Tower Evo: Anti-collision for drones

Topics

- Video presentations of the solution
- Product details
- Applications and guidance
- Turn-key and custom integration
- MOMMIT Use case

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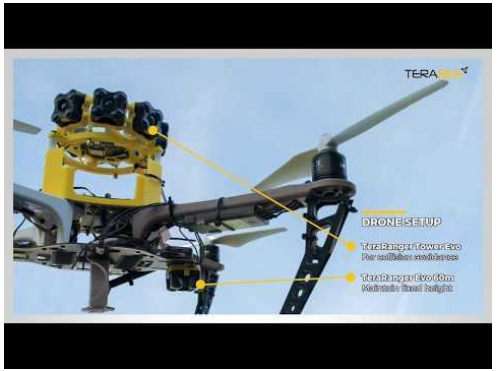
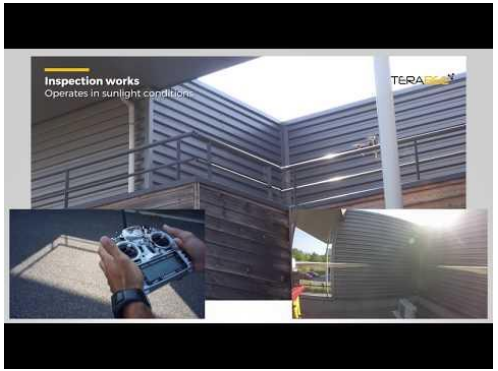
Anti-collision with tower evo

Obstacle avoidance drone flying through vegetation

Indoor obstacle avoidance drone flight



Outdoor obstacle avoidance drone flight - Close inspections



Using Static Lidar (IR LED Time-of-Flight)

- **No** positioning system
- **No** GPS
- **No** optical flow camera
- **No** RF system
- **No** vision system

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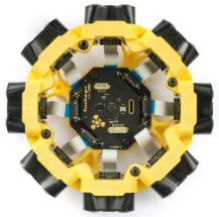
Tower Evo products

Tower Evo 60m



8 sensors

4 sensors

Max. range = **60 meters indoors**
Outdoor performance can be lower

Min. range = **0.5 meters**

Update rate = Up to 240 Hz with 4 sensors or up to 120 Hz with 8 sensors

Compatibility:

ROS and Pixhawk (APM) ready

Requires a battery connector for 11.1V Li-Po battery

Can be powered by 12V 5A power supply for testing purposes

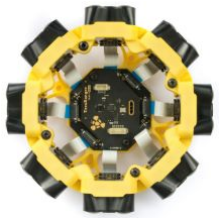
360° coverage as soon as the drone is in movement

No cross talk

Learn more about full specs and features on the product page

Tower Evo products

Tower Evo 600Hz



8 sensors

4 sensors

Max. range = **8 meters indoors**
Outdoor performance can be lower

Min. range = **0.75 meters**

Update rate = Fixed 600 Hz with 4 sensors or fixed 320 Hz with 8 sensors

Compatibility:

ROS and Pixhawk (APM) ready

Requires a battery connector for 11.1V Li-Po battery

Can be powered by 12V 5A power supply for testing purposes

360° coverage as soon as the drone is in movement

No cross talk

Learn more about full specs and features on the product page

Benefits of Terabee Time-of-Flight products

- High frame rate from 100 Hz to 600 Hz allows quick obstacle detection
- 8m to 60m range gives the ability to detect obstacles far enough away for fast moving drones
- Small form factor (diameter of 120 cm) enables easy integration on any kind of drones
- Light weight (from 92g) and maximum power consumption of 1100 mA at 12 V allows extended flight range
- Always eye safe means health protection of operator and people around the sensor

TECHNOLOGY COMPARISON

Distance sensor for robotics

	Ultrasound	Infrared triangulation	Laser	TeraRanger Time-of-Flight (ToF)
High reading frequency			•	•
Long range			•	•
Minimal weight	•	•		•
Small form factor	•	•		•
Eye safety	•	•	Class 1 laser only	•
Use with multiple sensors				•

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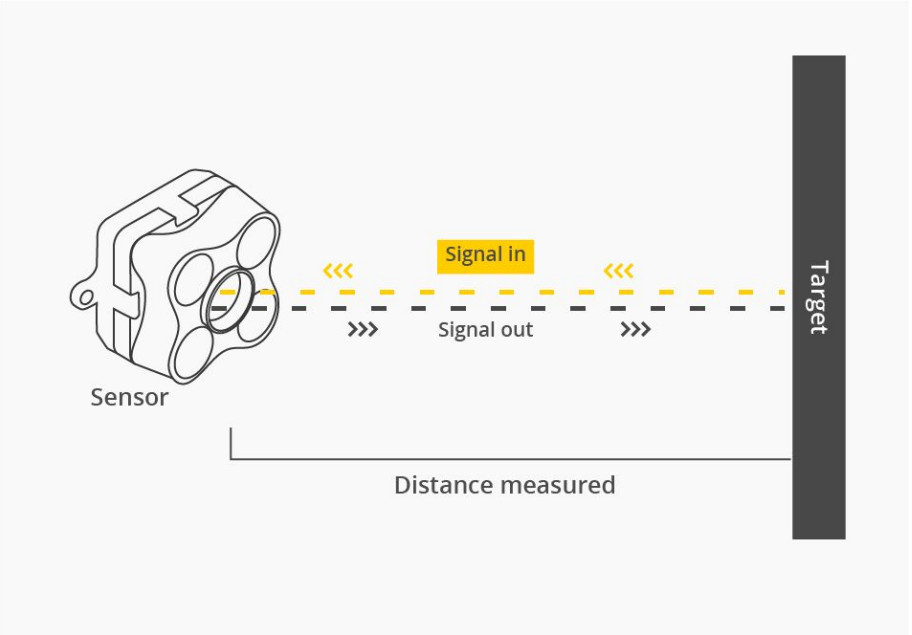
Obstacle detection by Terabee sensors

Each sensor has a 2° FoV (Field of View). This means that the area covered by each sensor is:

- ➔ 3 x 3 cm @ 1 m range
- ➔ 17 x 17 cm @ 5 m range
- ➔ 35 x 35 cm @ 10 m range



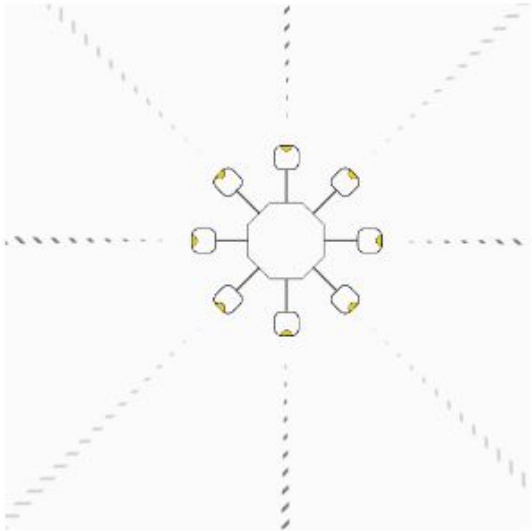
Tower Evo optimized operation modes

Light interference can become an issue to detect obstacles when using several Time-of-Flight sensors together

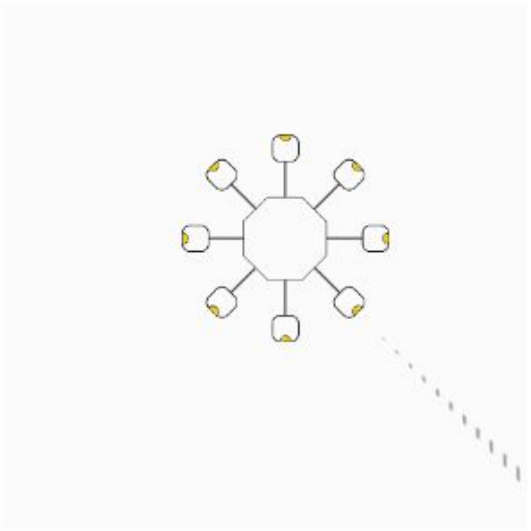
Terabee has addressed this problem called “crosstalk” by enabling two operating modes on the Evo Towers

For more details, please read page 19 of the user manual

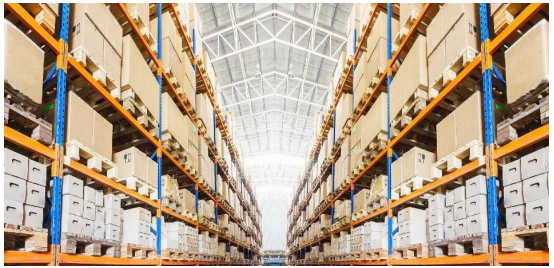
1. Tower mode



2. Sequential mode



Indoor applications



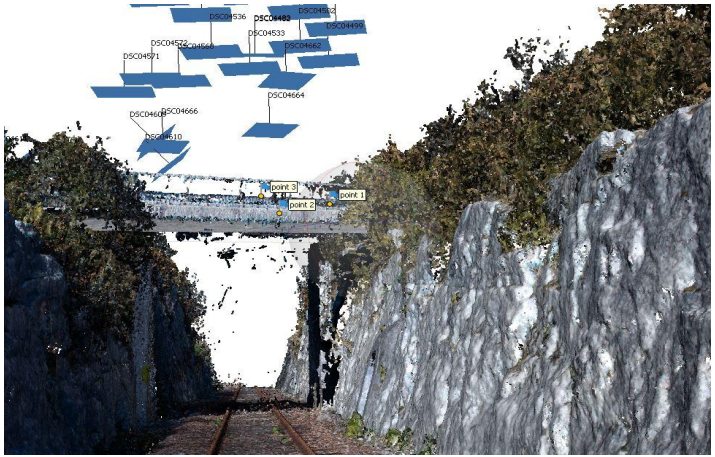
Obstacle avoidance in warehouses for safe indoor flights

Obstacle avoidance in GPS denied areas such as tunnels or underground facilities

Outdoor applications

Bridge drone inspection with Tower Evo 60m

Obstacle avoidance during Photogrammetry mission



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Guidance for the usage of Evo Tower

Max. tilt angle	20°			This angle implies high speed 14-16 km/h	
	Max. drone speed			Anti-collision Radius	
	Km/h	mph	Foot/s	m	Foot
Industrial Warehouses	7	4.3	6.37	4 - 6	13 - 20
Tunnels	2	1.2	1.8	3	10
Inspection works (Bridges)	4 - 7	2.4 - 4.3	3.6 - 6.37	6	20
Photogrammetry	14 - 16	8.7 - 10	12.8 - 14.6	20 - 25	65.6 - 82

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Selection guide for Tower Evo models

Applications	Tower Evo 60m	Tower Evo 600Hz
Indoors (Warehouse with pylons)		X
Indoors (Warehouse without poles)	X	
Tunnels	X	
Civil inspections	X	
Photogrammetry	X	
Narrow places	X	

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Turn-key solution with Pixhawk/APM

	Pixhawk 1 (FMUv3)		Pixhawk 2.1 CUBE (FMUv3)		Pixhawk 4 (FMUv5)	
	APM	Px4	APM	Px4	APM	Px4
TeraRanger One	ArduCopter V3.6.9	--	ArduCopter V3.6.9	Flight stack v1.9.0	ArduCopter V3.6.9	Flight stack v1.9.0
TeraRanger Duo	--	--	--	--	--	--
Teraranger Tower	ArduCopter V3.6.9	--	ArduCopter V3.6.9	--	ArduCopter V3.6.9	--
TeraRanger Tower Evo	ArduCopter V3.6.9	--	ArduCopter V3.6.9	--	ArduCopter V3.6.9	--
TeraRanger Evo 60m	ArduCopter V3.6.9	--	ArduCopter V3.6.9	Flight stack v1.9.0	ArduCopter V3.6.9	Flight stack v1.9.0
TeraRanger Evo 600Hz	ArduCopter V3.6.9	--	ArduCopter V3.6.9	Flight stack v1.9.0	ArduCopter V3.6.9	Flight stack v1.9.0
TeraRanger Evo 3m	ArduCopter V3.6.9	--	ArduCopter V3.6.9	Flight stack v1.9.0	ArduCopter V3.6.9	Flight stack v1.9.0

No compatibility

Compatibility between products (Latest Version)

Px4 removed most of the Range Finders from this board. They run out of memory in the board and can not support all of them. Clients could work with this board but they need to customize the autopilot code by adding a single code line to it.

For more information please consult our tutorial on Tower Evo integration with Pixhawk Autopilots

https://www.terabee.com/connection-to-pixhawk-autopilots-teraranger-tower-evo/

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Going beyond the ready-to-use solution

Scope of responsibilities

Terabee

- Design, sell and support the Evo Tower products, which stream an array of distances
- Provide GUI Software for tests on PC
- Develops and update ROS and Pixhawk drivers for various platforms
- Document the instructions required to use and integrate Evo Tower products

APM or PX4

- Design drone control laws:
  - Anti-collision
  - Object detection

Customers

- Use existing platforms/drivers/drone control laws as-is
- Design own custom drone control laws or through a 3rd party
- Hire the Terabee Project team for a custom development of drone control laws

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Alternatives to Tower Evo

Build custom arrays with Hub Evo and up to 8 Evo sensors (Evo 3m, Evo 600Hz or Evo 60m)

TeraRanger Hub Evo features

- ➔ Compatible with ROS & Pixhawk APM
- ➔ Connect 2 to 8 sensors of the same type per hub
- ➔ Compatible with the following distance sensor:
  - ◆ TeraRanger Evo 60m
  - ◆ TeraRangerEvo 3m
  - ◆ TeraRanger Evo 600Hz
- ➔ Each sensor connects with a Hub Evo backboard interface
- ➔ Stream distance data in millimeters via USB or UART interfaces
- ➔ Optimized for sensor crosstalk avoidance
- ➔ Built-in IMU

Link to product page: https://www.terabee.com/shop/accessories/teraranger-hub-evo/

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MOMIT use case 1/2

MOMIT
MULTI-SCALE OBSERVATION AND MONITORING OF RAILWAY INFRASTRUCTURE THREATS

Programme: Shif2Rail
Call: H2020-S2RJU-2017
Topic: S2R-OC-IP3-03-2017 Satellite and autonomous monitoring systems
Project Title: Multi-scale Observation and Monitoring of railway Infrastructure Threats

- **1st Objective:** Survey critical parts of bridges or buildings looking for structural damages
- **2nd Objective:** Detect instabilities affecting the rocky slopes

Tower Evo 60m has been integrated in DJI Matrice 600 Pro and DJI Flamewheel 450 frames using Pixhawk 4 and APM as a flight controller.

European Commission
Horizon 2020
European Union funding
for Research & Innovation
Shift2Rail
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MOMIT use case 2/2

MOMIT
MULTI-SCALE OBSERVATION AND MONITORING OF RAILWAY INFRASTRUCTURE THREATS

Tower Evo helped protect the drone when inspecting under bridges Inspections

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Let’s talk about your application

Contact us