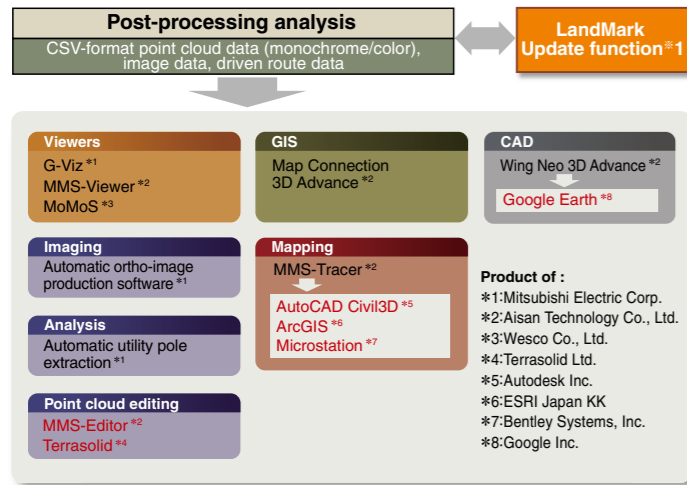


Mobile Mapping System High-accuracy GPS Mobile Measuring Equipment

Various Application Software (Optional)



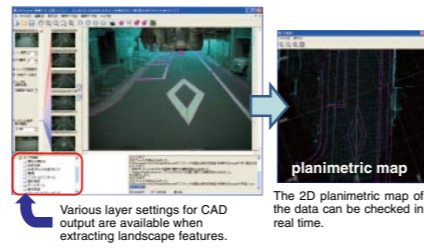
G-Viz Laser Point Cloud Viewer Software

G-Viz can be used to display laser point clouds, verify the coordinates of each point, and perform simple measurements inside the point cloud. It can also be used to display point clouds captured by aircraft lasers.



MMS-Tracer (Aisan Technology Co., Ltd.)

This software can be used to overlay laser point clouds onto camera images, trace road features, and convert data from 3D to 2D planimetric maps. Other options are also offered, such as the automatic extraction of road markings and curbstones.



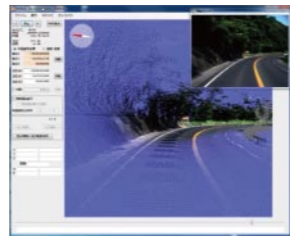
MMS-Viewer (Aisan Technology Co., Ltd.)

MMS-Viewer displays image data captured using the MMS, a bird's eye view of the driving route, colored point cloud data, and longitudinal/cross-sectional data from the vehicle, on a single screen.



MoMoS (Wesco Co., Ltd.)

This software generates triangulated irregular network (TIN) models inside of the point cloud data in real time. When utilized in a three-dimensional model, MoMoS can be used to create movies, extract landscape feature data, create cross-sectional maps, determine visual range, and create imaginary objects in the 3D model for construction planning.



Main Specifications

Item		MMS-X320R	MMS-X (640, 440, 320, 220)
Camera	No. mounted	3	Select set of 2, 3, 4 or 6
	No. of pixels	5 megapixels	
	Field of view	Horizontal: 80°, Vertical 64° (each unit)	
	Mounting direction	CH1: Front Left, CH2: Front Right, CH3: Side Left	CH1: Front Left, CH2: Front Right, CH3: Side Left, CH4: Side Right, CH5: Rear Left, CH6: Rear Right
	Max. capture rate	10 images/sec	
Laser scanner	No. mounted	2 standard lasers, 1 long-range/high-density laser	Standard lasers: Select set of 2 or 4
	Mounting direction (angle)	CH1: Front Down (-25°), CH2: Front Up (25°) long-range/high-density laser: 30° (whole perimeter)	CH1: Front Down (-25°), CH2: Front Up (25°), CH3: Rear Up (45°), CH4: Rear Down (-45°)
Continuous recording capacity	Data log	8 hr (max.)	
	Camera images	90,000 images per unit (max.)	
Absolute accuracy*1,3		Within 10cm (rms) at 80m*4,5	Within 10cm (rms) at 7m
Relative accuracy*2,3		Standard lasers: Within 1cm (rms); Long-range/high-density laser: Within 10cm (rms)*4,5	
Self-positioning accuracy*3		Within 6cm (rms)	
Power consumption		12VDC, 650W or less	12VDC, 900W or less*6
Installation verified vehicles*7		Volkswagen Golf Touran or Toyota Vanguard	

*1: Absolute accuracy: Accuracy of coordinate data (true positions) acquired through a mobile unit-based survey (Accuracy)(rms: root mean square)
 *2: Relative accuracy: Stability of coordinate data acquired through a mobile unit-based survey (Precision)
 *3: Assuming favorable GPS reception
 *4: Driving on a flat road at a constant speed of approx. 40km/h
 *5: Calibration of the long-range/high-density laser scanner is required before each survey
 *6: Power consumption with maximum specifications (6 cameras/4 laser scanners)
 *7: Prior to installing the unit on other vehicles, further experiments and testing will be required.
 ● Company and product names listed are trademarks or registered trademarks of each respective company.

CAUTION To ensure safe and correct use, please read the instruction manual carefully prior to use.

Eco Changes is the Mitsubishi Electric Group's environmental statement, and expresses the Group's stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.

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Please visit our website for further details regarding the MMS.

www.MitsubishiElectric.com/bu/mms/

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MITSUBISHI ELECTRIC
Changes for the Better

for a greener tomorrow

Mobile Mapping System High-accuracy GPS Mobile Measuring Equipment



- ◆ No traffic control required during measurement
- ◆ Achieves 1/500 accuracy without ground control point correction



By utilizing advanced position-estimation technologies developed through Mitsubishi Electric's vast experience in the fields of aerospace and space systems, the MMS accomplishes consistent accuracy during measurement.

Mitsubishi Electric's Mobile Mapping System (MMS) consists of a vehicle-mounted GPS antenna, laser scanners, cameras and other equipment, enabling the efficient acquisition of highly accurate 3D positional information such as buildings, road contours, road signs, guardrails, road lettering, manholes, utility poles/lines and other peripheral data along the road while driving. Having already completed more than 50 public survey projects in Japan, use of the MMS by Japanese local governments and other groups continues to expand. Additionally, the newly developed MMS-X320R equipped with a long-range/ high-density laser can measure distant areas which were not possible to measure before.

MMS Features

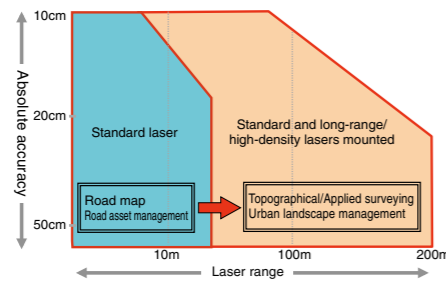
Highly Accurate Measurement

3D positional measurement with an absolute accuracy within 10cm

●A unit consisting of GPS antenna, an inertial measurement unit (IMU), cameras, and standard lasers is mounted on the roof of the vehicle. In areas where satellites are visible, and without the use of ground control points (GCPs), the MMS can measure the road surface and roadside periphery with an absolute accuracy* within 10cm and a relative accuracy* within 1cm at a distance of 7m or less.

●Under the same conditions as stated above, the MMS-X320R equipped with a long-range/high-density laser can survey the area within 80m of the vehicle with an absolute accuracy within 10cm.

●The MMS can maintain highly accurate measurement up to a vehicle speed of 80km/hr.



*Absolute accuracy: Accuracy of coordinate data (true positions) acquired through a mobile unit-based survey (Accuracy)
*Relative accuracy: Stability of coordinate data acquired through a mobile unit-based survey (Precision)

Operability

●If GPS satellites are not visible, such when the vehicle is in a tunnel or driving under an overpass, the positions of landscape features measured by traditional surveying methods (landmarks) can be used to correct errors in the coordinate values measured by the MMS. As a result, highly accurate measurements are possible even in tunnels or when driving under overpasses.

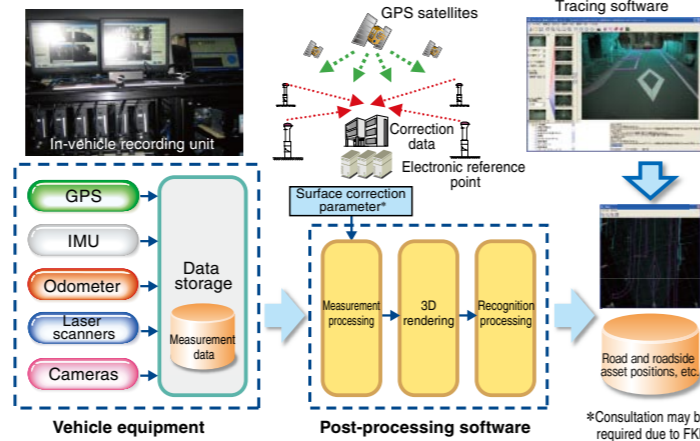
●In addition to displaying equipment status, GPS reception and driving route, estimated error is shown in graph form, simplifying survey operation and ensuring accurate data capture.

●Utilizing surface correction parameters (i.e., *flaechen korrektur parameter* [FKP] method) for GPS correction, accuracy remains consistent even when driving long distances.

●A multiple electronic reference point switching function enables continuous measurement without considering the location of electronic reference points.

●Post-processing of measurement data is performed using a personal computer at an office, and then data is automatically converted to point cloud format.

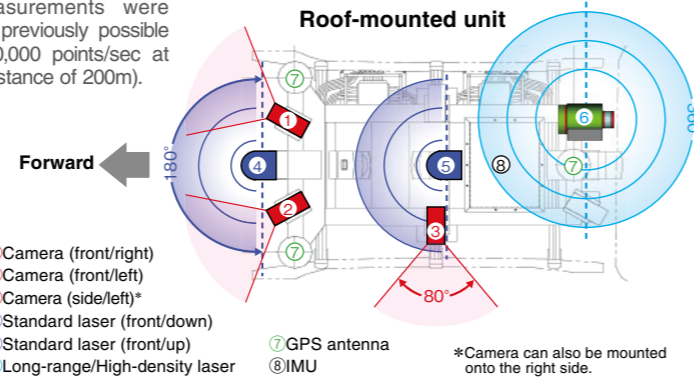
MMS data processing flow



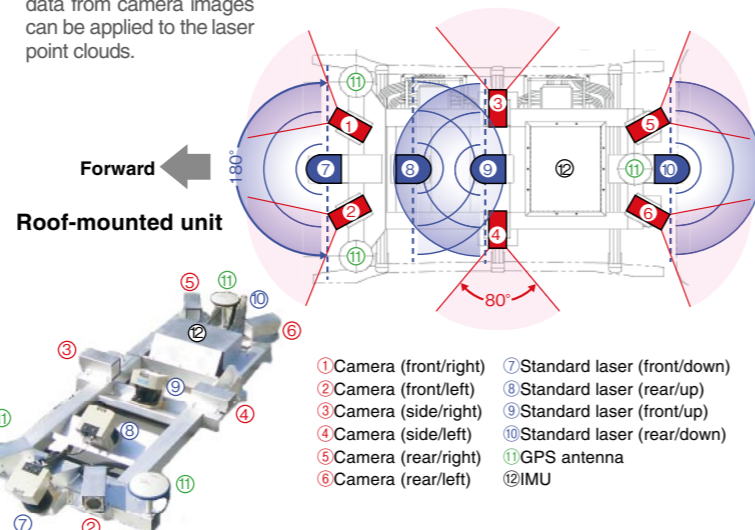
Long-range/High-density Laser Point Clouds

Efficient mapping is possible by superimposing data captured using cameras and lasers

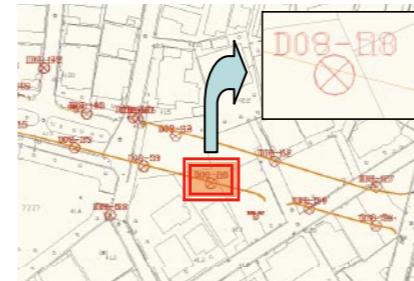
●The MMS-X320R is equipped with three high-definition cameras and a long-range/high-density laser capable of 360-degree measurements. This equipment enables high-density data to be captured in areas where measurements were not previously possible (300,000 points/sec at a distance of 200m).



●The MMS-X640 is equipped with six high-definition, five-megapixel cameras with a wide field of view (horizontal: 80°; vertical: 64°) and four laser scanners to measure the road surface and road periphery. Color data from camera images can be applied to the laser point clouds.

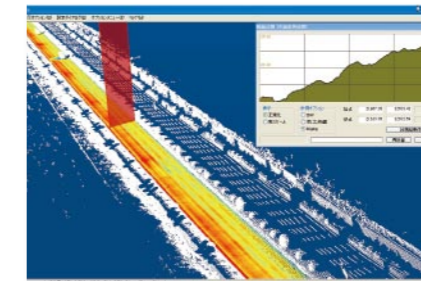
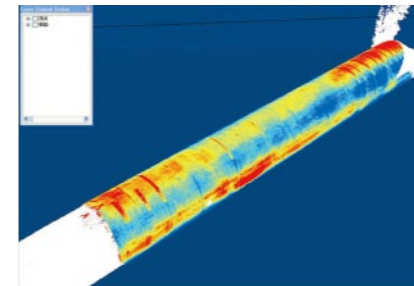


Various Application Examples



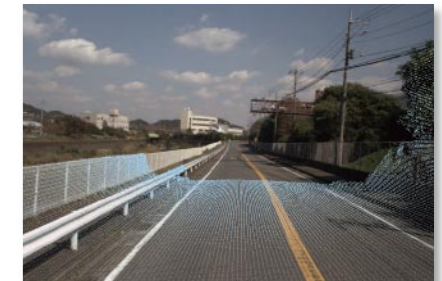
Road registers

Many municipal governments in Japan, such as Toyonaka, uses MMS to ensure map precision and accuracy by superimposing data onto digital maps of the city.



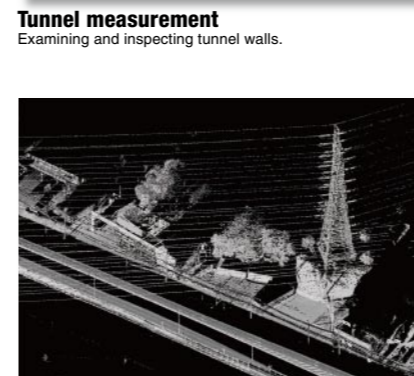
Road surface contours

More precise and efficient road maintenance is possible by measuring the slope of the road (lateral and vertical), road roughness, and the size and depth of tire ruts or other road wear.



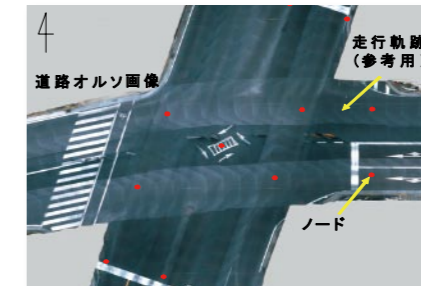
Measurement of roadside features

Useful for the management of roadside features such as utility poles and manholes.



Tunnel measurement

Examining and inspecting tunnel walls.



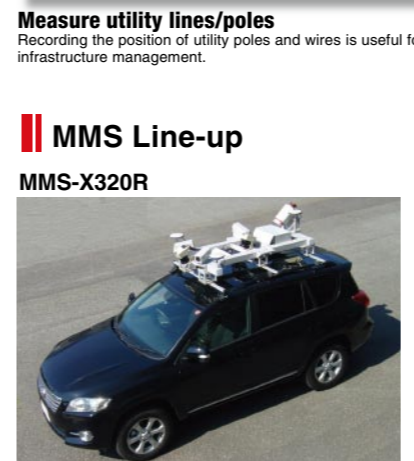
Capture road linearity data

Using highly accurate ortho-images of roads, road linearity data around intersections and road network data can be acquired.



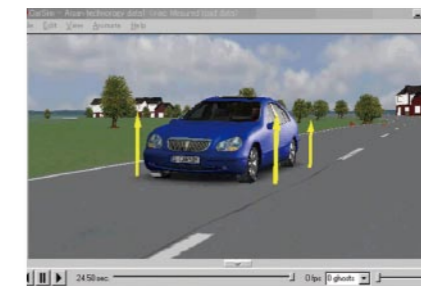
Computer graphic processing based on real-world models

Convenient for creating computer graphics at actual size modeled by laser point cloud data.



Measure utility lines/poles

Recording the position of utility poles and wires is useful for infrastructure management.



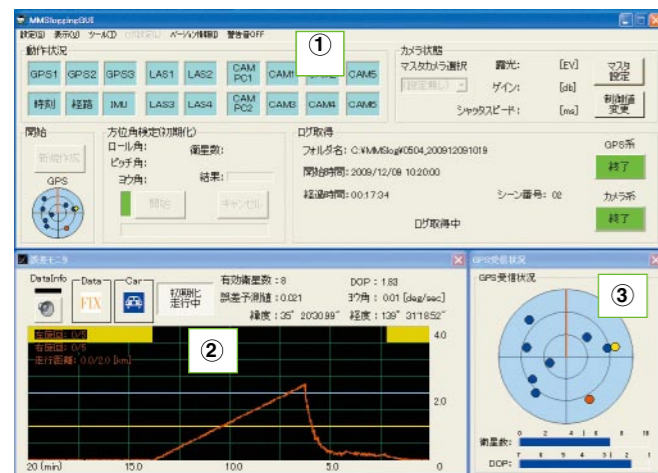
Vehicle motion simulation software

Used in vehicle design and verification. *Carsim® is a product of Virtual Mechanics Corporation.



Integration with aerial laser data

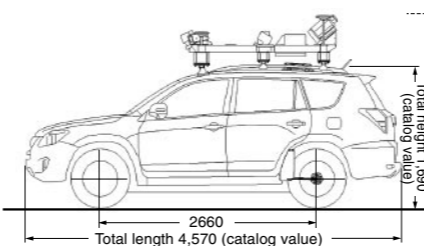
Can be used to complement aerial light detection and ranging (LIDAR) surveys, photos for road locations under overpasses and in tunnels, and GCP data for map correction.



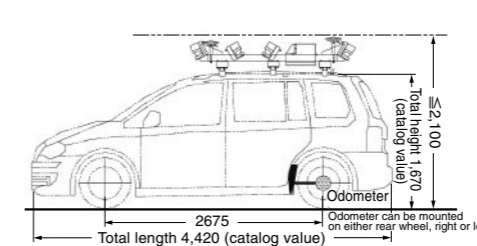
▲Operation screen
Operation screen layout
① Main screen ③ GPS reception status
② Error monitor

MMS Line-up

MMS-X320R



MMS-X (640, 440, 320, 220)



Configuration

Model name	Measurements	Specifications
MMS-X320R	Front/Left Long-range/High-density	3 cameras, 2 standard lasers, 1 long-range/high-density laser
MMS-X640	All directions	6 cameras, 4 standard lasers
MMS-X440	Front/Rear	4 cameras, 4 standard lasers
MMS-X320	Front/Left	3 cameras, 2 standard lasers
MMS-X220	Front	2 cameras, 2 standard lasers

*Customization is possible at additional cost.
*Laser scanners other than the products of RIEGL Laser Measurement Systems GmbH can be installed.
*Please consult the manufacturer regarding changes to camera and laser mounting positions.

Laser models
Standard laser: SICK LMS 291
Long-range/high-density laser: RIEGL VQ-250