



TERRA DRONE

UT Drone technology

Oktober 2018

The UT drone is RoNik's proprietary development and is based on patented technology that enables the drone to firmly and precisely press the UT probe against a surface. The drone has been specially developed for indoor use in industrial confined spaces and can be controlled in the presence of steel and concrete.²



RoNik UT Drones highlights

Highlights:

- Reduced HSE risk by mitigating work at height and confined space entry.
- Reduce (scaffolding) costs.
- Lower downtime of assets.
- Easy deployment, faster data gathering – full API653 grid of 300 points executed in <1 day.
- Certified measurements at 0,1mm accuracy validated by Level 2 NDT engineer.
- Detailed monitoring of measurements live on screen.
- No permits from aviation authority needed for indoor flying.
- No weather dependency when flying indoors.

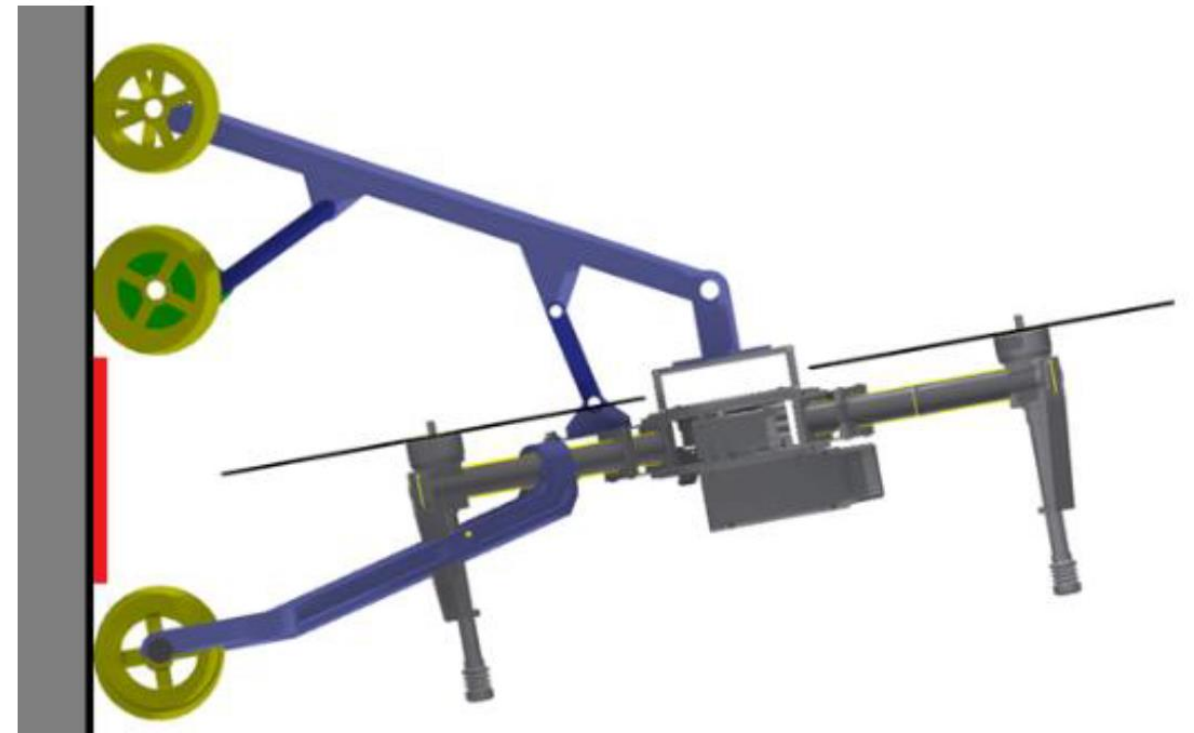


RoNik UT Wall drone

How does the proces work?

The process:

- Certified wall thickness meter manufactured by Eurosonic \ Mistras
- Outer wheels seat the drone and a tilting mechanism pushes the sensor firmly to vertical walls.
- Flexible arm ensures perfect alignment of UT probe with tilted roof plates.
- A couplant gel ensures optimal contact with the wall during the collection
- Live video feed plus wall thickness testing in order to assure quality collection
- Optimize UT parameters (“gains” and “gates” during flight)
- UT Data is validated by certified level 2 NDT engineer

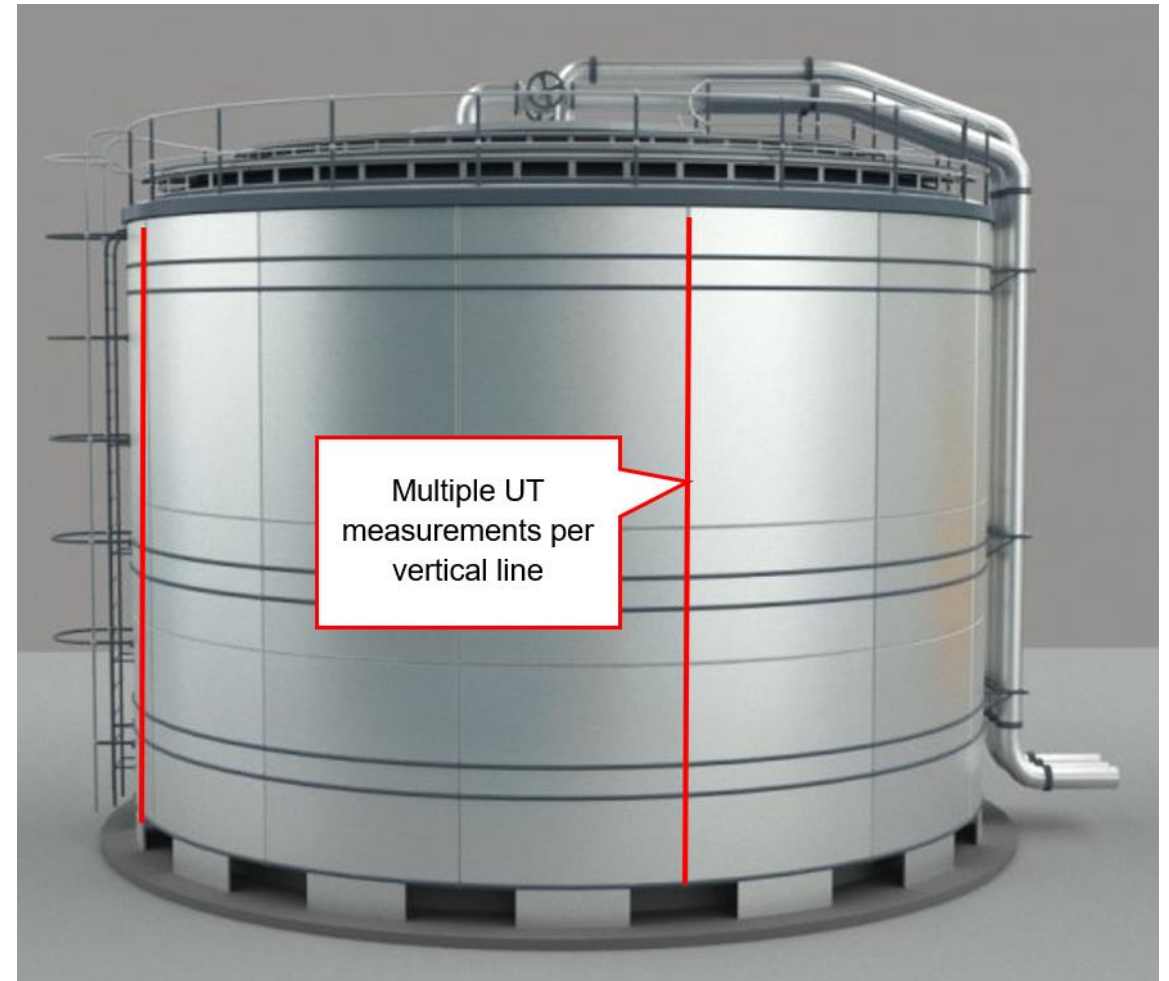


Schematic view of the tilting mechanism

Example use case tank shell

EEMUA159/API653 tank shell measurements:

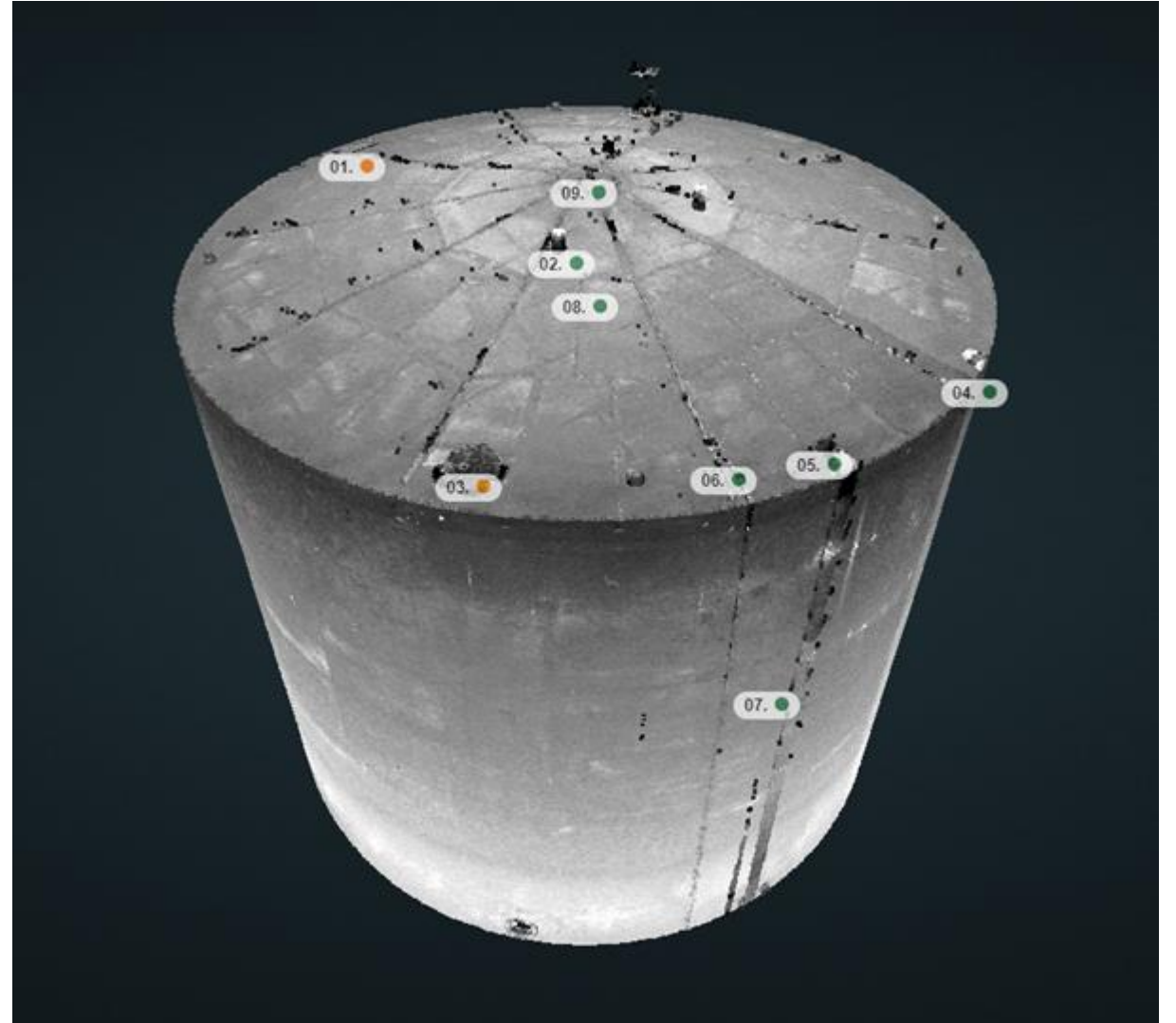
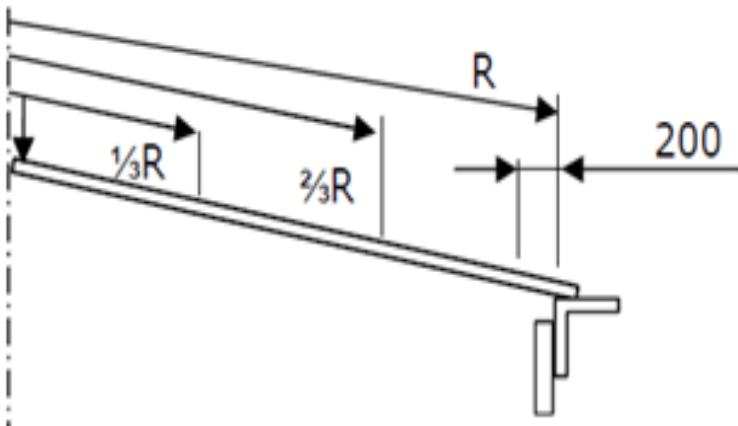
- Scan 4, 8 or more vertical lines of the shell.
- Take measurements on each wall plate on:
 - 30 cm from bottom
 - $\frac{1}{3}$ of the plate
 - $\frac{2}{3}$ of the plate
- Optional: take 3 measurements within a 10cm area and take average as result
- Max reporting precision: 0,1mm
- UT sensor shows data at 0,01mm



Example use case roof plates

EEMUA159/API653 tank roof measurements:

- Scan 4, 8 or more vertical lines of the roof.
- Take measurements on each line on:
 - 20 cm from shell
 - $\frac{1}{3}$ of scan line
 - $\frac{2}{3}$ of scan line
 - In the center of the roof (crown)



[illegible]

What is it?

Diameter	22" (fits through standard manhole)
Frame type	Quadcopter
Flight computer	216MHz STM32F722RET6 MCU with barometer
IMU	32K ICM20602 chip
Weight	3 Kg
Control	Manual control by operator at ground station
Max flight height	40 Meters
Flight time	15 minutes (using an battery-carousel, unlimited flight time is possible)
Voltage	22 Volts
Radio frequency	2,4Ghz and 5.8Ghz
Failsafe	<ul style="list-style-type: none">• Redundant setup• Auto soft-land when communication fails• Auto soft-land at critical low battery
Measuring speed	Max 300 measurements per day

Payload

The RoNik UT Wall drone utilises a **Eurosonic UTC 110 wall thickness meter**.

Manufactured	Eurosonic
Type	UTC110
Accuracy	0,1mm
Control	Live data feed of the full UT graph on ground station
Gel capacity	100 milliliters
Scans types supported	A, B or C (when mounted on the drone only A scan)
Usable surfaces	Vertical walls, horizontal ceilings
Probe	All normal probe types can be used



Technical specs UT sensor

TECHNICAL SPECIFICATIONS

General information	
Operating principle	Ultrasonic refraction method
US channels	P-R / T-T
Encoder inputs	2 or 4 encoders
Display	A, B or C-scan
Liaison and communication	USB 2.0
Compatible	XP, Vista, Seven, Windows 8
Software	EuroscanV, UTWIN, API EurosonicUT
Consumption	3 W (USB)
Dimensions	86 x 54 x 22.5 cm
Protection class	IP 65

Pulser	
Type	Negative pulse
Impedance	50 ohm
PRF max	10 kHz
Emission Voltage	10 to 280 V
Emission Width	20 to 400 ns (résolution 5 ns)
Fall Time / Rise Time	4.8ns / 5.2ns

Receiver	
Input Impedance	50 Ω
Bandwidth	0.9 to 22 MHz (-3dB)
Insulation	P/R – T/T
Amplification	0 to 88dB
Averaging (hard)	2, 4, 8, 16
Digitizing	25 / 50 /100 MHz 12 bits
Digital filtering	RIF 32 coefficients

TCG	
Max point number	256 points
Accuracy	10ns, 0.1dB
Maximum slope	40dB/ μ s

Moniteurs	
Monitor Number	3
Configuration	0 -> 160ms
Strategies	Absolute Max / threshold / 1st echo
Polarity	positive, negative, double

Echo Start	
Configuration	0 -> 160ms
Strategies	Zero before / zero after / peak / threshold crossing
Polarity	Positive, negative, double

Acquisition	
Synchronization type	Internal : 10Hz to 10 kHz External : on encoder position
Encoder synchronization accuracy	2 to 65535 encoder step
Maximum acquisition frequency	10000 acquisition/s
Maximum data rate during acquisition	15 Mo/s

Setup and operations

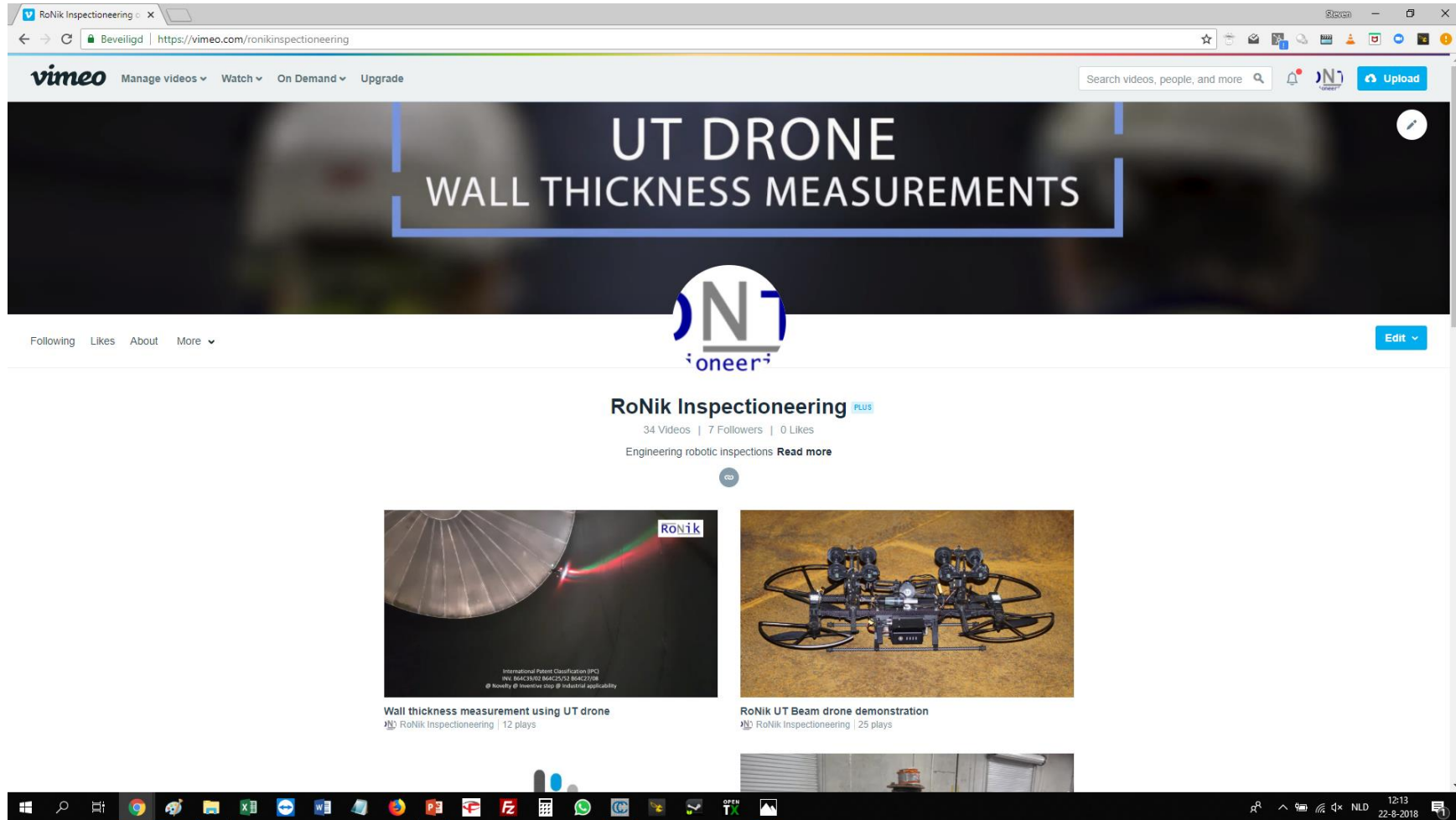
- Two person team:
 - Drone operators
 - UT sensor operator
- Preparations:
 1. Drawing of object
 2. What material
 3. What expected thickness
 4. Cleanliness
- Drone setup:
 1. Unfold arms
 2. Mount propellers
 3. Mount bottom tilting arms
 4. Set angle top arm
 5. Mount the right UT probe
 6. Fill gel cannister
 7. System startup
 8. Calibrate UT sensor
 9. Test UT probe
 10. Take measurements

Operational checklist available



The RoNik UT Roof drone ready for take-off

Videos



The screenshot shows a web browser window displaying the Vimeo channel for RoNik Inspectioneering. The browser's address bar shows the URL <https://vimeo.com/ronikinspectioneering>. The Vimeo interface includes a top navigation bar with the Vimeo logo, links for 'Manage videos', 'Watch', 'On Demand', and 'Upgrade', a search bar, and an 'Upload' button. The channel's header features a large video thumbnail with the text 'UT DRONE WALL THICKNESS MEASUREMENTS' and the RoNik logo. Below the header, the channel name 'RoNik Inspectioneering' is displayed with a 'PLUS' badge, along with statistics: '34 Videos | 7 Followers | 0 Likes'. A bio line reads 'Engineering robotic inspections' followed by a 'Read more' link. The video grid shows two featured videos: 'Wall thickness measurement using UT drone' (12 plays) and 'RoNik UT Beam drone demonstration' (25 plays). The Windows taskbar at the bottom shows various application icons and the system clock indicating 12:13 on 22-8-2018.

RoNik Inspectioneering **PLUS**
34 Videos | 7 Followers | 0 Likes
Engineering robotic inspections [Read more](#)

UT DRONE
WALL THICKNESS MEASUREMENTS

RoNik

Wall thickness measurement using UT drone
RoNik Inspectioneering | 12 plays

RoNik UT Beam drone demonstration
RoNik Inspectioneering | 25 plays

See our vimeo channel: <https://vimeo.com/ronikinspectioneering>

Reference clients



Limitations

- No ATEX certification. Tank needs to be clean and gas-free.
- If tank is heavily corroded, UT measurements are not possible (see photo).
- For outdoor use:
 - Max wind 3m\s.
 - No GPS.
- Cleaning mechanism in under development (Q1 2019).
- Only vertical walls and roof plates, H beams are under development (Q1 2019)



Example of a surface that cannot be measured with the RoNik UT drones

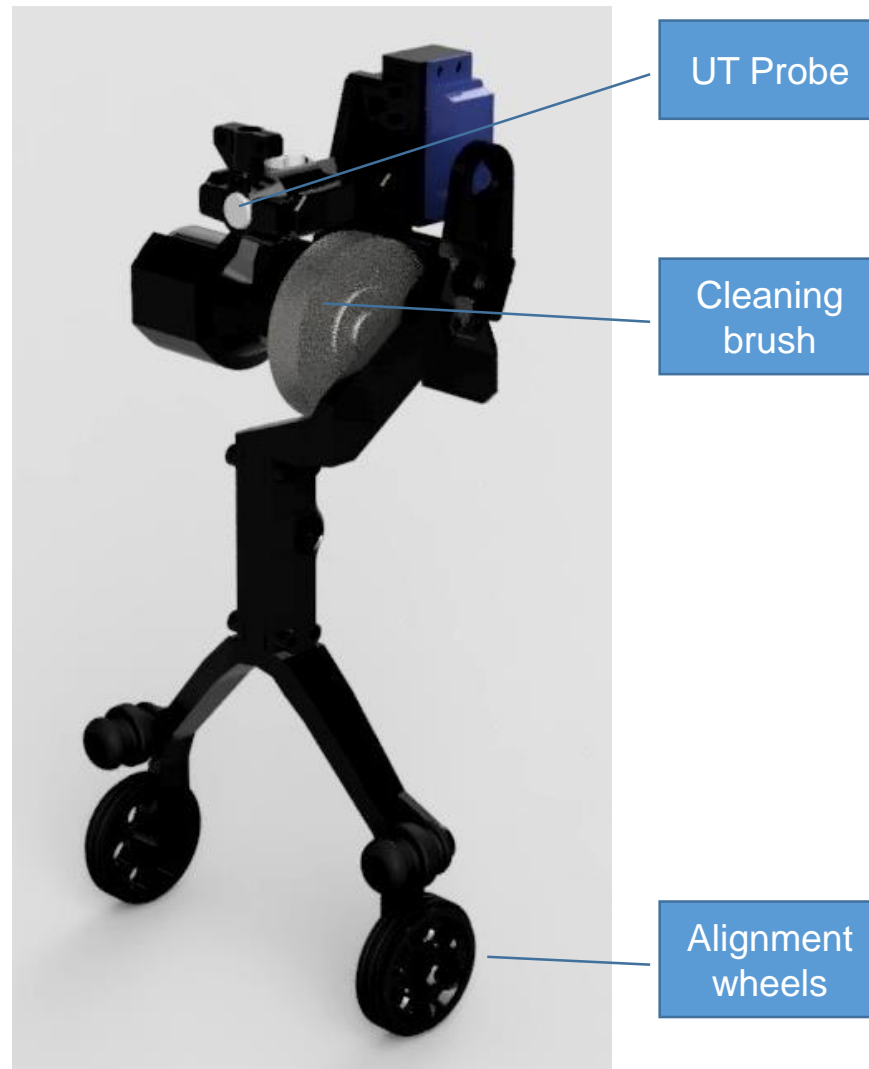
Cleaning mechanism

The cleaning mechanism allows the surface to be cleaned before taking UT measurements.

Highlights:

- New measurement arm on top bar
- Integrated steel brush
- UT sensor in rubber O ring
- Steel brush and UT sensor can turn 90 degrees in <1 second
- Protection of steel particles

Status: testing phase.
Available from Q1 2019.



UT H-Beam drone

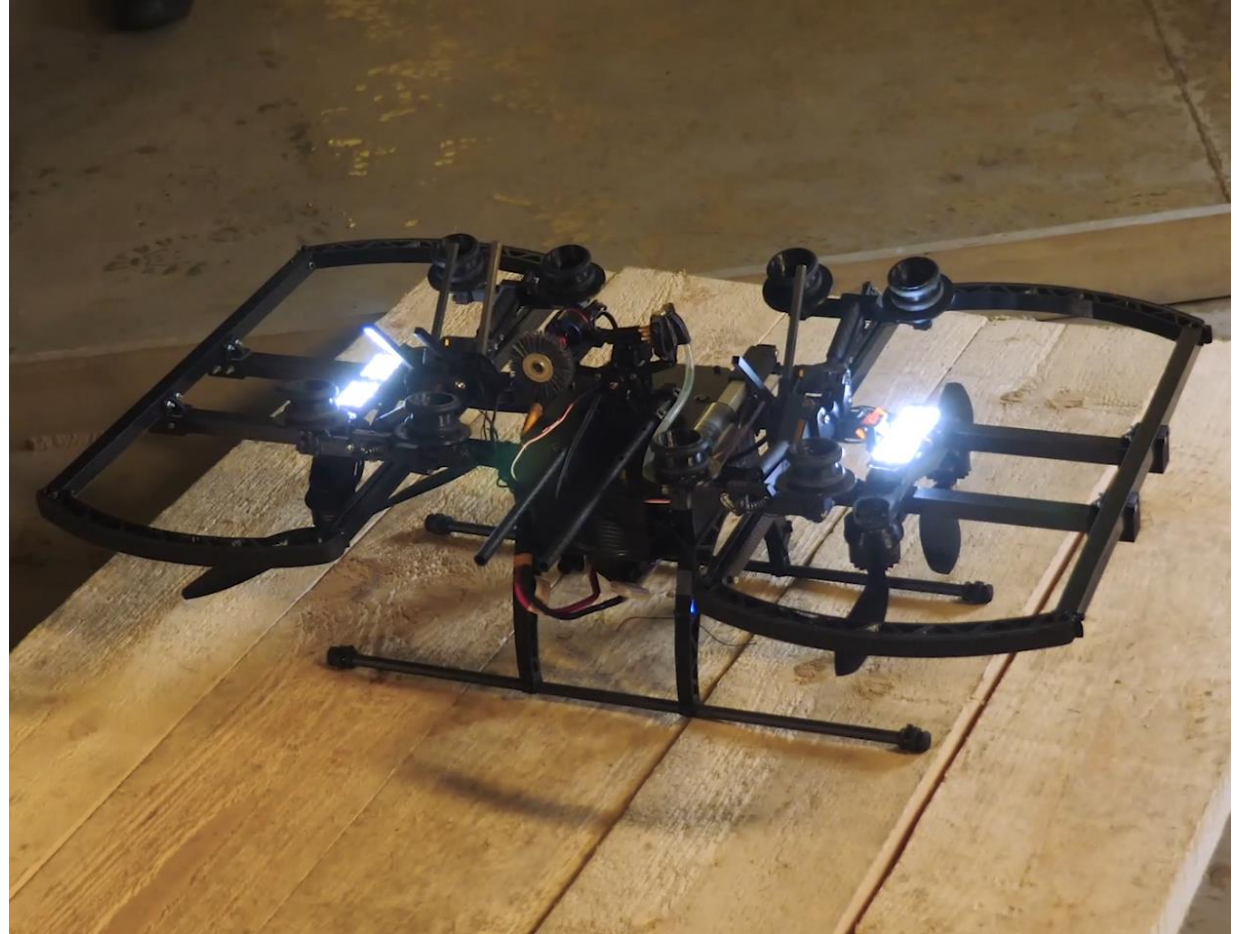
The RoNik UT Beam drone allows for visual and UT inspection of H beams.

Highlights:

- Patented gripping arms enable this drone to attach itself to an H or I beam.
- Drone engines can be turned off when attached to beam.
- Capable of visual inspection and UT measurements.
- Prepared for non-entry use.

Status: testing phase
Available in Q1 2019.

Video: <https://vimeo.com/290357142>





TERRA DRONE

Worldwide partner network