



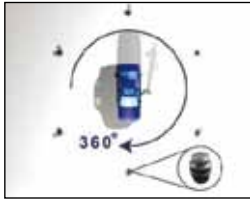
iSpace

Large volume metrology, tracking and positioning



Turn your shopfloor into
a metrology enabled workspace

iSpace drives Metrology Assisted Production



Scalable systems for large volume metrology

iSpace systems can be scaled from small work cells to facility-wide installations by just adding more transmitters. The measurement volume is configured to the size of the application, resulting in 360° part coverage.



Uniform accuracy for industrial large scale application

The typical accuracy of an iSpace system is 200µm. Where traditional metrology equipment accuracy decreases with distance and as a result of leapfrogging-related measurement errors, iSpace accuracy is uniform across the entire measurement volume, regardless of the size of the metrology enabled area.



Inherent robustness

Unlike traditional laser-based metrology tools, iSpace offers 360° part coverage without line-of-sight issues thanks to transmitter redundancy. Continuous health monitoring including on-line compensation in case of transmitter displacement and drift, guarantees optimum system performance without user intervention.



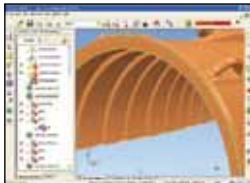
Easy to deploy and straightforward to use

Installing iSpace on the shop floor is easy and straightforward: just set up the transmitters on their portable tripods and calibrate the system by walking around in the measurement volume while holding a calibrated scale bar. As such, shopfloor measurement eliminates the need to transport large heavy parts to/from the measurement room.



Multi-user for concurrent applications

iSpace has the unique ability to serve multiple users simultaneously without performance loss. Once a work cell is iSpace-enabled, additional users and new applications can be added with minimum additional investment. Next to supporting a range of handheld metrology devices, iSpace positions tools or tracks multiple objects simultaneously, such as automated guided vehicles (AGVs) in a manufacturing environment.



Open solution that grows along with your measurement needs

As a modular and scalable solution, iSpace offers a broad application reach. Using off-the-shelf iSpace components, tailor-made tooling and the software development kit (SDK), all elements are present to build a custom solution that perfectly meets your needs.

Inspection applications

Ideally, large parts or components are verified on the shop floor where they are produced. Measuring large heavy parts using traditional metrology tools may require transportation overhead to bring the parts to the measurement equipment. iSpace overcomes these challenges by converting your workspace into a metrology enabled facility where users can easily measure multiple parts.



Aircraft fuselage inspection

- Measure individual points on a fuselage using the i7 Articulated Arm
- iMCA allows for easy measurement of hidden points in the workspace



Full car body inspection

- Operators use the i6 Long Reach Probe to measure multiple car bodies without leap-frogging
- Ideal for concurrent measurement of jigs/tooling



Measurement of features on large turbine casting

- The i6 Probe is used to measure surface features across the entire casting
- Full freedom measurement through wireless connection between PDA and portable client

Expandable measurement volume...



Tailored configurations for each application

The iSpace portfolio consists of 3 standard setups, with 4, 6 or 8 transmitters. More transmitters create a larger measurement volume and further improve line of sight. The 4-series iSpace setup is easy to deploy, providing a smaller and unobstructed measurement volume. The 6-series setup is typically used where left/right measurements are taken on a vehicle body, for example, while the 8-series preserves the best line of sight in a measurement volume with a footprint up to 1.200m².

Each iSpace setup is available in different configurations: the x-series configuration is a portable lightweight system that is easy to set up. The s-series are delivered with **base stations** that provide reference detectors for continuous health monitoring.

The top-line i-series inherently provide highest accuracy and system robustness. They utilize fixed **iSpace monuments** to capture position and scale reference points throughout the workspace. After having determined the positions of the reference points during system setup using an external measurement device, iSpace continuously monitors these monuments to be able to maintain transmitter positions at highest accuracy.

Workstation options for every application

In a single application, data processing and system monitoring is handled by a portable, combined client/server workstation that runs the Surveyor control software and a (3rd party) application. In case of concurrent applications, the data streams and system monitoring are controlled by a metrology server that manages the connectivity between the measurement systems and multiple portable client applications.

Dynamic Tracking Kit

The Dynamic Tracking Kit (DTK) is an add-on to any iSpace system to support dynamic referencing and 6DOF part tracking. The DTK can be semi-permanently fixed to a part or jig and used for 6DOF tracking or dynamic referencing within an iSpace volume. The DTK can be configured to track a part's local coordinate system by following a straightforward alignment procedure.

Tracking applications

iSpace offers dynamic tracking in support of precision assembly of large parts and continuous monitoring of tools and objects. As such, closed-loop iSpace measurements are directly integrated into the production and assembly stages, realizing a first-time-right Metrology Assisted Production process.



Dynamic tracking of ship models in towing tank applications

- Ship models are equipped with a Dynamic Tracking Kit (DTK)
- Ship model behavior is monitored using synchronized dynamic measurement data



Tracking and monitoring of industrial robots

- DTKs are embedded into robot and fixtures
- A single iSpace system monitors multiple robots on a factory-wide scale



Aligning and joining large subassemblies

- Fuselage sections, wings and control surfaces are equipped with iSpace DTKs to track their position
- iSpace systems enable monitoring of drilling and riveting robotic machining systems

... with countless applications



i6 Probe - lightweight 6DOF metrology probe

The i6 Probe is a wireless handheld measurement device that provides exchangeable and inclinable 6DOF measurements within an iSpace or iGPS enabled workspace. Equipped with a stylus probe tip, the i6 Probe allows for accurate large volume inspection in the most flexible way. The i6 Probe can also be configured as a 6DOF localizer for 3rd party instruments. Accuracy is dependent on the iSpace setup, but is equal throughout the complete measurement volume. The i6 Probes ergonomic design and wireless operation make iProbe suitable for long duration measurement.

i6 Long Reach Probe - Dual purpose measurement & setup tool.

The i6 LRP is a wireless handheld measurement and setup device that enables 6DOF measurement as well as bundling of the iSpace system. Equipped with interchangeable tip styli and extensions up to 1m, the i6 LRP allows for flexible large volume inspection of hard to reach features. By acting as the bundle tool, the i6 LRP simplifies the iSpace setup and ensures high accuracy across large volume without the need for a Scale bar.

i7 Articulated Arm – iSpace enabled articulated arm

The moveable i7 Articulated Arm tripod stand is designed to support a metrology grade MCA articulated measuring arm to operate anywhere within the iSpace enabled workspace. The iSpace determined position and orientation of the i7 Articulated Arm stand is combined with the coordinate information received from the MCA arm in order to measure a single point within the iSpace coordinate system. This 'extends' the working volume of the articulated arm and provides a large, continuous working cell without having to 'leapfrog' measurements.

Localizing applications

Localizing third party tools and instruments is essential in a wide range of large volume applications. iGPS technology enables 6DOF localization of any tool to enhance process capability or improve quality assurance for applications such as coating thickness measurement, drill marking, robot-guided painting, etc.



Targetless Laser Projection For Aircraft Final Finishes

- Laser projectors are equipped with iSpace enabled frames & the target aircraft is equipped with DTKs
- The aircraft & projectors are automatically aligned by the iSpace system enabling complete part coverage for final finishes layouts



Gap & Flush Measurements for Fasteners & Weld Seams

- A 2D laser gap and flush gauge is iSpace enabled via a custom i6 Probe adapter
- Positional information is linked with gap/flush measurements enhancing quality records and simplifying rework processes



Coating thickness measurement in aerospace applications

- i6 Probe is equipped with a coating thickness tool
- Exact position recording of coating measurement

Full freedom operation in large volumes



iGPS technology provides the building blocks for the iSpace systems

iGPS is a scalable measurement concept that converts a workspace into a metrology enabled work volume. The operation of an iGPS system is comparable to a global positioning system (GPS) in a car, but it is designed for industrial applications on a facility-wide scale. GPS satellites are replaced by infrared iGPS laser transmitters that activate a measurement field as large as an entire room or facility.

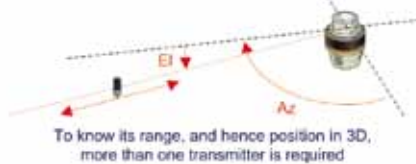
iGPS features accuracies that are roughly a hundred thousand times higher than consumer GPS systems. Tools, parts, probes and equipment, such as AGVs, can be equipped with iGPS receivers that are tracked by the transmitters. As such, positions can be measured or dynamically tracked with a high degree of confidence in order to provide accurate metrology data or to facilitate tracking and positioning applications.

To obtain accurate positioning, receivers need line of sight from minimum 2 transmitter fields. Adding more transmitters enlarges the measurement area, improves robustness by guaranteeing line of sight, and further increases measurement accuracy. iGPS is a flexible metrology solution that offers full freedom operation for indoor and outdoor use. The iSpace systems are standardized configurations built with iGPS components focusing on ease of installation and use.

2 output signals are used by a sensor to establish azimuth and elevation position from a transmitter



With Azimuth and Elevation a sensor's position is known along a line to the transmitter



Extra transmitters increase the positional accuracy as better triangulation possible



iSpace delivers significant value to the customer, right from the start!

Configurations and specifications

iSpace setups, configurations, tools and options

	4 series	6 series	8 series
Transmitter count	4	6	8
Available configurations ¹	x, s	x, s, i	x, s, i
Typical measurement volume footprint	from 10x10m up to 40x40m		
Typical use case	Smaller volume / Unobstructed line of sight / Lower accuracy	General purpose / Standard system size / Moderate line of sight obstructions	Larger volumes / Obstructed line of sight / Maximum accuracy

¹ Configurations can be customized to suite the application and desired measurement volume.

	x	s	i
Hardware configuration	Free network of transmitters	Transmitters plus base stations	Transmitters plus monuments
Calibration method	Traceable length of scale	Traceable length of scale	Traceable monument network
3D Point uncertainty ^{1,2,3}	< 200µm + 10ppm	< 200µm + 10ppm	< 200µm over monument volume
Point to Point uncertainty	< 200µm over 3x scale-bar length	< 200µm over 3x length of scale	< 200µm over monument volume
Typical use case	Portable/Deployable setup Short term measurement and tracking Engineering or R&D focused Less health monitoring	Semi-portable or semi-fixed installations Longer term measurement and tracking Production focused High level of health monitoring	Fixed installation Always-on production system Maximum system robustness accuracy and reliability

¹ For optimum performance, it is recommended to keep the distance between sensors and transmitters between 3 and 35m and guarantee individual sensors to be within line of sight of at least 4 transmitters.

² System performance testing in conjunction with an independent accredited measurement standards lab. iSpace is a network based metrology system that does not follow traditional uncertainty models. Coordinate uncertainties are interdependent, do not scale with range for monument systems and are repeatable within the volume.

³ x and s system performance when bundled with a 2m length of scale. Scale factor increases to 20ppm when using a 1m length of scale.

Tools and options	Available series	Description
Fixed Workstation	6, 8	Allows multiple independent clients to be used in the same iSpace network leveraging scalability
Dynamic Tracking Kit	4, 6, 8	Kit of 4 vector bar sensors allowing 6DOF tracking of an object in the iSpace volume
i5 Probe (5DOF)	4, 6, 8	2 sensor vector tool providing handheld inspection capability
i6 Probe (6DOF)	4, 6, 8	4 sensor 6 DOF tool providing handheld inspection capability with customizable probe tips
i6 Long Reach Probe	4, 6, 8	4 sensor 6 DOF dual purpose inspection and bundle tool
i7 Articulated Arm	6, 8	Support base for MC4 articulated arm that utilizes the iSpace system for automatic alignment

Related products

- Hardware: iGPS / Laser Radar / MCA articulated arms
- Supported software: Nikon Metrology Surveyor / NRK Spatial Analyzer / Tango!3D / Verisurf / Mobigage
- Software development kit (SDK) for 3rd party integrations



Environmental requirements

Operating temperature (standard performance)	10°C to 30°C (50°F to 86°F)
Storage temperature	-20°C to 50°C (-4°F to 122°F)
Relative humidity	10% to 75% (non-condensing)



NIKON METROLOGY NV

Geldenaaksebaan 329
B-3001 Leuven, Belgium
phone: +32 16 74 01 00 fax: +32 16 74 01 03
info@nikonmetrology.com

NIKON CORPORATION

Shin-Yurakucho Bldg., 12-1, Yurakucho 1-chome
Chiyoda-ku, Tokyo 100-8331 Japan
phone: +81 3 3773 9026 fax: +81 3 3773 9062
www.nikon-instruments.jp/eng/

NIKON METROLOGY EUROPE NV
tel. +32 16 74 01 01
sales_europe@nikonmetrology.com

NIKON METROLOGY GMBH
tel. +49 6023 91733-0
sales_germany@nikonmetrology.com

NIKON METROLOGY SARL
tel. +33 1 60 86 09 76
sales_france@nikonmetrology.com

NIKON METROLOGY, INC.
tel. +1 810 2204360
sales_us@nikonmetrology.com
us.nikonmetrology.com
www.nikoninstruments.com

NIKON METROLOGY UK LTD.
tel. +44 1332 811349
sales_uk@nikonmetrology.com

NIKON INSTRUMENTS (SHANGHAI) CO. LTD.
tel. +86 21 5836 0050
tel. +86 10 5869 2255 (Beijing office)
tel. +86 20 3882 0550 (Guangzhou office)

NIKON SINGAPORE PTE. LTD.
tel. +65 6559 3618

NIKON MALAYSIA SDN. BHD.
tel. +60 3 7809 3609

NIKON INSTRUMENTS KOREA CO. LTD.
tel. +82 2 2186 8400

More offices and resellers at www.nikonmetrology.com