

Custom Wind Tunnel Datasheet



Introduction

This product is a fully customizable wind tunnel that provides endless possibilities for free flight testing. You have full control over the wind tunnel size, shape and accessories. It is specifically designed to study the effects of different wind profiles on motors, propellers, ESCs, batteries, drones and any electric aircraft.

Description

The **Custom Wind Tunnel** is an open wind tunnel that is tailor-made to fit your needs. The wind generator is composed of stackable modules that each have 9 wind pixel fan units (figure 1). Each wind pixel is equipped with 2 counter-rotating fans that can generate a flow speed up to 16 m/s. By analogy with a TV screen, where more pixels yield a better image, WindShape walls are composed of hundreds or even thousands of wind-pixels (fans) that enable precise control over the airstream.

The wind tunnel is managed with the WindControl software that allows you to fully and precisely control wind settings with simple commands. You can manually select the wind pixels that you wish to activate or you can input a mathematical function to reproduce any steady or time-variable wind profile. You can also control your wind tunnel directly from a Python script using WindShape's Python 3.x control API.

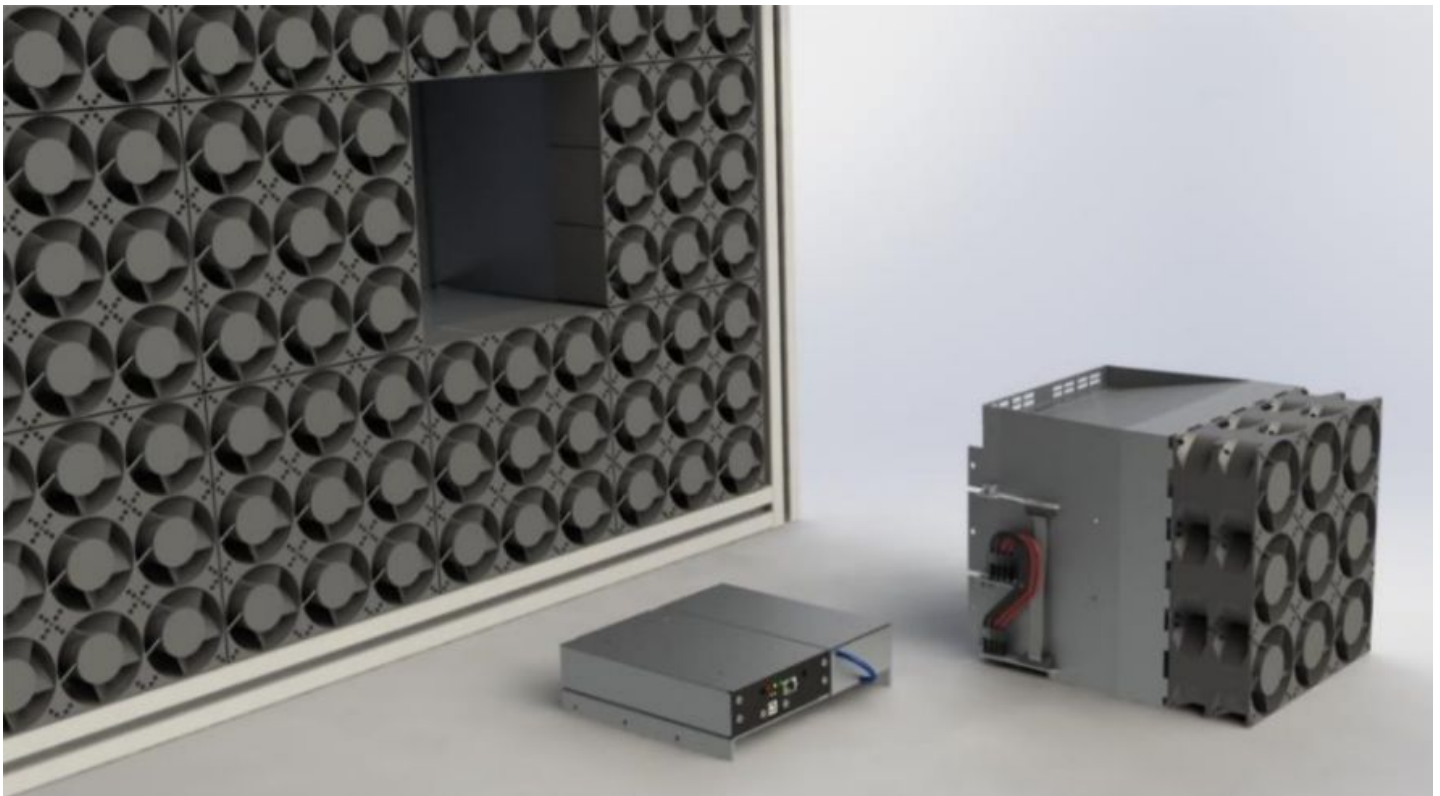


Fig. 1: Structure of a wind module

Structure (figure 2):

The facility's wind generator consists of a wall of fans that generate both horizontal and vertical flows (1). Side walls (2) can also be installed to generate various cross wind profiles. The system is powered by two main distribution boxes (3) and a control network consisting of Ethernet switches, routers, and an onboard computer (4).

Power and Control Unit

Each WindShape module is connected to a WindShape Power and Control (P&C) unit. This unit contains two different systems: the module's control system and the module's power system. The power system can convert the input AC tension into 12VDC which is needed to power the fans. The control system is controlled with a microcontroller. It is connected to the WindShaper's Local Area Network (LAN) and communicates with the onboard computer through an Ethernet protocol. The integrated microcontroller interprets the signals received and pilots the fans accordingly. The status of the module (power status, health, fan status,...) is sent back to the main onboard computer.

Customizable parameters (figure 3):

- Wind tunnel size
- Wind flow shape and direction
- Climate factors such as rain or fog
- Take-off and landing conditions
- Motion capture systems
- Filters to reduce turbulence
- Tilting system from 0° to 90°

Study aircraft capabilities such as:

- Performance in various wind profiles
- VTOL transitions in flight
- Fixed-wing profile optimization
- Multi-copter control systems
- Landing phase optimization
- Drone failure effects (loss of GPS, motor, sensor etc...)
- Turbulence limits
- Waterproof testing

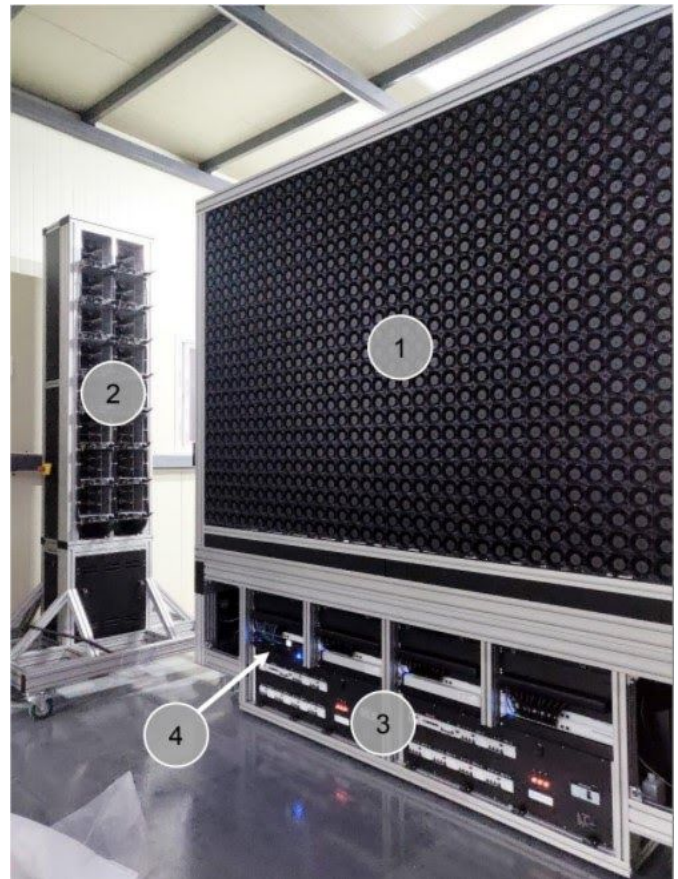


Fig 2. Wind generator components

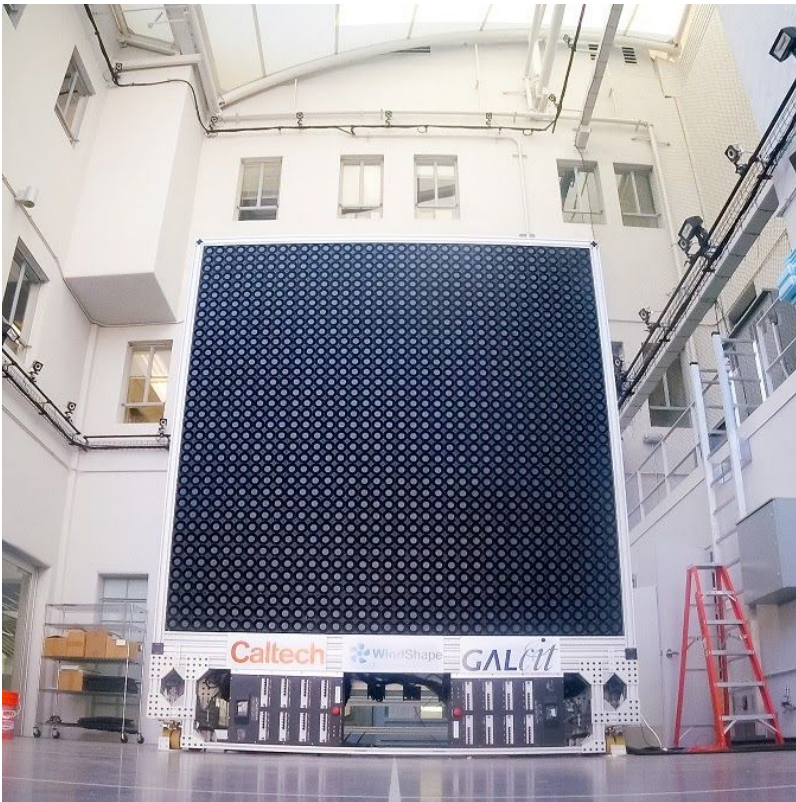
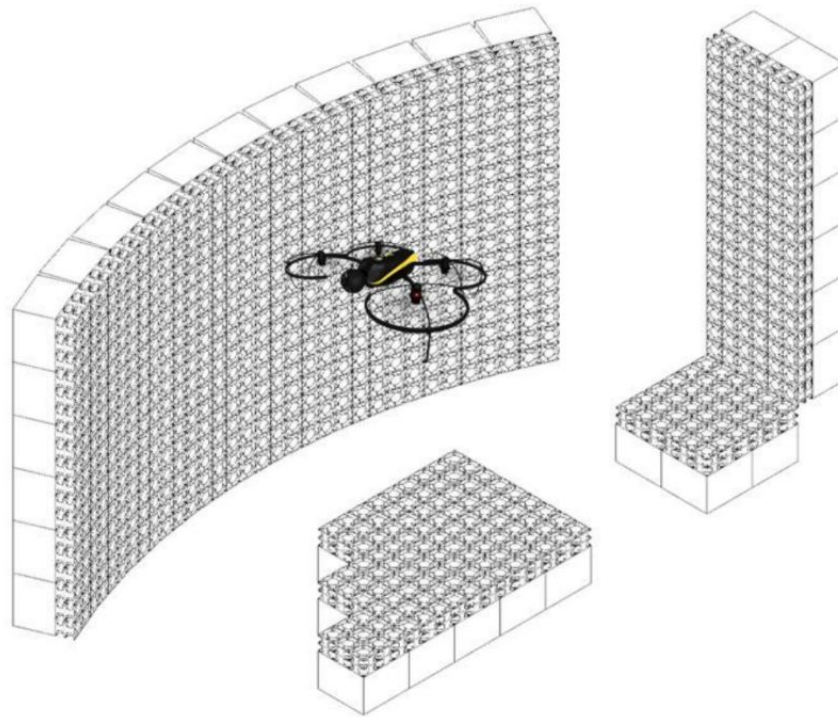


Fig. 3: A sample of the possible custom wind tunnel sizes and configurations

Customizable features:

Filter:

The wind tunnel can be equipped with a flow filter to reduce unwanted turbulence. This feature ensures an even flow of air and is a great option for studying ground effect and a multicopter's ability to fly in its own landing-phase turbulence.



Rainmaker:

The rainmaker feature allows for drone testing in conditions simulating rainfall. This is an excellent way to test the waterproofing of your drone or determine how performance is affected by changing weather conditions. Simulated fog is also available.



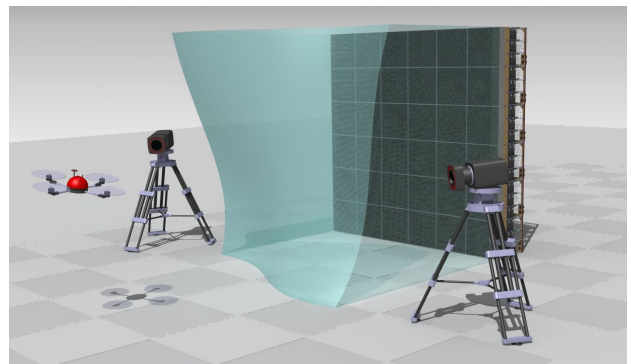
Tilt:

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.



Optitrack and ProCap:

The Optitrack feature performs live tracking of your drone using motion cameras. ProCap's pitot tube-like probe measures air pressure and 3D flow in real-time. Each tool is paired with a software and together they capture aircraft motion and 3D air flow in real-time.



Series 1780 test stand (figure 4):

We offer a number of propulsion testing tools that are designed to precisely measure the thrust, torque and efficiency of your motors and propellers. Partnered with a WindShape wind tunnel, a test stand can help you evaluate and optimize your aircraft components for optimum performance. The Series 1780 test stand is ideal for medium and large size propellers up to 70" in diameter and it can measure up to 75kgf of thrust and 48Nm of torque. The stand is controlled with easy to use software that has preset scripts and custom scripting capability. Click here to learn more about the [Series 1780 test stand](#).



Fig. 4. Series 1780 test stand

Software features

- Dynamic control of the wind profile $u = f(x, y, t)$
- Smallest possible time step with dynamic control: 0.1s
- Ready swirl control for each wind pixel
- Improved WindControl Version 2.2 software (figure 5)
- Cross-platform portability (operating system)
- Network communication between user and wind tunnel through Ethernet connexion
- Custom scripting interface using Python 3.x API
- Web-based graphical user interface

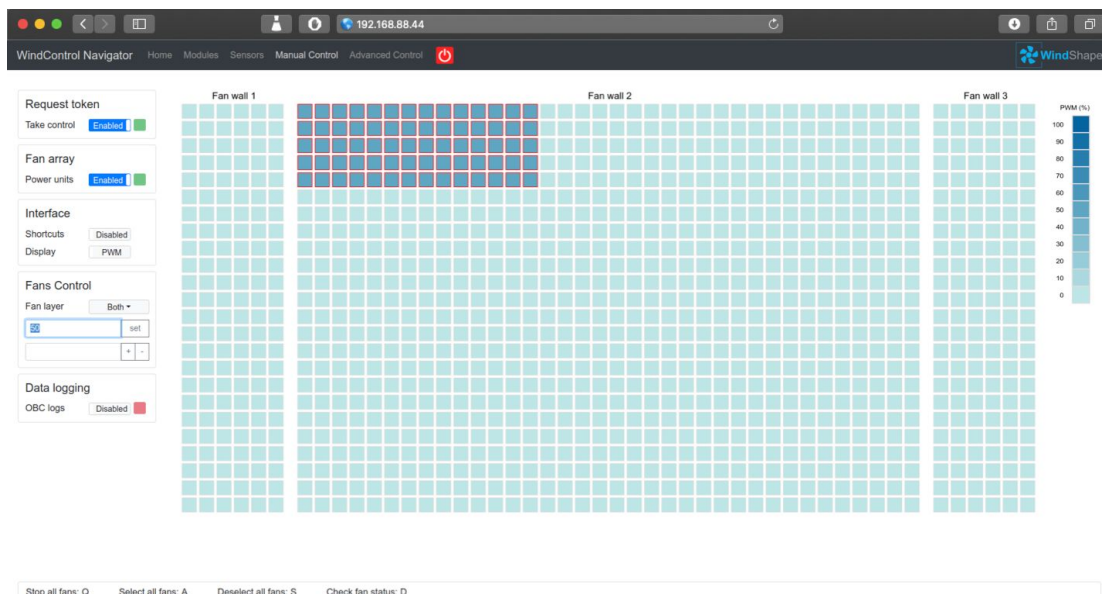


Fig. 5: WindControl GUI