

# STENCIL 2-16

POWERED BY KAARTA ENGINE

KAARTA®

## Real-time, high fidelity 3D mobile scanning and generation



Kaarta Stencil® 2-16 is a low cost, flexible mobile mapping platform for rapid mobile scanning; a computer small enough to fit in your hand but powerful enough to process and view any of the data it captures. Stencil's integrated 3D mapping and real-time position estimation allows capabilities not possible with fixed-base scanning systems.

At the heart of Stencil is Kaarta Engine, Kaarta's patent-pending advanced 3D mapping and localization algorithms. Kaarta Engine's proprietary approach surpasses the drift error of alternative SLAM systems by an order of magnitude.

Stencil accurately maps exterior and large interior spaces quickly and easily with a range of up to 100 meters with a lidar accuracy of  $\pm 30$ mm. Data rate is 300,000 points per second up to 10Hz.

Stencil records GNSS data for use in loop closure to georegister or geolocate datasets, correcting for drift and further enhancing the fidelity of large area scans. Kaarta provides an optional GNSS receiver and bracket kit or Stencil integrates with most NMEA 0183 GNSS systems.

Stencil's user interface and on-screen keyboard accessed on the included tablet makes real time operation easy, organized, and intuitive; giving users better control over scanning operations.

Confidence Metrics provide immediate feedback on the quality of scan matching by signaling whether new scan data is registered properly in the existing map, signaling the likelihood of errors and allowing the user to increase the level of confidence by adjusting data collection techniques, or adjusting parameters. Automated Floor Leveling/Sectioning algorithms identify floor structures and levels for better scans and reduced post-processing time. Floor Planner levels, rotates, and generates 2D images of "slices" from a point cloud.

The combination of small size and customizable capture hardware creates a system that is easily adaptable. Stencil base configuration is an aluminum enclosure with machined plates for lidar mounting and adapters as well as mounting points to attach to monopods, ATVs, UAVs, drones, etc. Feature Tracker, a high frame-rate imaging device, enhances operation in open, unstructured environments. Stencil 2-16 includes a Velodyne VLP-16 and accepts Velodyne VLP-32 and HDL-32 with an adapter ring.

Stencil is a turnkey system that contains everything needed to capture and process the captured data. No internet connection, additional computers, software licenses, or subscription needed. Stencil serves as a stand-alone scanning solution but can also be used to complement or augment other scanners.

Stencil's ease of use, breadth of applications, and streamlined workflow make it the perfect choice for infrastructure inspectors, surveyors, engineers, architects, facilities planners, security personnel, or anyone who needs an easy way to document the 3D world quickly and dependably.

### STENCIL 2-16 SPECIFICATIONS

OUTPUT	.ply, .las
MODES	Baseline mapping Add-on mapping for complex & larger areas Compatible with .ply files from Kaarta Contour™ or other devices
IMU	Internal MEMS-based IMU Six DoF: X, Y, Z, Roll, Pitch, Yaw
PROCESSOR	Intel NUC 717 Quad Core
PORTS	2 HDMI 4 USB 3.0 RJ-45 Gigabit Ethernet
STORAGE	1 TB SSD
DISPLAY	iPad 9.7" 32GB Wi-Fi HDMI port supports optional display
OS	Ubuntu Linux OS
LIDAR	Standard adapter fits Velodyne VLP-16 lidar 1m [min] – 100m [max] range 360° horizontal FOV 30° vertical FOV Class 1 Eye-safe per IEC 60825-1:2007 & 2014
GNSS	Optional Emlid Reach RS+ RTK GNSS receiver and bracket Integrates with other NMEA 0183 GNSS systems
ACCURACY	$\pm 30$ mm (lidar)
SPEED	300,000 points/sec [data acquisition] Up to 10 Hz [scanning speed]
FEATURE TRACKER	640 x 360 Resolution 50 Hz frame rate Black & white images
WEIGHT	1730g (3.8lb)
OPERATING TEMPERATURE	0°C [min] – 50°C [max]
HUMIDITY	<85%
POWER	12-19 VDC
BATTERY LIFE	2 hours
MOUNTING PLATFORMS	Hand held Monopod Roadway vehicle, ATV, UAV
INCLUDED ACCESSORIES	23000 mAh, 85W external LiPo battery (USA only) AC power adaptor Base plate for camera or tripod Hard plastic shipping container
OPTIONAL ACCESSORIES	Vehicle Mounting Kit Stencil Accessory Kit GNSS Kit
WARRANTY	1 year
SAFETY	Complies with FCC Part 15, Subpart B Class B Radiated and Conducted Emissions
MODEL NUMBERS	KRT-STN-FT-16-020: Base + VLP-16 + feature tracker KRT-STN-FT-00-020: Base + feature tracker KRT-ACC-GS-00-010 : GNSS Kit KRT-ACC-BK-00-010: GNSS Bracket KRT-STN-SW-00-010: 1 yr software service KRT-STN-HW-01-010: 1 yr extended hardware warranty KRT-STN-HW-02-010: 2 yr extended hardware warranty KRT-ACC-ST-00-010: Stencil Accessory Kit KRT-ACC-VH-00-010: Vehicle Mounting Kit

### KAARTA ENGINE

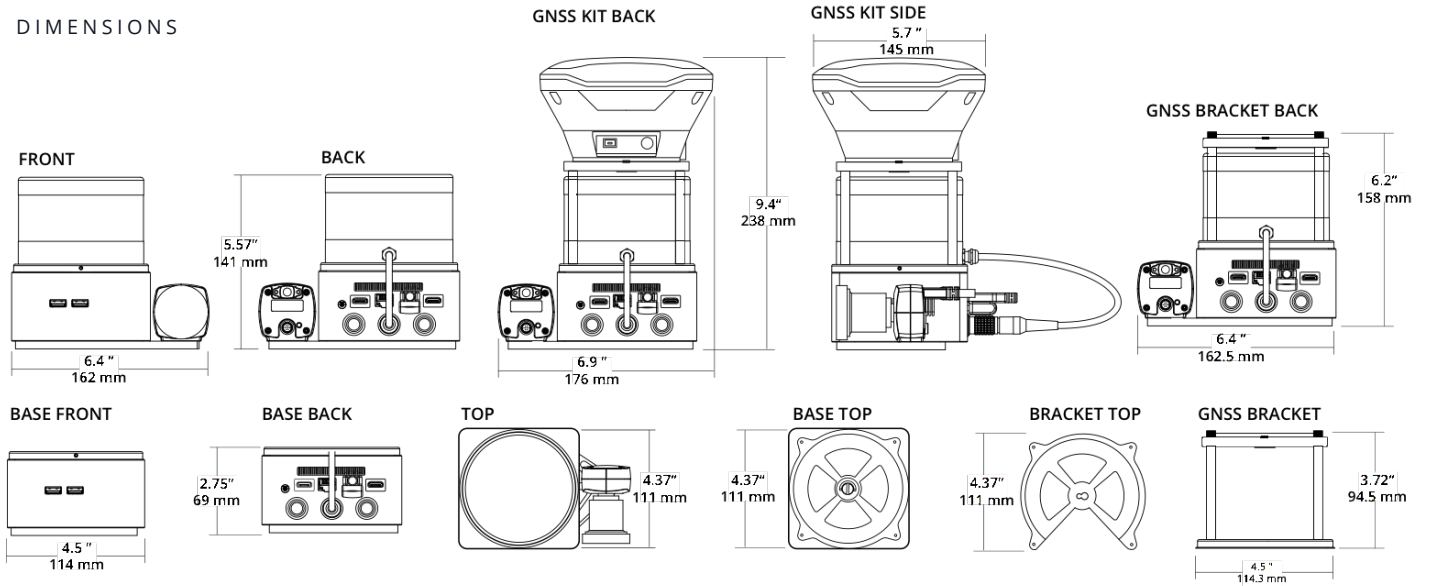


Real-time registered point cloud generation
Real-time localization
Multi-sensor input (lidar, IMU, feature tracker)
Continuously self-correcting minimal drift techniques
Implicit loop closure
Fast, explicit loop closure at point of scan
Point-of-scan work confirmation
Point cloud sharpening technology
Patent-pending technology
1 <sup>st</sup> place Microsoft Indoor Localization Competition 2016 & 2017
1 <sup>st</sup> & 2 <sup>nd</sup> ranking KITTI Vision Benchmark Suite

# STENCIL 2-16

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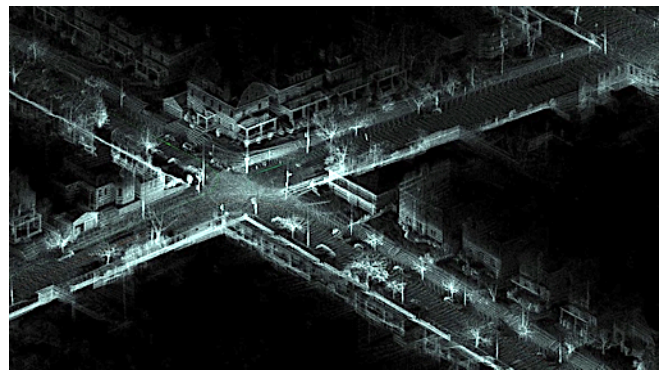
## DIMENSIONS



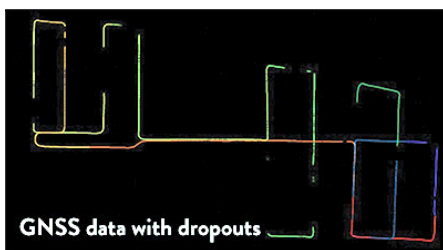
## SAMPLE OUTPUT



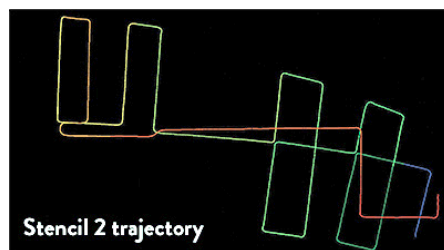
Stanford University Quad scanned in 15 minutes



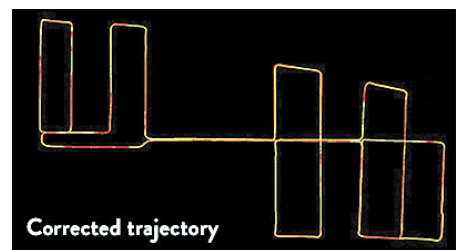
Three passes through an intersection correctly registered in post processing using GNSS in loop closure



GNSS data with dropouts

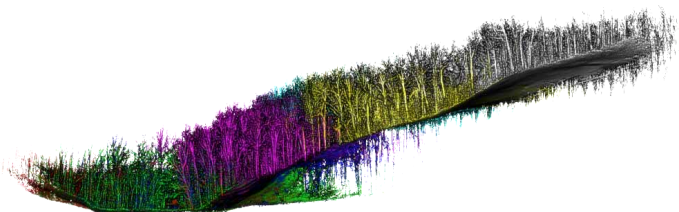


Stencil 2 trajectory

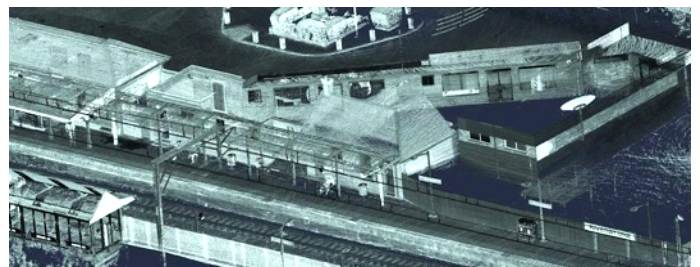


Corrected trajectory

GNSS in loop closure: GNSS data showing dropouts over the course of the data collection [left], trajectory data from Stencil 2 with some drift [center], and corrected trajectory in yellow overlaid on the original GNSS data [right]



Scan of heavily wooded area. Topography can be seen by cropping to terrain.



Stencil captured fine details such as overhead wires at this light rail station. The scan's 72,000,000 points of data were captured in the 20 minute interim time between trains.