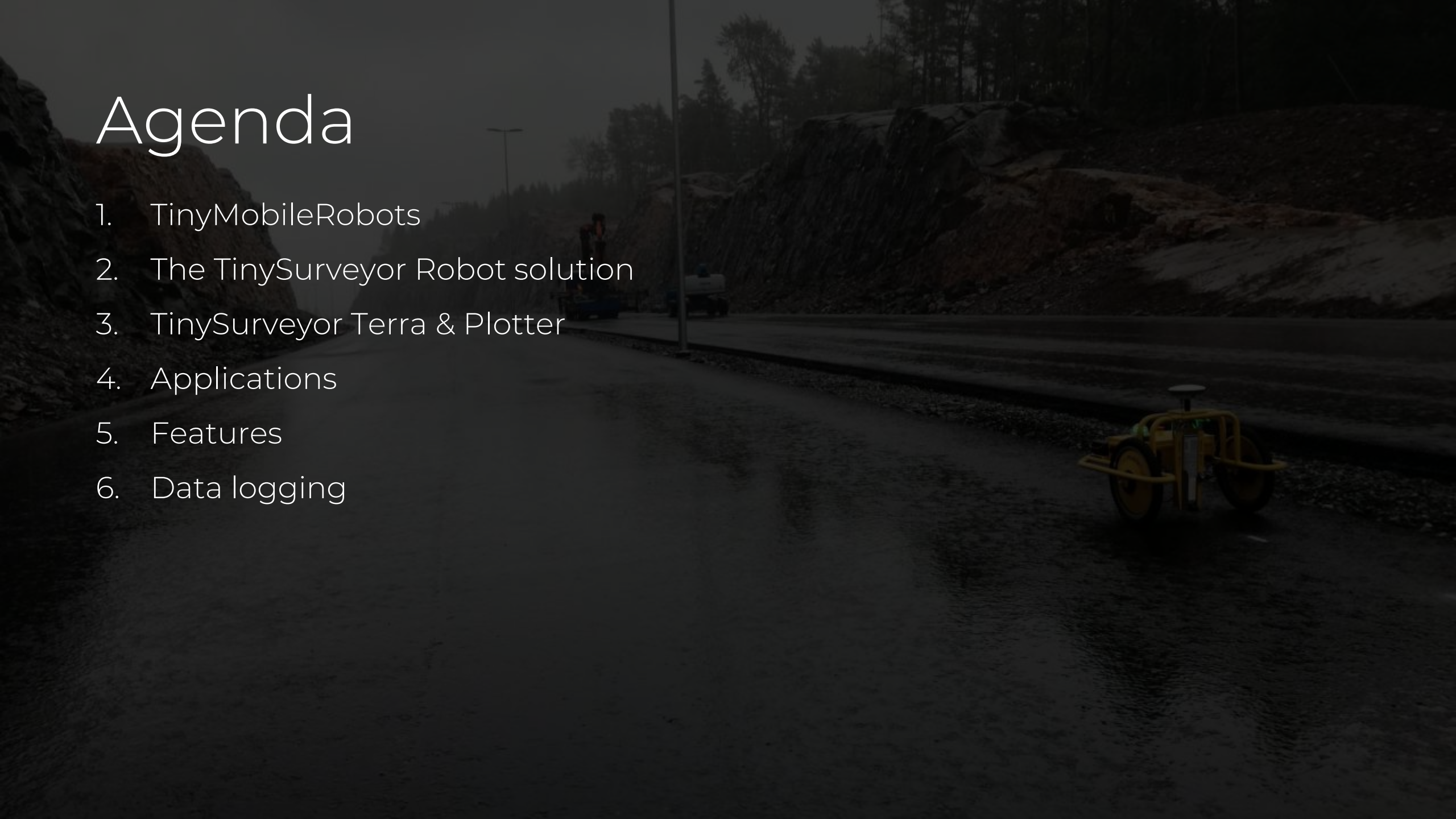
TinyMobileRobots

Agenda

1. TinyMobileRobots
2. The TinySurveyor Robot solution
3. TinySurveyor Terra & Plotter
4. Applications
5. Features
6. Data logging



2015

Headquarter established in Denmark

+100

Employees with in-house R&D and production teams & TinyMobileRobots US

4

Different autonomous robot models for high precision marking and stake-out in operation globally

+20

National distribution partners in North America, Europe and the Pacific regions

Your new colleague

What is the TinySurveyor?
The TinySurveyor is the ultimate high-precision instrument for the surveying and infrastructure industries. It has an unparalleled ability to execute large tasks up to 10x faster than traditional surveying and stake-out methods.

What does it solve?
The TinySurveyor performs pre-marking, stake-out / set-out, data collection, as-built surveys etc. In short, it increases quality, efficiency and safety in the infrastructure industry.

Who can benefit?
Land surveyors, road construction companies, civil engineering companies, construction companies, airport maintenance services etc.

Key features

- **Fast**: Significant time savings (fast and agile)
- **Safe**: Can be remote operated from a safe distance (beacon, ultrasound collision detection, fit-a-flag option)
- **Easy to use**: User-friendly tablet solution
- **GNSS / Total Station**: Brand independent
- **Lightweight and portable**: 18-25 kg excl battery
- **Performance**: High accuracy and long-lasting battery
- **Data**: Common data formats (DXF and CSV)

System overview

GNSS/Total station

TinySurveyor Robot

TinySurveyor App

TinySurveyor App workflow

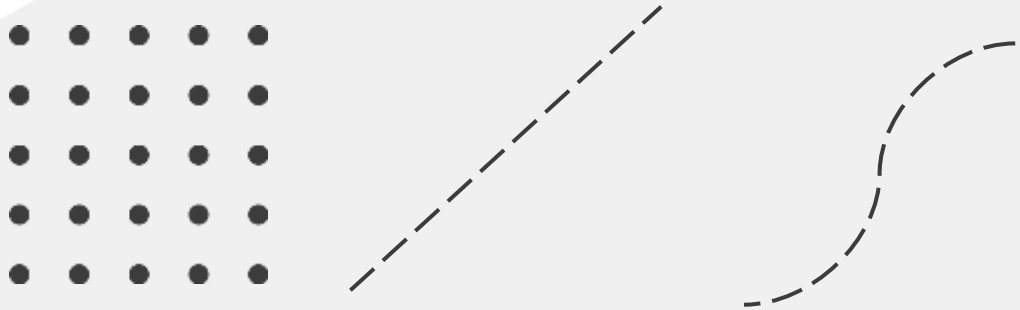
- Load existing job via USB or Computer
- Use DXF and CSV files

- Create new job from template (geometric shapes, parking lot, coverage area etc.)
- Collect data to create new job

- Automatic and manual driving mode
- Real-time visualization of task execution
- Edit, copy and offset points and lines directly from tablet

Your design file laid out

Mark points, lines, splines and curves



- Ability to pick up and set out points and lines from GNSS or total station
- Load points and lines via DXF or CSV files
- Set operating speed, wait time at points, and spray duration, etc....
- Auto-resume functionality
- Lay out complex designs
- Customize your points and lines (point diameter, line dashing, intervals, etc.)

TinySurveyor Plotter

- “On-Road”
- Designed for road works and “solid” surfaces
- Extra safety features
- Extra connectivity features

TinySurveyor Terra

- “Off-Road”
- Designed for both solid and uneven surfaces
- The multipurpose robot for layout, stakeout, surveying, etc.

Potential TS Plotter

Pre-marking

- Roads
- Parking lots
- Airports
- Indoor

As-built survey

Potential TS Terra

- Large-scale stake-out
- Pre-marking
- As-built survey
- Topography

Key outcomes

- **Labor cost savings:** 60-90%
- **Productivity:** Complete more work faster
- **Mobility**: Deployed in minutes
- **Performance**: Tirelessly executes large tasks
- **Worker health & safety**: Safer work environment for surveyors and operators. No bending over to put marks on the ground.

Quality

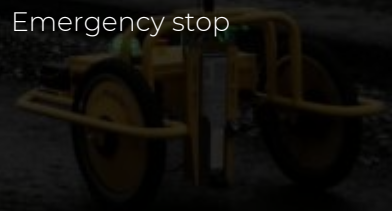
- Repeatable results with GNSS and Total Station
- Accuracy 2 cm / 0.8 in using GNSS
- 10 Millimeter precision using total station
- Customer evaluations show substantial quality improvements in project execution

Efficiency

- Stake out 2-600 points per hour
- 5-10x times faster than traditional methods
- No longer need to stop, level and bend to mark out points or lines
- Operation for min. 8 hours on one battery charge
- Rugged tablet to operate the TinySurveyor even in demanding weather conditions
- Efficient reduction in use of paint required

Safety

- Operate from the safety of a vehicle or behind safety barriers
- Reduce fatigue and body strain on operator
- Operator can stay out of live traffic areas and never has to be facing away from traffic
- Emergency stop



Applications

Road pre-marking

“Example of TinySurveyor being 5 times faster than a person and delivering better result.”

Speed

The TinySurveyor can tirelessly execute large tasks at 4 km/hour / 2.5 mph, allowing surveyors and road marking companies to complete pre-marking 5-10 times faster than usual.

Workflow integration

Existing CAD data allows the TinySurveyor to instantly mark out points, lines and arches before permanent markings.

Accuracy

GNSS connectivity yields an accuracy of 2 cm / 0.8 in. Integrating with a total station allows for millimeter precision.

TinyMobileRobots

Airport

“What would have taken five weeks, this little robot has done in one week.”

Safety

No need for any person to be on any runway or traffic zone.

Workflow integration

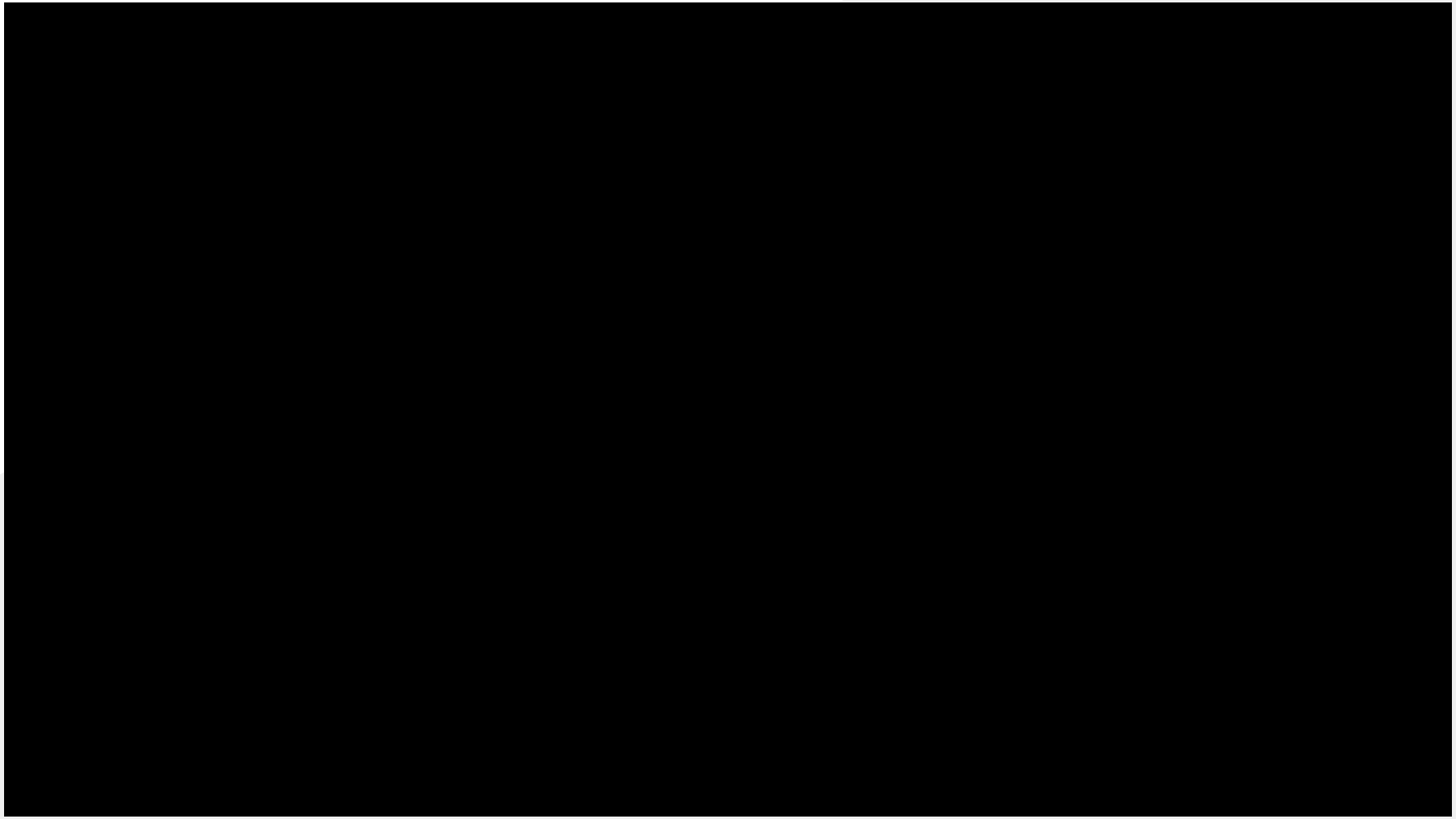
Existing CAD data allows the TinySurveyor to instantly mark out points, lines and arches before permanent markings.

Speed

The TinySurveyor can tirelessly execute large tasks at 2.5 mph completing tasks much faster, giving more flexibility in a time limited industry. Operating day and night helps reducing costly disruptions to flights.

Accuracy

GNSS connectivity yields an accuracy of 2 cm / 0.8 in. Integrating with a total station allows for millimeter precision.



Car park set-out

More resources

Using a pre-marking robot for car park set-out is much faster than traditional stake-out methods. The surveyor or operator can focus on project critical tasks instead of rudimentary line marking.

Productivity

With more than 8 hours continued use on one battery charge and with data well prepared, this automated layout process can dramatically increase productivity on large-scale projects.

Density

More information is provided on the ground for the line painting crew to instantly start painting without any interpretation.

Drill hole set-out

Robust

The rugged design and high traction wheels operate in a variety of environmental conditions.

Reduce downtime

Drill patterns can be set out quickly, reducing heavy machinery downtime.

Safety

Removes operators from heavy machinery as well as live traffic.

Harbor set-out

Robust

The high traction motor wheels enable TinySurveyor to operate on a variety of surfaces, including sand.

Repeatability

Reliable and efficient positioning means that the TinySurveyor can mark up to 300 points per hour on sand and up to 600 points per hour on hard surfaces.

Quality

With CAD data prepared and sent to the TinySurveyor via tablet, this automated layout process gives a very high accuracy every time.

Construction set-out

“Does foundation layout 2-3 times faster than 1 person with a Total Station.”

Speed

The TinySurveyor can tirelessly execute large tasks at 4 km/hour / 2.5 mph, allowing surveyors complete marking e.g. perimeter foundation up to 2-3 times faster than usual.

Workflow integration

Existing CAD data allows the TinySurveyor to instantly mark out points, lines and arches.

Accuracy

GNSS connectivity yields an accuracy of 2 cm / 0.8 in. Integrating with a total station allows for 10-millimetre precision.

Outdoor stake-out

“Stake-out 2-600 points per hour depending on terrain and distance between points.”

Robust

The rugged design and high traction wheels operate in a variety of environmental conditions.

One person

The TinySurveyor will mark the ground and a single person can stake, pin or peg the locations of the pilings.

Speed

Complete the stake-out tasks quickly to allow other trades to get to work faster, improving project productivity.

Accuracy

GNSS connectivity yields an accuracy of 2 cm / 0.8 in.

Railway set-out

Speed

The TinySurveyor can tirelessly execute large tasks at 4 km/hour / 2.5 mph, allowing surveyors complete marking e.g., the centre line up to 10 times faster than usual.

Workflow integration

Existing CAD data allows the TinySurveyor to instantly mark out points, lines and arches.

Accuracy

GNSS connectivity yields an accuracy of 2 cm / 0.8 in. Integrating with a total station allows for 10-millimetre precision.

Indoor

“Made it possible to transfer our height curve CAD file to the actual floor.”

Versatile

Total station integration gives the TinySurveyor the ability to work in any location.

Maneuverability

The compact design makes the TinySurveyor ideal for staking out and driving between small spaces at construction sites.

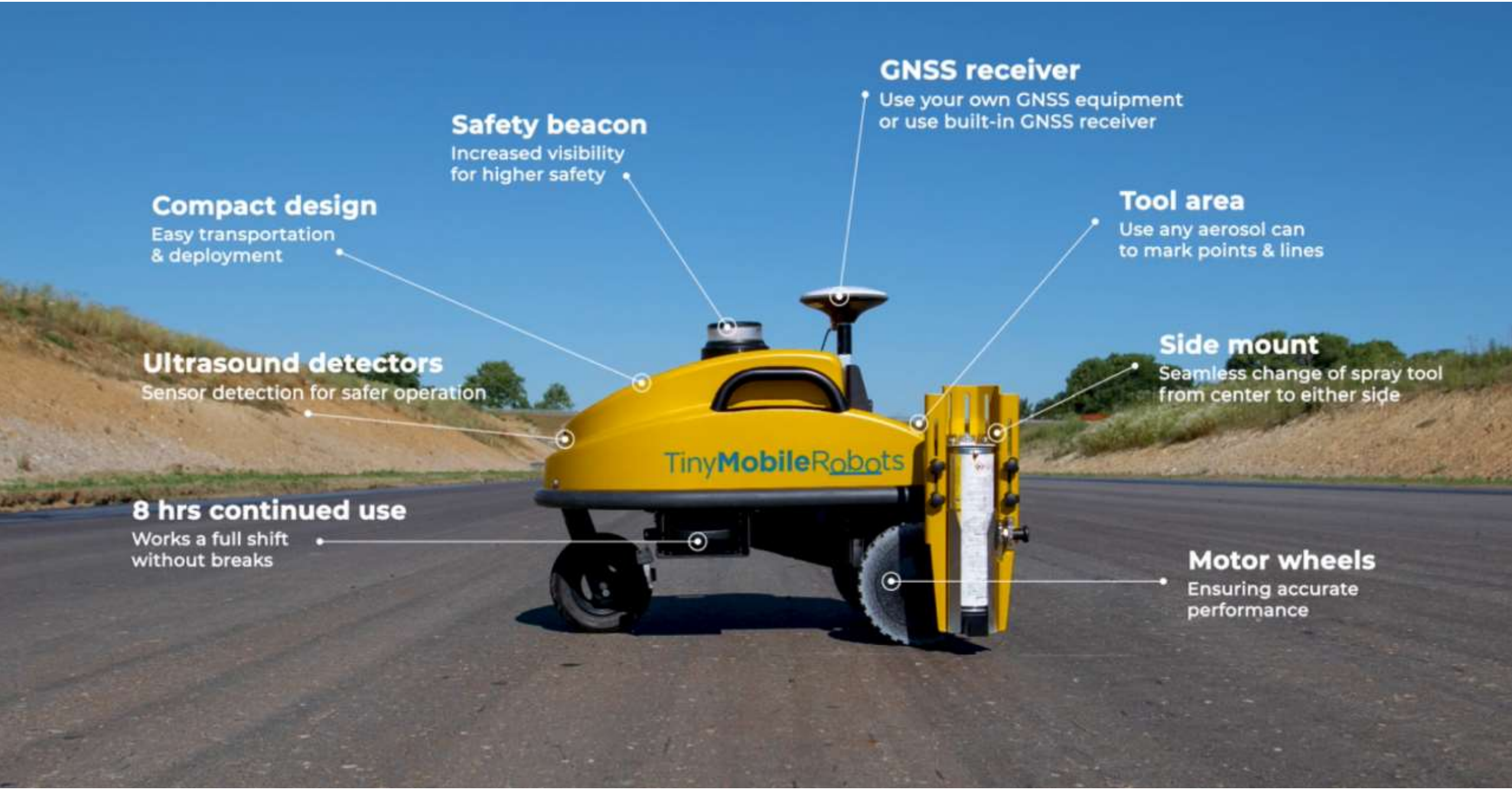
Speed

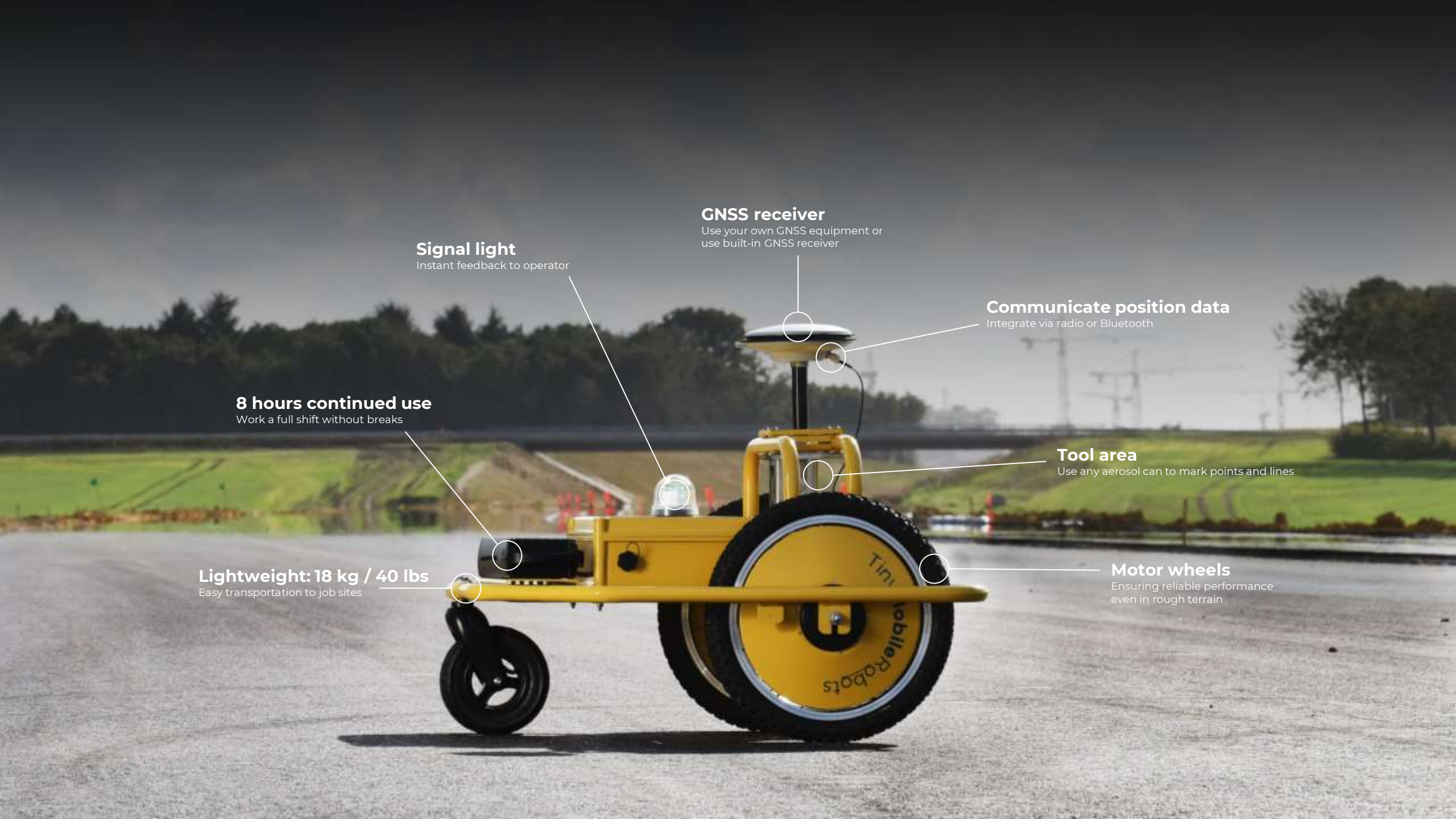
Complete the set-out tasks quickly to allow other trades to get to work faster, improving project productivity.

Accuracy

The TinySurveyor can operate at an accuracy of 10 mm / 0.4 in when integrating with a total station.

Features


GNSS receiver
Use your own GNSS equipment
or use built-in GNSS receiver
Safety beacon
Increased visibility
for higher safety
Compact design
Easy transportation
& deployment
Tool area
Use any aerosol can
to mark points & lines
Ultrasound detectors
Sensor detection for safer operation
Side mount
Seamless change of spray tool
from center to either side
TinyMobileRobots
8 hrs continued use
Works a full shift
without breaks
Motor wheels
Ensuring accurate
performance

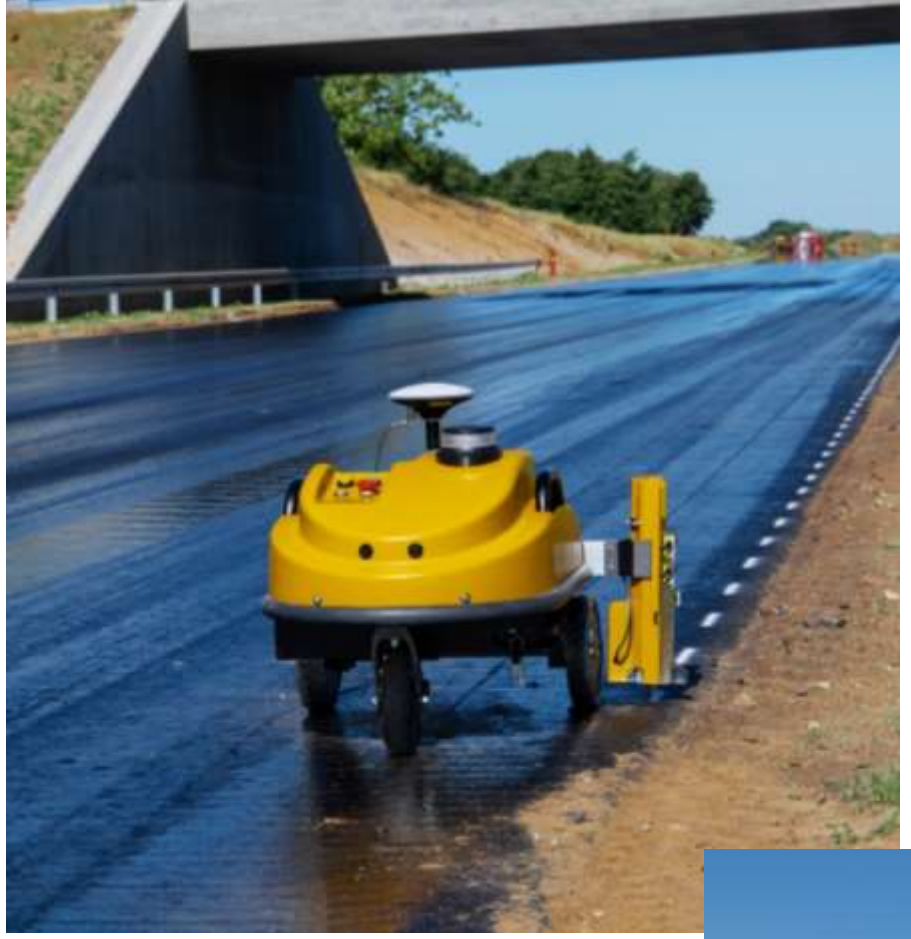

GNSS receiver
Use your own GNSS equipment or use built-in GNSS receiver
Signal light
Instant feedback to operator
Communicate position data
Integrate via radio or Bluetooth
8 hours continued use
Work a full shift without breaks
Tool area
Use any aerosol can to mark points and lines
Lightweight: 18 kg / 40 lbs
Easy transportation to job sites
Motor wheels
Ensuring reliable performance even in rough terrain

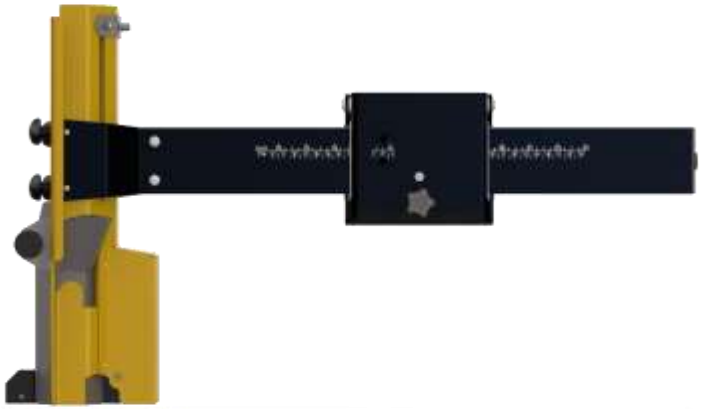
Side mount

- Reposition the spray tool to fit the task at hand
- Easily move the spray tool to the left or right side of the TinySurveyor
- Drive near edges on road works
- Simple configuration on user tablet
- Adjust spray tool height using built-in handles
- Used for: Edge seal, barriers, kerbing, driving near asphalt slab edges etc.

Side mount

- Reposition the spray tool to fit the task at hand (up to 58cm/23in left – 42cm/16.5in right)
- Easily move the spray tool to the left or right side of the TinySurveyor not needing tools
- Drive near edges on road works
- Simple configuration on user tablet
- Adjust spray tool height using built-in handles
- Used for: Edge seal, barriers, kerbing, driving near asphalt slab edges etc.





New data logging feature

ROBOT

Creates Data Log in Real-time

Format & Export .CSV

TABLET via BlueTooth

or

USB

LOG Files

Stored on Robot Internal Memory

What will be logged?

POSITION DATA
Calibrated Tool Coordinates, Antenna Coordinates (RAW + Proj.), Planned Coordinates

ACCURACY DATA
Standard Deviation from external GNSS via GPGST - latitude, longitude, altitude, RMS value

SURVEYED POINTS
Calculated average coordinates of time-series position data collected at stationary waypoint

ROBOT SETTINGS
Input Source, Tool Position, Tool Sideshift, Tool Height, Line Length, etc...

When & Why will it be logged?

LOG SPRAY

Whenever the spray tool does something…
Used to log where paint is applied on the surface

LOG DRIVING

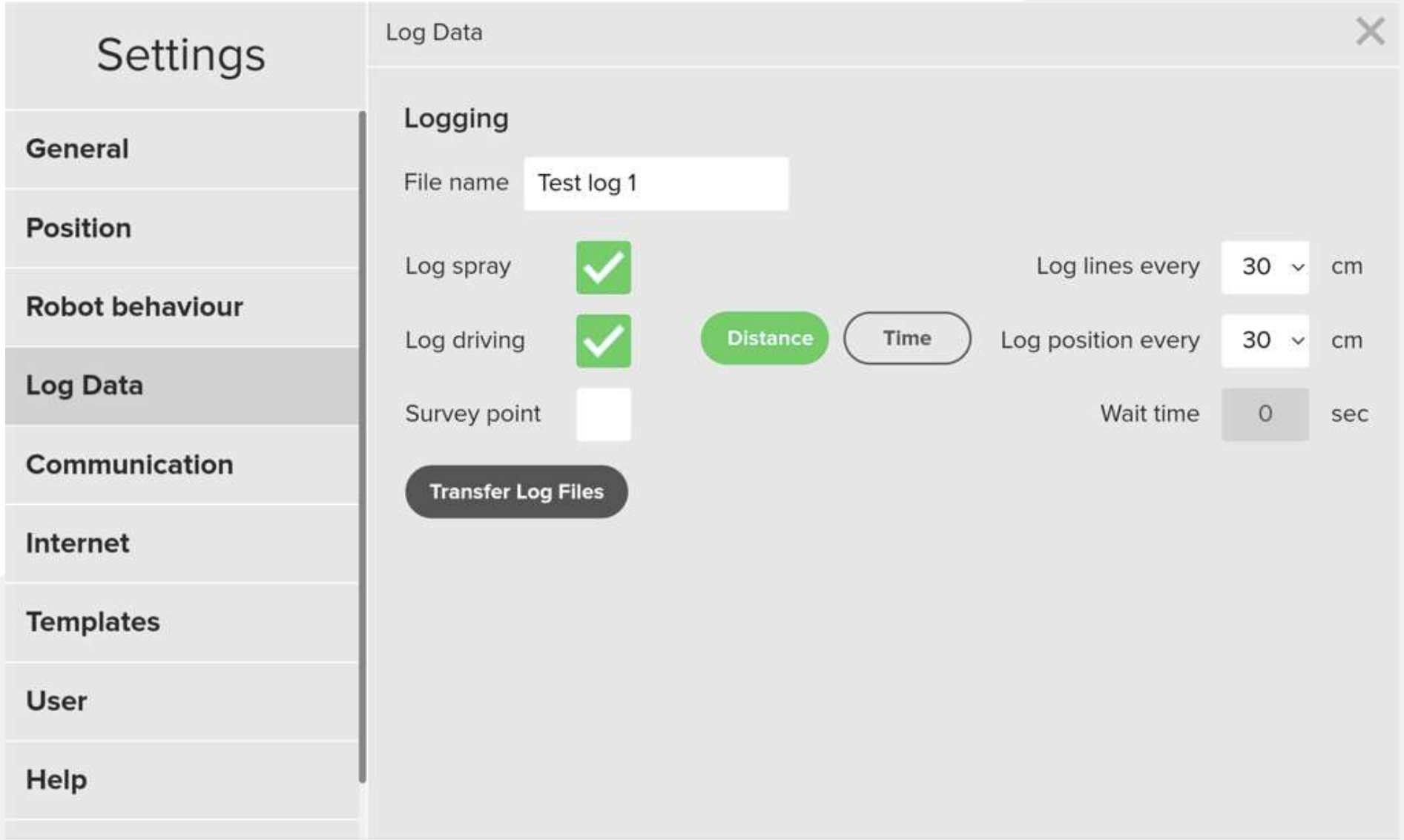
Whenever the Robot drives autonomously…
Used to track when and where the robot has been

SURVEY POINTS

Whenever the robot reaches a waypoint…
Increased accuracy of static point coordinates

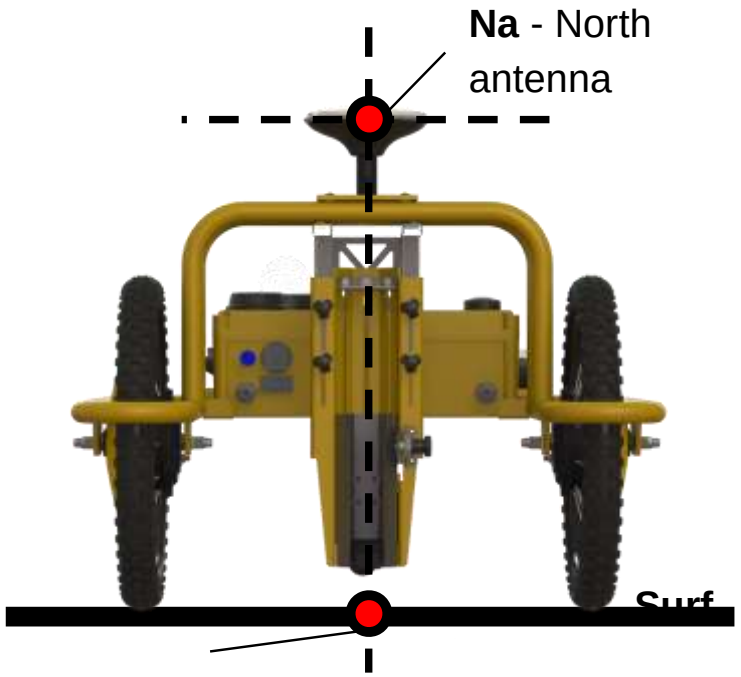
Log Data

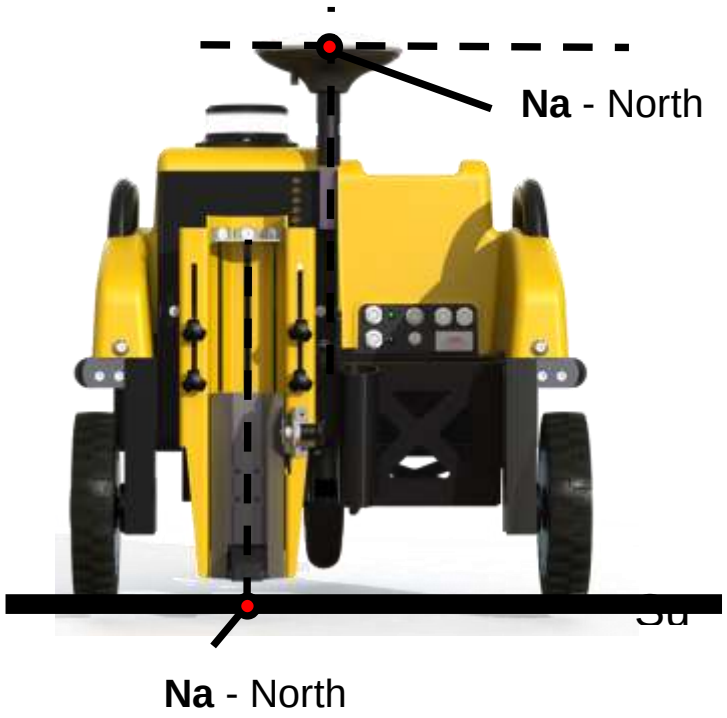
New tab in settings menu



Tool vs. Antenna

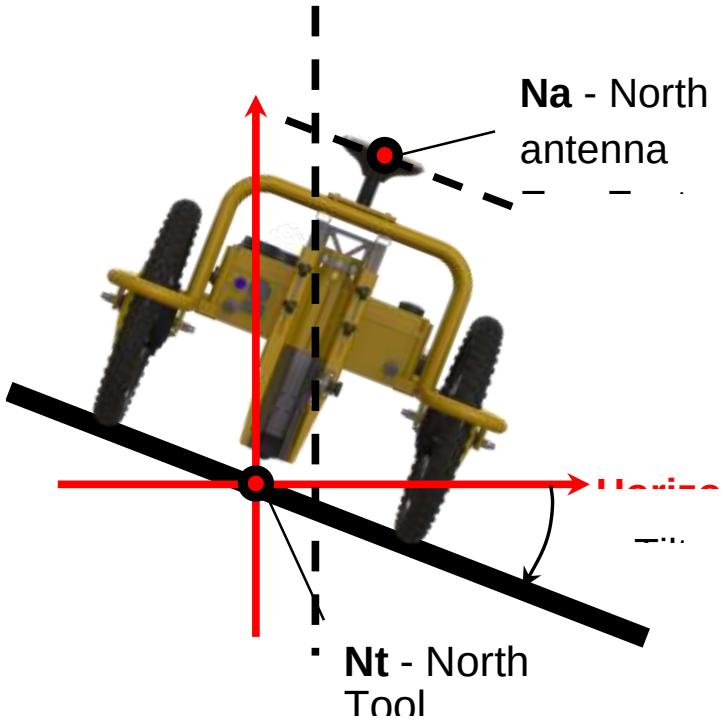
- Flat horizontal surface

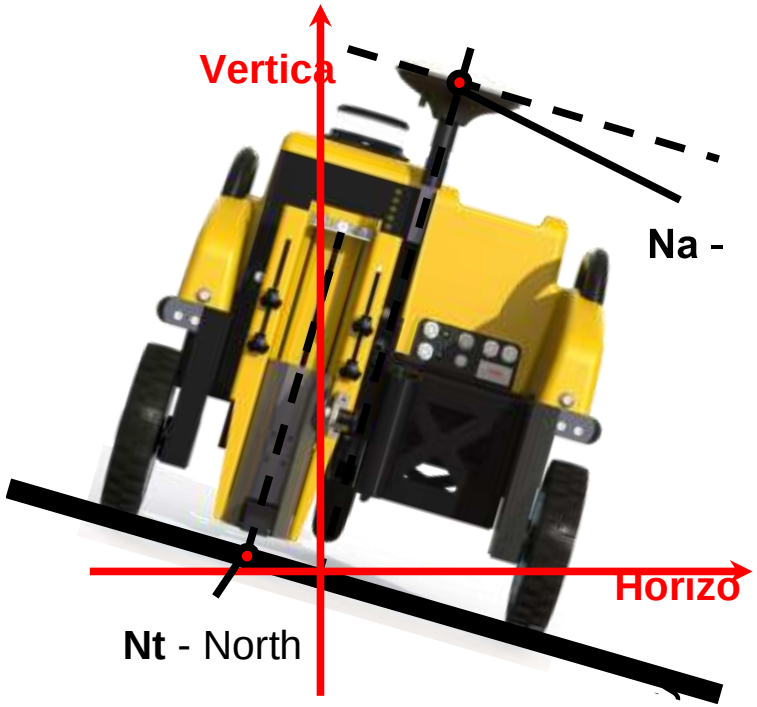




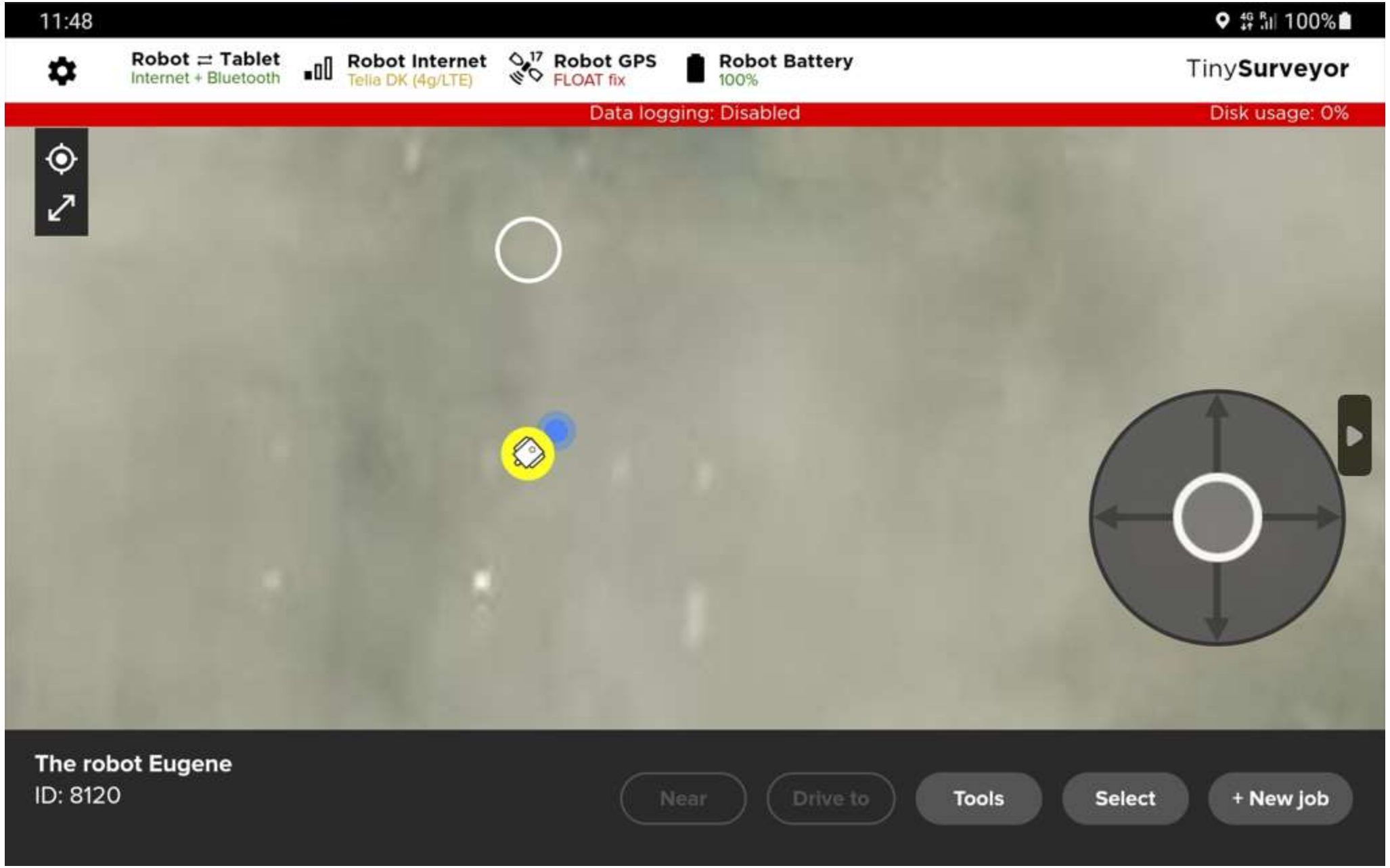
Tool vs. Antenna

- Tilted horizontal surface





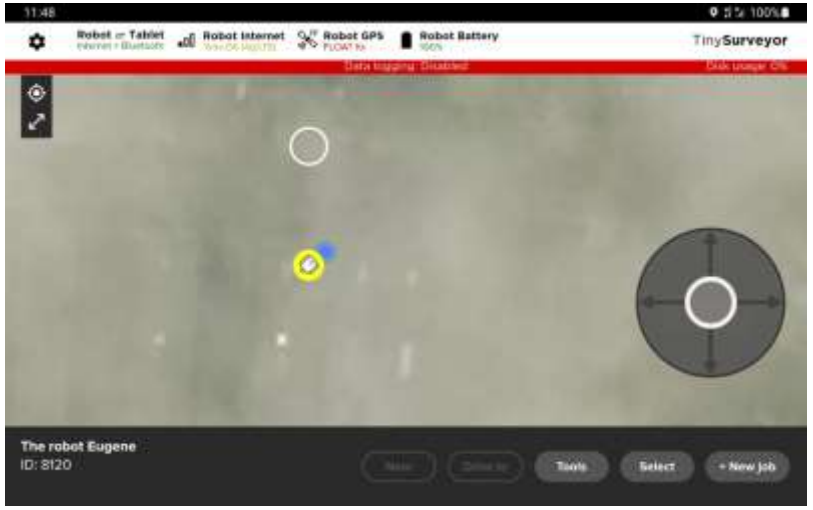
Data Logging Status Bar



Data Logging Status Bar

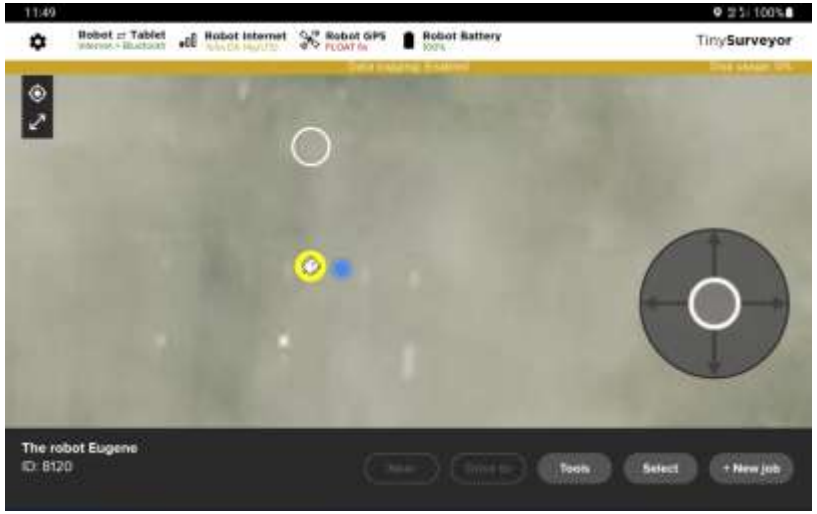
A highly visible status bar has been added to the map screen to ensure you don't forget to activate logging when on the job. It's accompanied by a data storage % to let you know when storage is getting limited on the robot.

Disabled



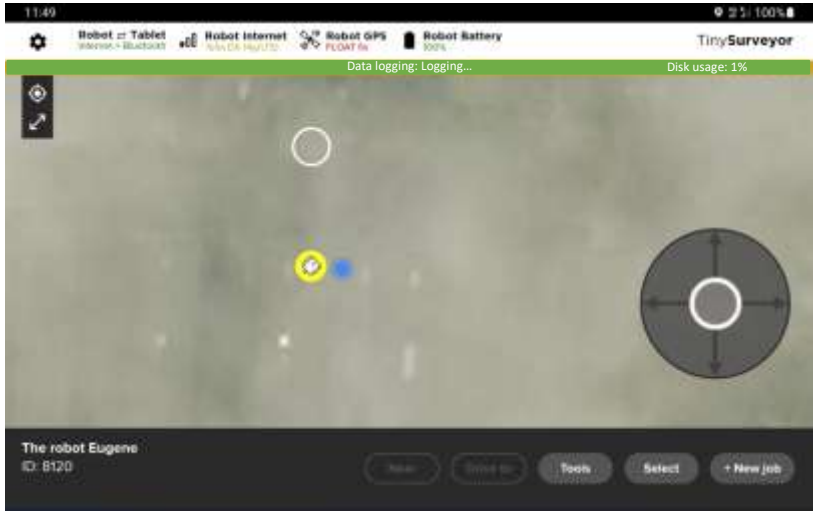
When no logging options are enabled. Don't forget to activate logging options if you want to record data.

Enabled



When one or more logging options are enabled. This means Logging is armed and ready to go.

Logging…



When the robot is executing a task/job and data is being logged.

Thank you

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