTWARE

Our open-source propulsion testing software comes free with the Series 1585. It allows you to control your propulsion system and record data easily.

The thrust stand can be controlled manually or automatically with Windows, Linux, Mac and Chrome OS. The interface displays sensor information in textual and graphical form, which can be recorded as single data points or continuous data. We provide pre-written test scripts, which you can then edit or you can write your own custom scripts.

Once the data is recorded, you can easily export it to a .CSV file, readable with most spreadsheet softwares. You can set-up your own working units, safety cut-offs and live plots to meet your needs. Your results will provide you with important information about propeller and motor efficiency as well as consumed power.

Key Performance Data

Measured Data:

- Thrust
- Torque
- RPM
- Current
- Voltage
- Temperature
- Wind velocity

Computed Data:

- Mechanical power
- Electrical power
- Motor efficiency
- Propeller efficiency
- Overall system efficiency

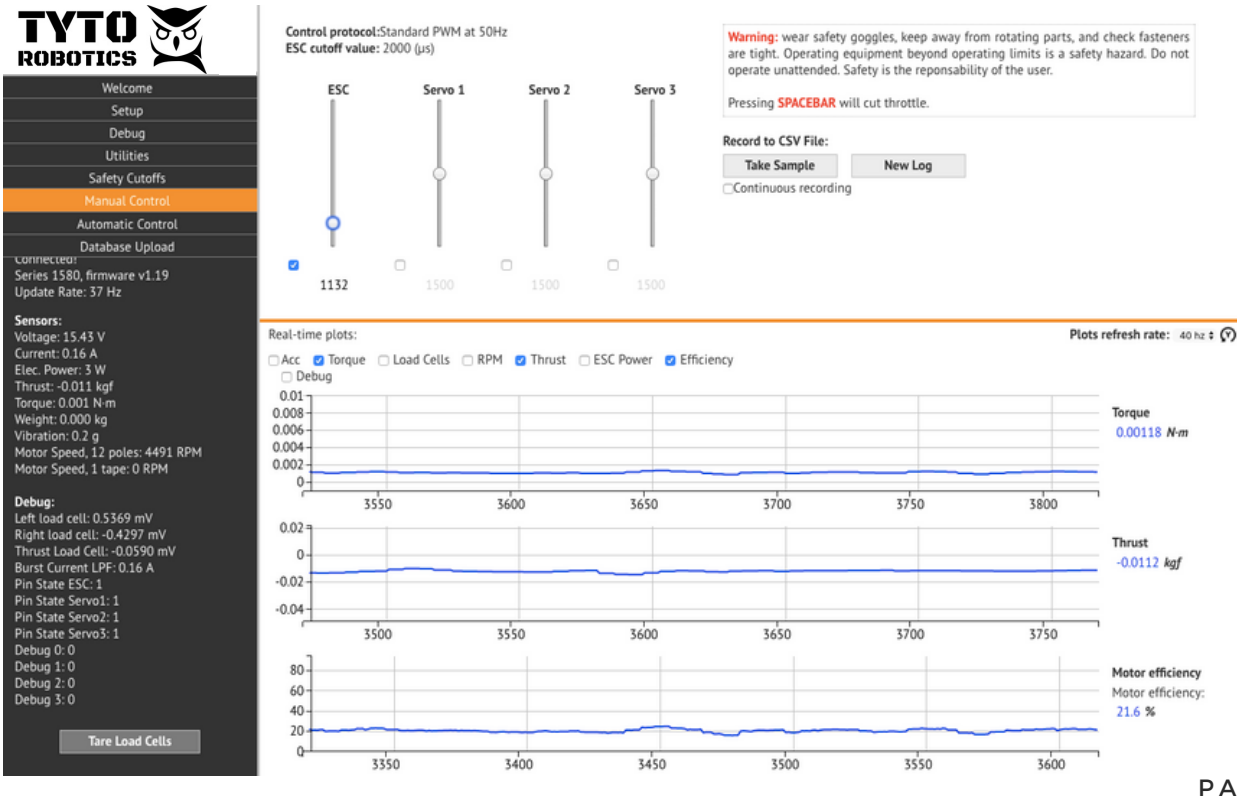
Working Units and Safety Cut-Offs

ESC cutoff value: 2000 (µs)

The system will automatically cutoff the throttle when any of these limits are exceeded:

	Min	Max	System
Voltage (V)	0	30	0 / 35
Continuous Current (A)	-40	40	-40 / 40
Burst Current (A)	-50	50	-50 / 50
Power (W)	0	1400	0 / 1400
Thrust (gf)	-5000,0	5000,0	-5000 / 5000
Torque(N·m)	-2,0	2,0	-2.0 / 2.0
Motor Rotation Speed(RPM)	0	50000	0 / 83000
Vibration (g)	0	8	0 / 8

Graphical User Interface



WINDCONTROL SOFTWARE

Windshapers are controlled with the WindControl software - an intuitive graphical interface that is accessed with a web browser application or Python API.

The software allows you to control wind profiles with simple commands and is included with all Windshapers. Each wind pixel is individually controlled, so it is easy to produce highly custom wind profiles. The Windshaper can be controlled manually using the web app or automatically through the Python API and custom scripting interface.

Once tests are completed, data from each wind module is output into a zip folder on the home computer containing time-stamped information about the Windshaper's performance and status.

Windshaper Control Options

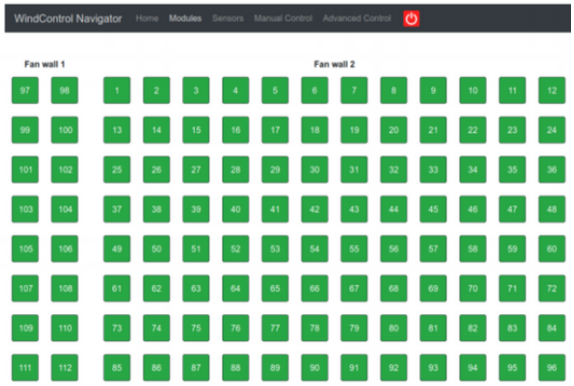
Python API:

- Python 3.6 or newer required
- Python API can be imported and used directly in Matlab
- Detailed instructions provided

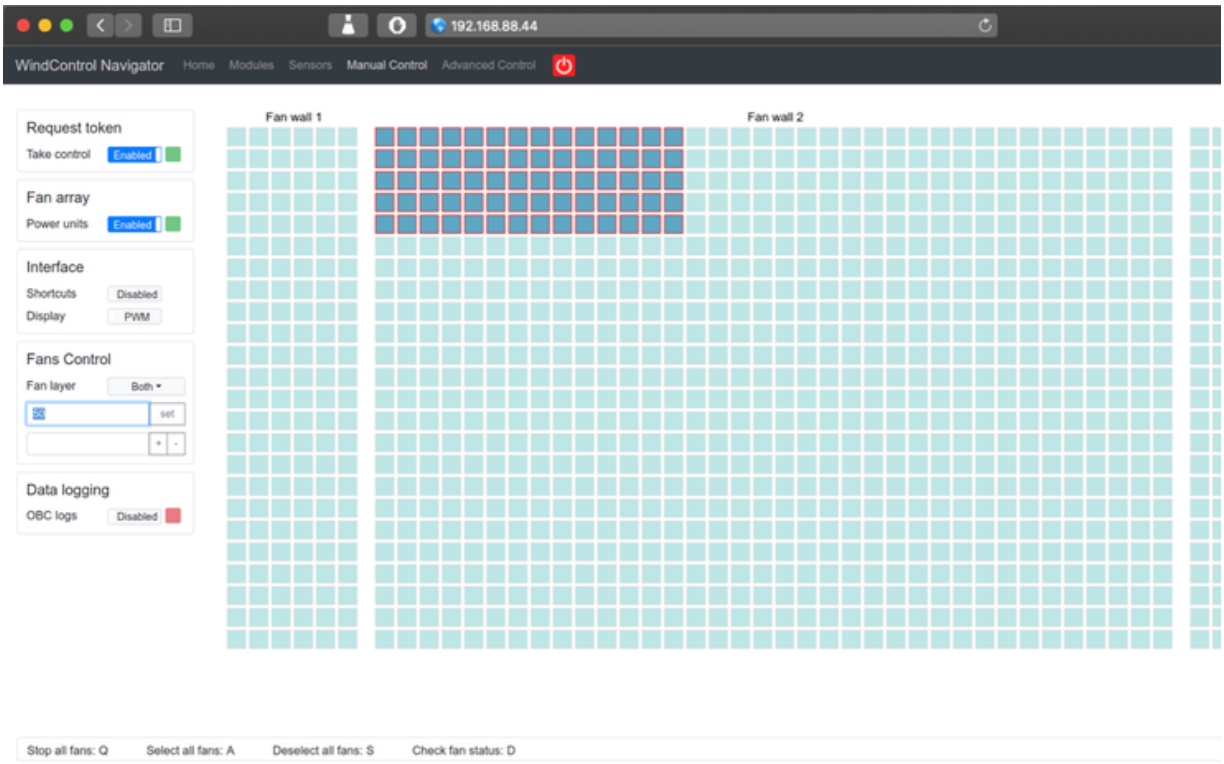
Web Application:

- Manual control of the Windshaper
- Works with any modern browser
- Stores test data for download

Monitor Wind Modules



Graphical User Interface

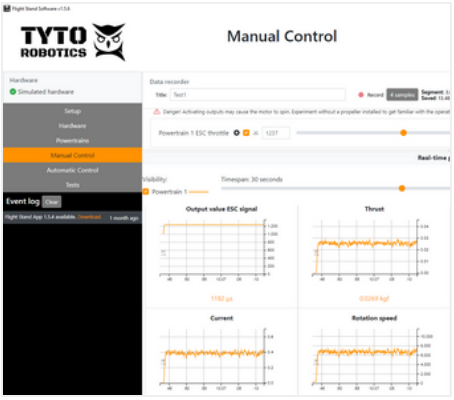


KNOWLEDGE AND DATABASE RESOURCES

At Tyto Robotics we have a diverse and well informed team with knowledge to share. We have put together these free resources for drone designers of any level to learn about the theory and industry of electric propulsion.

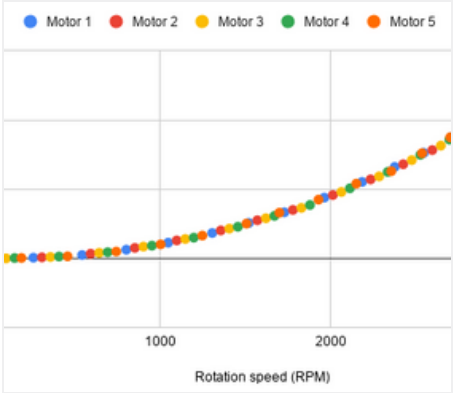
Software Tutorials

Add-ons to enhance your propulsion testing



eBook and Articles

Informative content on UAVs and propulsion systems



Database

Test data for brushless motors, propellers, and ESCs

SOFTWARE TUTORIALS

Our Flight Stand software has plenty of useful features, so we have created a series of tutorials to help users learn how to use them.

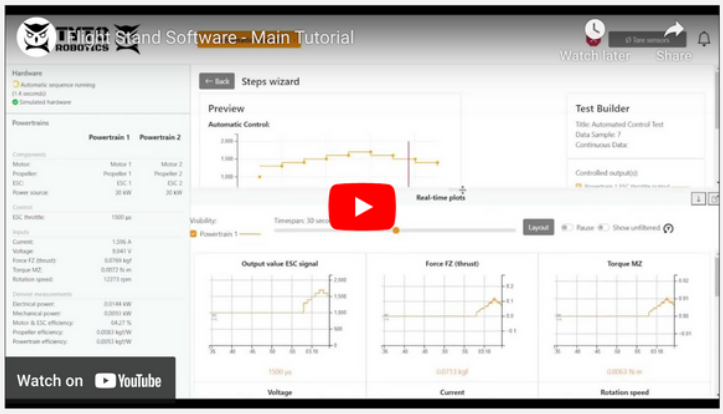
The software tutorials can be found on our website. The tutorials page includes videos on various topics with accompanying steps, like how to use the simulated circuit board, how to program an automated test, and how to set a rate limiter fir your motor.

1. Get started with the overview tutorial (9 mins):

Flight Stand Software Tutorials

Learn how to use the software for the Flight Stand 15, 50, and 150.

Download Now



More Resources:

Quick Start Guide

Past Versions + Changelog

Tutorial Videos by Subject

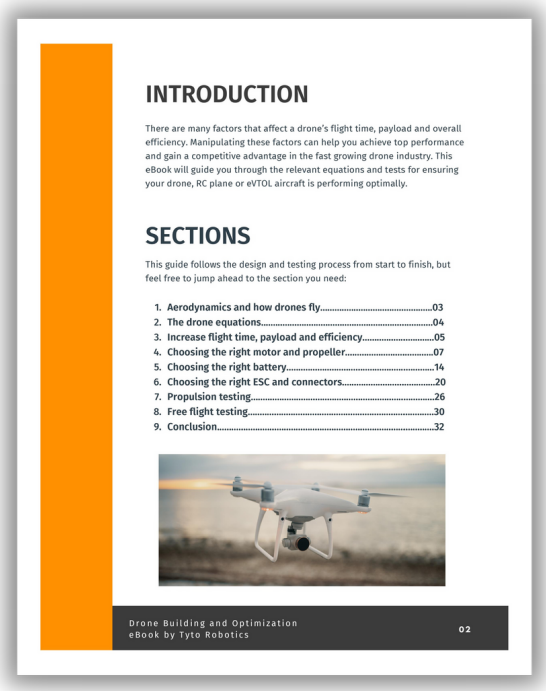
2. How to Perform a Manual Control Test (1.5 mins):

Steps:

1. Navigate to the 'Manual Control' tab
2. Name your test
3. Choose continuous recording or manual sampling
4. Activate the ESC and drag the slider to set the throttle
5. Deactivate the ESC to end the test then save the data

EBOOK

Our eBook - Drone Building and Optimization: How to Increase Your Flight Time, Payload and Overall Efficiency - takes your through the drone design process from aerodynamic theory to choosing your motor, propeller, battery and ESC. A great resource for designers hoping to build their most efficient drone yet. Download it here.



ARTICLES

We have a number of articles that cover everything from brushless motor theory to propulsion system scalability to the current state of drone manufacturers. See our full list of articles on our website or check out some of these top articles:

How to increase a drone's flight time and lift capacity

Brushless motor manufacturers for eVTOL and aviation

DATABASE

Our goal is to offer a community-driven database where anyone can upload and share their test data, greatly reducing the trial-and-error process typically required to optimize UAV propulsion systems.

The database currently contains results from more than 80 brushless motors, 126 propellers and 38 ESCs. Visit the database website to learn more or watch our video series on how to use the database to find and upload data.

The database can help to speed up the process of finding an ideal propulsion system by comparing results from other designers' public tests. Use the "Add filters" tool to narrow results to the motors, propellers and ESCs you are interested in working with, or filter by powertrain data to narrow results with performance cut-offs.

Here's an example: Let's say we want to build a quadcopter with a total weight of 2000 g. At hover, the total thrust must be equivalent to 2 kgf, or 0.5 kgf / propeller. Let's also assume we want the quadcopter to be capable of generating twice the thrust for control authority, so 1 kgf / propeller. Finally, assume we are constrained to a 5 inch propeller diameter and single motor configuration. Apply these filters to find the propulsion system which will provide the longest flight time:

- Only show tests done with a single motor
- Only show tests done with 5 inches propellers
- Only show results whose maximum thrust can reach at least 1 kilograms-force
- Add column: combined efficiency at 0.5 kilograms-force thrust
- Sort by added column: the first result is the most efficient at hover

The results of our search query are shown below:

Database Search Results

Showing 1 to 5 of 12 entries (filtered from 395 total entries)

	Title	Author	Device	Date	Interpolated multi rotor propulsion efficiency at total thrust of 0.5 kgf (gf/W)	Motor	Propeller	ESC
☐	TA110-20 Kv80 with Xoar 40x10	Erwan Labadie	Series 1780	2019-04-16	84.69	Xoar TA110-20 KV80	Xoar PJP-T-L 40"x10"	Flier Airplane 350A
☐	TA130-25 Kv80 with Xoar 47x10	Erwan Labadie	Series 1780	2019-04-15	15.61	Xoar TA130-25 KV80	Xoar PJP-T-L 47"x10"	Xoar titan esc
☐	Xoar 47" Propeller test	Dominic Robillard	Series 1780	2019-02-01	14.4	Xoar TA130-25 KV80	Xoar PJP-T-L 47"x10"	Xoar Pulse A200
☐	U15XXL and 62"Prop from T-	Baiyun Tang	Series 1780	2019-12-06	11.75	T-Motor U15XXL	T-Motor 62"x24"	T Motor FLAME

SUMMARY

Thank you for taking the time to browse our product catalog. Our goal as a company is to provide drone designers with the very best professional testing equipment.

Many of the products shown in this catalog can be purchased directly from our website in our Online Store. For larger products, you can contact our sales team for a quote (sales@tytorobotics.com) and they will be happy to assist you within 24 hours.

Series 1585 Thrust Stand
- Datasheet
- Product page

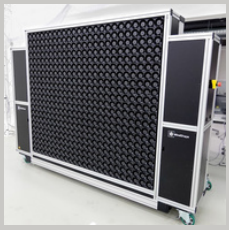
Flight Stand 15
- Datasheet
- Product page

Flight Stand 50
- Datasheet
- Product page

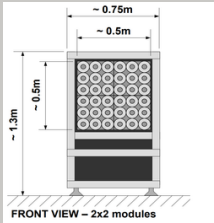
Flight Stand 150
- Datasheet
- Product page

Flight Stand 500
- Datasheet
- Product page

Distributed Electric Propulsion (DEP) Testing
- Product page
- Datasheets

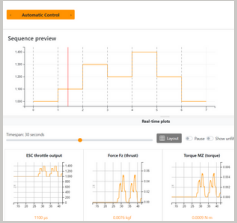


Custom Wind Facilities
- Datasheet
- Product page



Prop Testing Station
- Datasheet
- Product page

Accessories
- Online store



Software
- Flight Stand
- RCbenchmark
- Download