

innovmetric



# PolyWorks<sup>®</sup>

The Universal 3D Metrology  
Software Platform<sup>™</sup>



In today's competitive market, the time needed to bring a new product to market is a critical factor to commercial success. To face this challenge, leading-edge manufacturing organizations have integrated three-dimensional (3D) metrology tools into their product engineering cycle.

## 3D measurement devices

3D metrology is the science of measuring in 3D the surfaces of objects. The measurement devices used in industrial 3D metrology can be divided into two categories:

### Single-point measurement devices

Systems that operate by targeting and measuring one or several specific points at a time, such as articulated arms, coordinate measuring machines (CMMs), laser and optical trackers, and photogrammetry-based devices.

### High-density point-cloud digitizing devices

Systems that operate by projecting energy on a physical part (such as infrared light, fringe patterns, laser line, or x-ray) and sensing back the reflected energy with a camera. They can quickly capture surface points by the millions without the need for any contact.



## 3D metrology benefits

The access to measured 3D datasets of tools, parts, and assemblies enables a wide range of benefits for industrial manufacturers, such as a better understanding of their manufacturing process; a quicker resolution of manufacturing or assembly issues; the possibility to create a CAD model of a measured part or to update the CAD model of a modified tool; or the capability to certify tools prior to production.



## Maximizing the benefits of 3D measurement technologies for industrial manufacturing organizations

Defining the cutting edge of 3D metrology, the PolyWorks software suite maximizes productivity, quality, and profitability when integrating 3D measurement technologies into an industrial manufacturing process. From part and tool design and prototyping down to final inspection of assembled products, PolyWorks offers advanced solutions to cover the complete product development cycle. Interfacing directly with major brands and technologies of single-point and point cloud 3D measurement devices through plug-in extension modules, this universal platform also supports a wide array of native point cloud and polygonal model file formats. With its fully customizable user interface and powerful, user-friendly macro programming language, PolyWorks offers the most adaptable software solution on the 3D metrology market. This flexibility allows our customers to successfully develop and deploy automatic inspection processes or guided operator-driven workflows for effective shop floor operations.

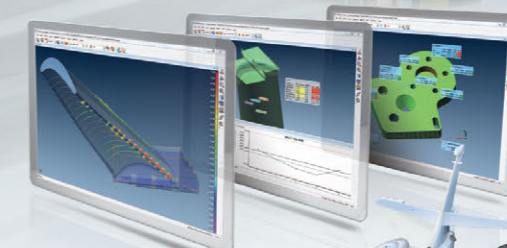


**PolyWorks | Inspector™**

The industry-standard 3D metrology toolbox for product engineering, assembly guidance, and final inspection.

**PolyWorks | Modeler™**

The modeling and reverse-engineering solution that enables true interoperability between digitized polygonal models and CAD/CAM applications.



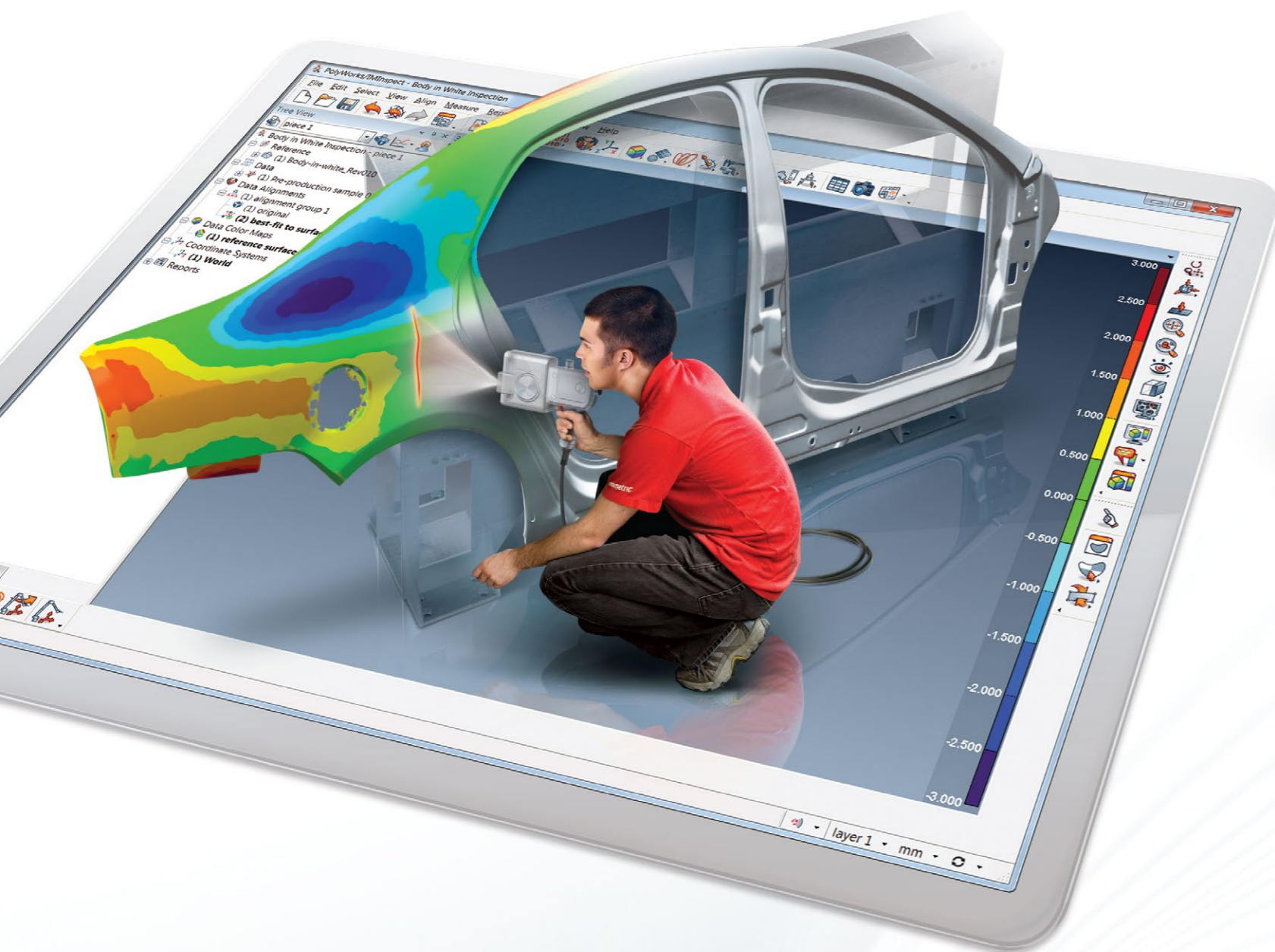
**PolyWorks | Viewer™**

The effective solution to deliver metrology results in 3D to everyone in the organization.

**PolyWorks | Talisman™**

The mobile app that boosts measurement productivity on the shop floor.

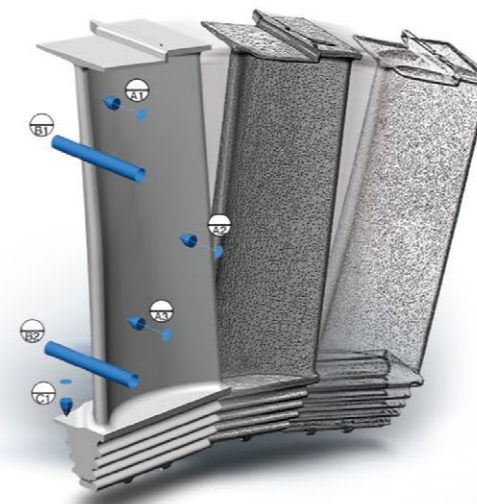




# PolyWorks | Inspector™

From product engineering to manufacturing —  
a 3D metrology solution to gain control of the entire process

PolyWorks|Inspector is a powerful industrial 3D metrology software solution to control tool or part dimensions, diagnose and prevent manufacturing and assembly issues, guide assembly building through real-time measurements, and oversee the quality of assembled products by using non-contact point cloud digitizers and single-point contact-based probing devices.



## Align

### Get the alignment right

Inspecting and analyzing a measured part is only possible if the digitized data is properly positioned and oriented in 3D. Typically, a measured part is aligned to its nominal CAD model to enable the extraction and comparison of nominal and measured dimensions. It can also be assembled with the surrounding mating parts in virtual 3D to check for interference issues or to analyze flush and gap deviations.

PolyWorks|Inspector offers a broad range of part alignment techniques that let users construct alignments with:

- Surfaces or cross-sections (measured-to-nominal best-fit, constrainable in rotation/translation, and within tolerance zone)
- Features (3-2-1, pairs of center points, and GD&T datum reference frames)
- Reference points and lines (RPS, surface points, and six-point nest)
- Virtual gauges (caliper, flush & gap, and airfoil)

## Measure

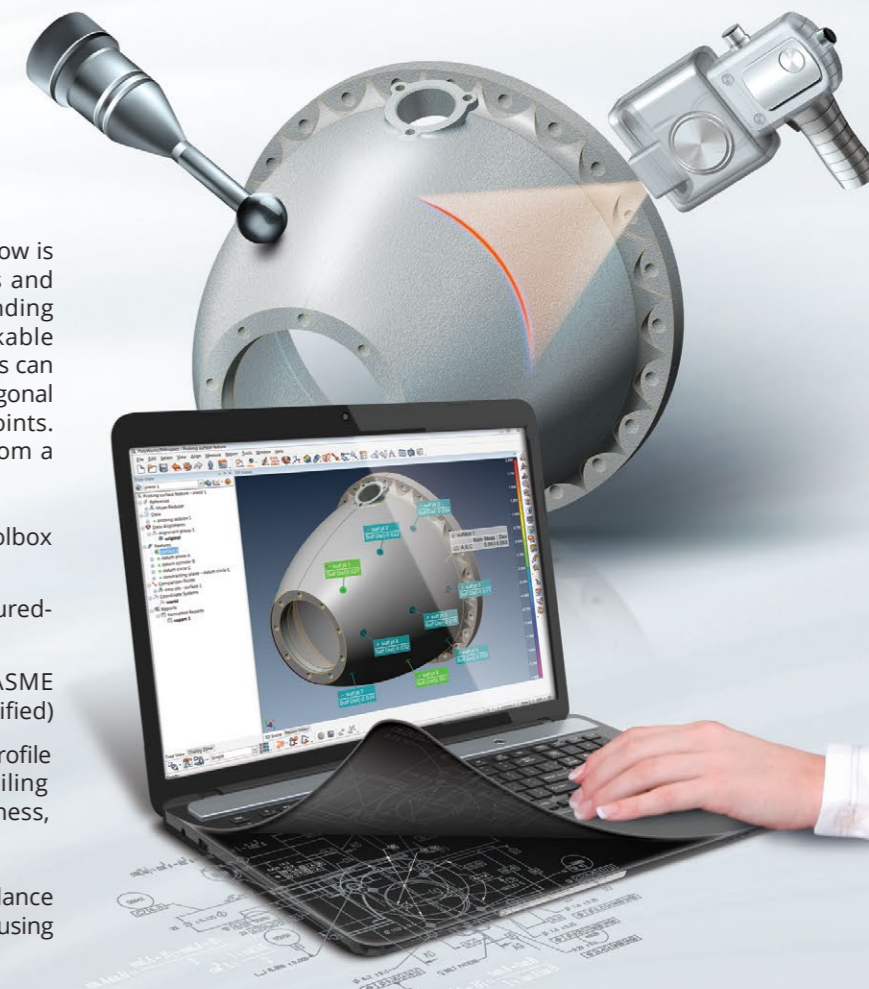
### Extract all required dimensions

At the core of the PolyWorks|Inspector workflow is the extraction of measured part dimensions and computing the deviations to their corresponding nominal dimensions. Thanks to the remarkable flexibility integrated into PolyWorks, dimensions can be extracted from measured point clouds, polygonal models built from point clouds, or probed points. Nominal dimensions can also be extracted from a CAD model or a measured reference part.

PolyWorks|Inspector delivers the complete toolbox you need to extract and analyze:

- Surface, boundary, and cross-sectional measured-to-nominal deviations
- Feature dimensions and GD&T controls (ASME Y14.5-2009 and ISO 1101, as well as PTB certified)
- Advanced dimensions such as flush and gap, profile radius, airfoil dimensions (leading edge, trailing edge, and global), assembly clearance, thickness, and more

PolyWorks|Inspector also offers real-time guidance to accurately build and inspect fixtures and jigs using single-point measurement devices.



# Report

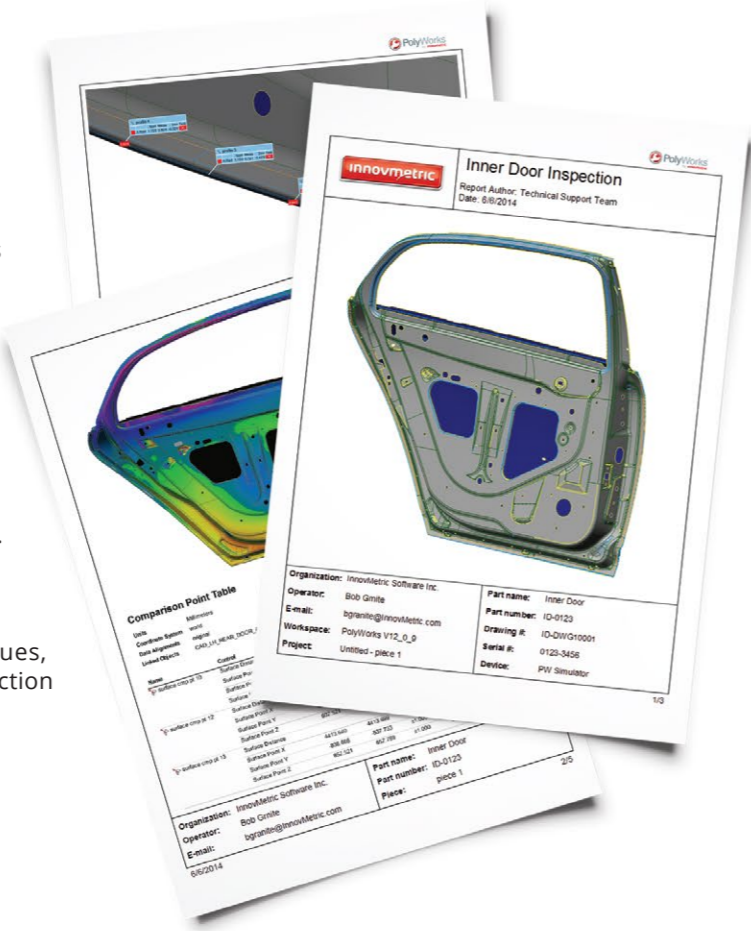
## Generate updateable reports

PolyWorks|Inspector provides an outstanding updateable reporting technology that guarantees the exactness of a report and dramatically accelerates multipiece inspection.

Report items, such as 3D scene screenshots and result tables, are automatically updated if a project is altered. You can modify the parameters of a project, or replace the measured data points of the current piece by the data points from a new piece, knowing that the entire inspection report will be automatically updated.

## Share inspection results

The PolyWorks|Viewer enables your colleagues, managers, and suppliers to review your inspection projects in 3D.



# Multiple piece inspection

## Simplify the inspection of multiple pieces

Preparing an inspection project for a multi-piece inspection task has never been this easy. With DirectReplay™, PolyWorks|Inspector literally does the work for you.

- 1 Create an inspection project and a report for a first piece.
- 2 Let DirectReplay automatically replay the same inspection on subsequent pieces.
- 3 Focus on acquiring the 3D measurement data of the new pieces with your point cloud digitizer, single-point measurement device, or both.

Thanks to the relational inspection architecture of PolyWorks|Inspector, zero teaching is now a reality.

## Monitor your process with statistical process control (SPC)

Thanks to its multipiece project format, PolyWorks|Inspector is capable of automatically computing and updating an SPC database of multi-piece statistics for object dimensions and surface deviations. SPC databases and related analysis tools, including trend charts and statistical color maps, are very powerful tools to diagnose manufacturing or assembly issues, or to approve a tool or a part before production.



4 PACKAGES AVAILABLE

	PROBING	PROBING++	STANDARD	PREMIUM
Single-point measuring device support for portable metrology	•	•	•	•
Single-point measuring device support for CNC CMMs		•		•
Point cloud digitizer support for portable metrology			•	•
Point cloud digitizer support for CNC CMMs				•
Real-time quality meshing and offline point cloud meshing				•
IGES/STEP neutral CAD file translator	•	•	•	•
Part alignment toolset	•	•	•	•
Dimensional control toolset	•	•	•	•
Smart GD&T toolset	•	•	•	•
Statistical Process Control toolset (SPC)	•	•	•	•
One-year support/maintenance	•	•	•	•

### AVAILABLE OPTIONS

Native CAD file translators	Option	Option	Option	Option
Airfoil gauges	Option	Option	Option	Option

**Single-point measuring device support for portable metrology:** All available plug-ins for articulated arms, optically-tracked probes, laser trackers, manual CMMs, and theodolites.

**Single-point measuring device support for CNC CMMs:** CNC CMM plug-in with direct communication with CMM controllers, plus I++ plug-in in CNC mode.

**Point cloud digitizer support for portable metrology:** All available point-cloud-digitizing plug-ins and import capabilities for a wide range of native point cloud file formats for laser line scanners, fringe-projection digitizers, long-range spherical grid scanners, and more.

**Point cloud digitizer support for CNC CMMs:** Laser scanning tool supported within the CNC CMM plug-in.

**Real-time quality meshing and offline point cloud meshing:** Transformation of digitized point clouds into polygonal models using real-time quality meshing for online processing while laser scanning a part, and offline meshing of point cloud data files.

**IGES/STEP neutral CAD file translator:** IGES and STEP file import.

**Part alignment toolset:** Powerful set of data-to-CAD alignment techniques that include constrained surface and cross-sectional best-fits, best-fits within tolerance, as well as techniques based on features, reference points, flush and gap gauges, and more.

**Dimensional control toolset:** Widest range of dimensional control tools on the market for a complete analysis of surface, boundary, and cross-sectional deviations, feature dimensions, flush and gap, profile radius, clearance, thickness, and more.

**Smart GD&T toolset:** GD&T engine based on algorithms prescribed by the ASME Y14.5-2009 and ISO standards, advanced Datum Reference Frame capabilities (supports datum feature patterns, composite datum features, and datum targets), material condition and datum modifiers, radial and slab-like tolerance zones, and more.

**Statistical Process Control toolset (SPC):** SPC engine that automatically computes and updates a database of multipiece statistics for object dimensions and surface deviations. Includes trend charts, statistical color maps, and related analysis tools.

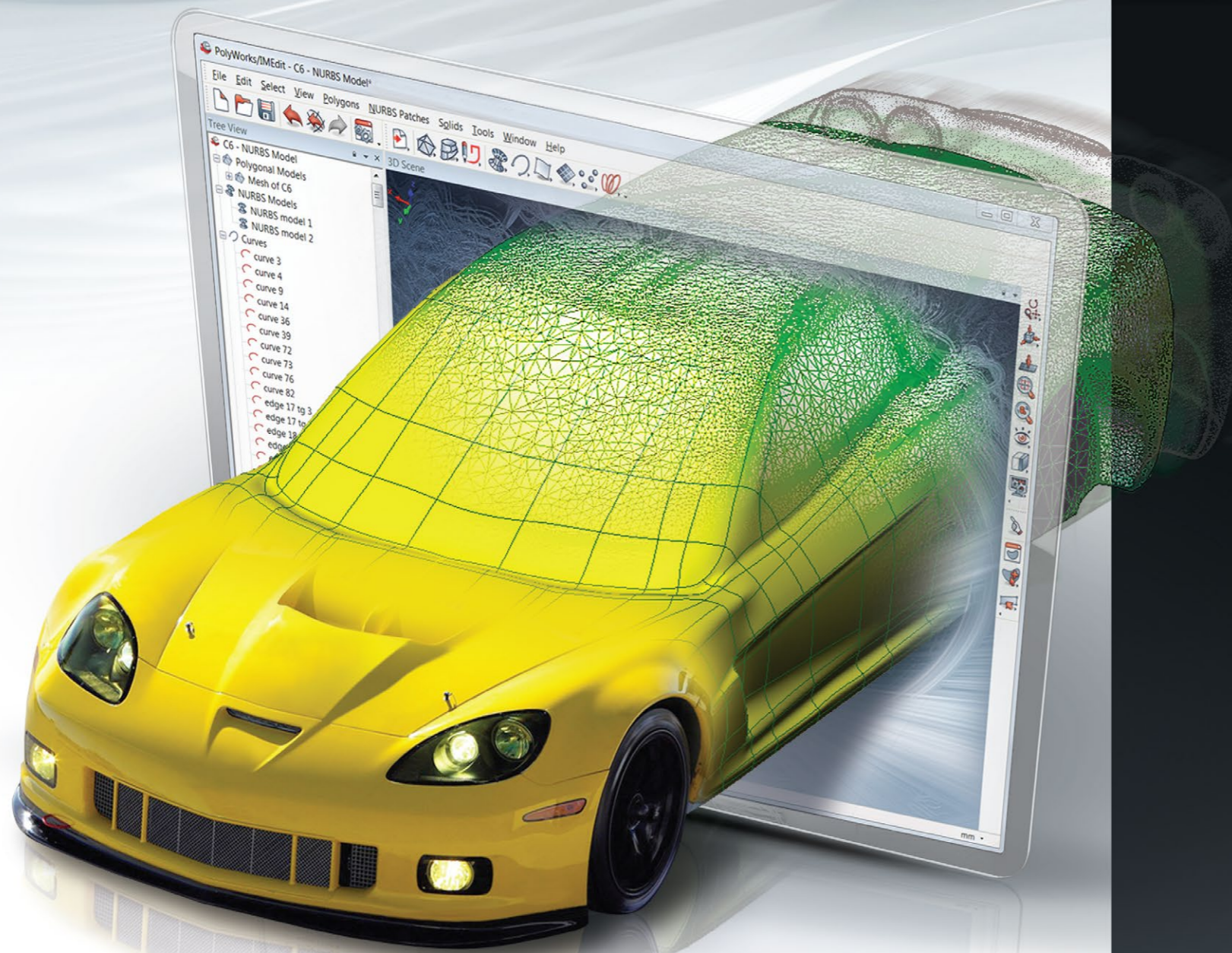
**Native CAD file translators:** Optional translators used to import CAD models produced by professional CAD solutions: CATIA V6/V5, CATIA V4, NX (UG), Creo (Pro/E), Inventor, and SolidWorks.

**Airfoil gauges:** Optional comprehensive dimensional analysis solution for fan, compressor, and turbine blades.

## What you get with your purchase

**One year of support/maintenance that includes:**

- New major PolyWorks releases launched during the year.
- Monthly intermediate releases that include software enhancements, bug fixes, and plug-in updates.
- Assistance from our technical support team by e-mail and telephone.
- Access to the Technical Support Zone.



Reverse-engineering solutions that leverage  
your professional CAD/CAM software

PolyWorks | Modeler is a comprehensive reverse-engineering software solution that allows extracting optimal CAD entities—curves, surfaces, parametric sketches, and prismatic features—from polygonal models of digitized parts to serve as the starting point in your professional CAD modeling solution.

## Polygonal modeling

### Manufacture from polygonal models

The first step in a reverse-engineering workflow consists in transforming digitized point clouds into a polygonal model, an operation also called "meshing". Sophisticated data-processing techniques, including point smoothing and curvature-based sampling, can be applied to raw point clouds during the meshing phase. As a result, polygonal models tend to be more compact, more accurate, and less noisy in comparison to the raw measurements.

Several industrial applications are capable of directly handling polygonal model representations. For example, polygonal models can be either directly milled, built using a 3D printer, or entered into aerodynamic simulation software. PolyWorks | Modeler provides two categories of polygon-editing tools to prepare polygonal models for these applications:

- A first set of tools is designed to repair and optimize imperfectly digitized geometry. For example, it may be necessary to interpolate new polygons over unmeasured areas to create a complete surface representation.
- A second set of tools offers CAD operations on polygonal models, such as extrusion, offset, fillet, and Boolean operations.

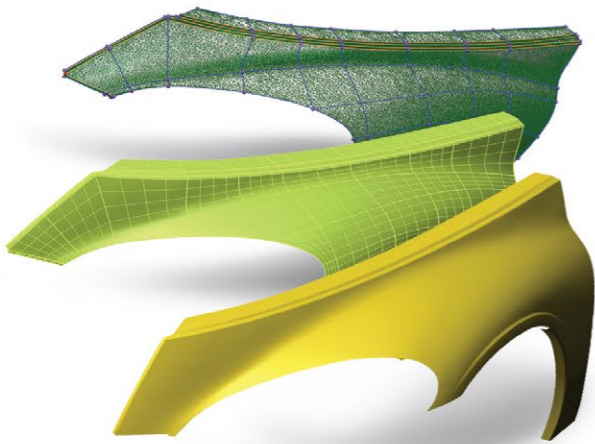


# Surface modeling

## Generate CAD-friendly freeform surfaces

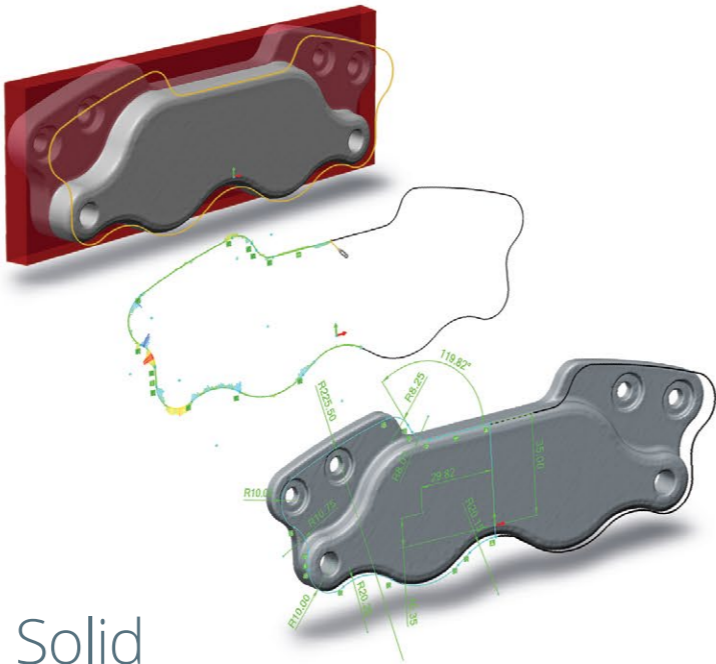
Professional CAD/CAM solutions do not typically offer 3D modeling tools for polygonal models. One common way to transfer the surface of a digitized object into CAD/CAM software consists in fitting a network of NURBS surfaces over a polygonal model built from digitized point clouds. NURBS surfaces are ideal to mathematically describe freeform surfaces, plus they are CAD/CAM friendly.

PolyWorks|Modeler offers an intuitive surfacing approach in which curves are first laid down on a polygonal model, and then automatically intersected to form four-sided or N-sided trimmed NURBS patches. Next, the NURBS patches are used to control the fitting of a continuous network of NURBS surfaces. Fitted surfaces can then be exported to IGES or STEP files and directly imported into your favorite CAD/CAM application for further processing.



PolyWorks|Modeler's NURBS surfacing technology offers a remarkable balance between lead time and surface quality, thanks to:

- Intuitive curve reshaping methods and curvature-continuous curves
- The best NURBS surface-fitting engine on the reverse-engineering market in terms of quality (accuracy, smoothness, and continuity) and flexibility (trimmed surfaces and T-junctions, curvature-based two-step fitting process, and the possibility of blending fitted surfaces to an existing CAD model for local CAD reconstruction purposes)
- G2-, G1-, or G0-continuity control over NURBS patch boundaries
- Automatic G2 surface fitting in areas where NURBS patches have a rectangular topology



# Solid modeling

## Build solid CAD models from optimized geometric entities

The solid modeling philosophy of PolyWorks|Modeler consists in optimizing the extraction of geometric entities on digitized polygonal models, and then transferring these entities to your corporate feature-based solid CAD modeler to guarantee the creation of parametric, associative, and fully editable solid models.

A fundamental building block in a solid modeling workflow is the parametric 2D sketch. 2D sketches consist in planar entities, such as arcs, lines, circles, and splines, defined on a plane embedded in 3D space. In solid-modeling software, sketches are used to create solid base features by performing Extrude, Revolve, Sweep, and Loft operations. Sketches are created by:

- 1 Defining a sketch plane
- 2 Computing a sketch outline by slicing cross-sections of the digitized model or extracting its silhouette edge
- 3 Anchoring and fitting sketch entities and dimensions, guided by the sketch outline

The parametric sketches are then transferred to the solid CAD modeler by using add-ins (for CATIA, NX, Creo, SolidWorks, and Inventor) or a neutral format (IGES). You can then combine the sketches and fitted NURBS surfaces, use the dimensions from fitted prismatic geometry, and design the solid model you want—all done directly in the professional CAD solution that you're most familiar with. The solid modeling possibilities are unlimited with PolyWorks|Modeler, so let your creativity lead the way!



2 PACKAGES AVAILABLE

	STANDARD	PREMIUM
Point cloud digitizer support for portable metrology	•	•
Single-point measuring device support for portable metrology	•	•
Real-time quality meshing and offline point cloud meshing	•	•
Polygonal editing	•	•
Parametric sketching	•	•
NURBS surfacing		•
One-year support/maintenance	•	•

**Point cloud digitizer support for portable metrology:** All available point-cloud-digitizing plug-ins and import capabilities for a wide range of native point cloud file formats for laser line scanners, fringe-projection digitizers, long-range spherical grid scanners, and more.

**Single-point measuring device support for portable metrology:** All available plug-ins for articulated arms, optically-tracked probes, laser trackers, manual CMMs, and theodolites.

**Real-time quality meshing and offline point cloud meshing:** Transformation of digitized point clouds into polygonal models using real-time quality meshing for online processing while laser scanning a part, and offline meshing of point cloud data files.

**Polygonal editing:** Complete polygon-editing toolbox to repair and optimize imperfectly digitized geometry and apply CAD operations on polygonal models.

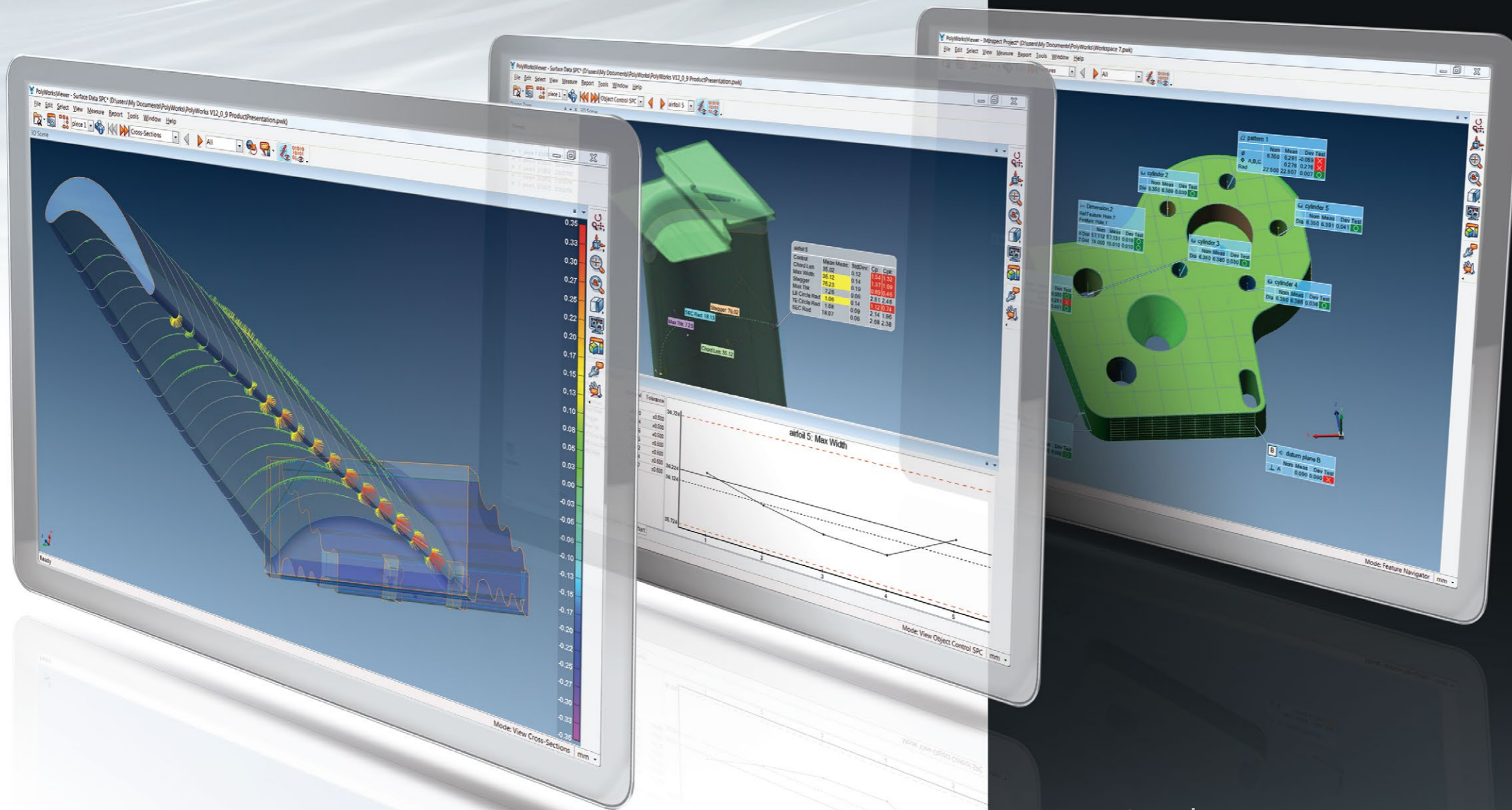
**Parametric sketching:** Parametric 2D sketching process to build sketches by defining sketch planes, computing optimal sketch outlines from digitized geometry, then anchoring and fitting sketch entities and dimensions, guided by the sketch outline + add-ins to import PolyWorks sketches into professional CAD solutions (CATIA V6/V5, NX (UG), Creo (Pro/E), Inventor, and SolidWorks).

**NURBS surfacing:** NURBS surfacing process to fit an optimal network of NURBS surfaces over a digitized polygonal model, including automatic and interactive curve network creation, support of N-sided patches and T-junctions, automatic NURBS surface fitting with G2/G1/G0 continuity, and more.

## What you get with your purchase

### One year of support/maintenance that includes:

- New major PolyWorks releases launched during the year.
- Monthly intermediate releases that include software enhancements, bug fixes, and plug-in updates.
- Assistance from our technical support team by e-mail and telephone.
- Access to the Technical Support Zone.



## Review

### Quickly evaluate measurement results

The PolyWorks|Viewer solution allows everyone in the organization to quickly review the contents of a PolyWorks|Inspector metrology project. Thanks to a contextual project navigation toolbar, colleagues unfamiliar with PolyWorks can easily select individual pieces from a multi-piece project, measurement object categories (Data Color Maps, Features, and so on), and individual objects within a category to view them in 3D. Also, the formatted analysis reports produced by the metrology team are accessible directly from the navigation toolbar.

PolyWorks|Viewer makes it easy for industrial manufacturing organizations to distribute metrology results to all the decision makers who need to access critical geometric data.



## Metrology results in 3D across the organization

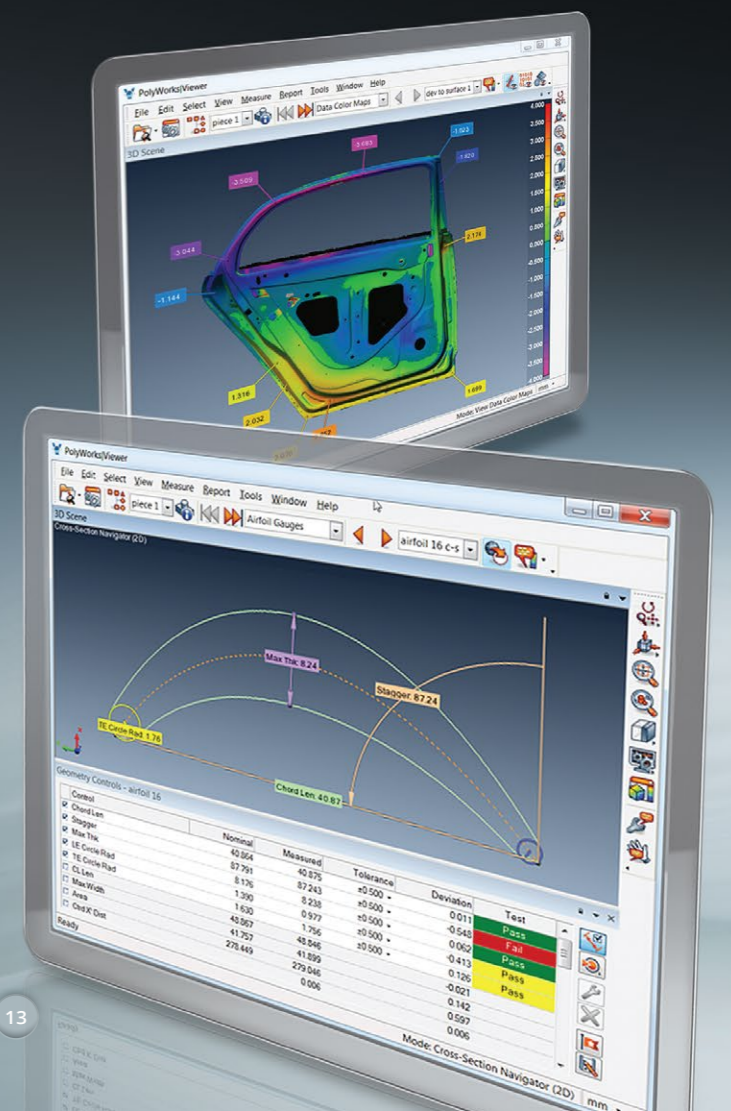
While engineering a new product or managing a manufacturing process, having access to 3D measurements and geometric analyses of parts, tools, assemblies, or products can be critical to making the right decision. Thanks to InnovMetric's free PolyWorks|Viewer, 3D measurement specialists can share their PolyWorks|Inspector projects across the organization, allowing team members to extract the information they need from the measurement database.

## Analyze

### Build your own view of the measurement database

PolyWorks|Viewer goes beyond its primary project reviewing functionality by offering the capability of extracting and reporting dimensional information that was not part of the original measurement plan.

Using the Geometry Controls interface, users can control new dimensions and set up custom tolerances. The Data color map display can be fully customized and additional point annotations can be picked to highlight local deviations. For multipiece projects, users have access to the complete PolyWorks|Inspector SPC analysis toolset for object controls and surface Data objects. Finally, PolyWorks|Viewer allows users to create new report tables, object annotations, snapshots, and formatted reports. With PolyWorks|Viewer, everyone can build their own view of the measurement database.





The mobile app that  
boosts measurement  
productivity on the shop floor

A single measurement specialist performs a measurement task that normally requires two people. An operator measures a part twice as fast by eliminating back-and-forth trips to the computer running PolyWorks. These are just a couple of examples of the outstanding productivity gains that the PolyWorks|Talisman mobile app generates – available for free from InnovMetric.



## Control remotely

### Bring PolyWorks into the palm of your hand

The PolyWorks|Talisman app runs on mobile computing devices and communicates with PolyWorks through a Wi-Fi connection. A major benefit of the app is its capability to remotely control PolyWorks. While being in front of their part, operators can directly connect to their probing or laser-scanning device, configure measurement modes and parameters, launch a probing operation, and perform typical probing actions, such as measuring a point, ending object probing, deleting the last probed point, or reprobing an object.

## Stay connected

### Get live feedback, anywhere

PolyWorks|Talisman also provides remarkable feedback on the PolyWorks measurement session in real time, such as:

- 3D Scene display, along with critical measurement information, such as guiding instructions, guiding images, guiding points, point counters for object probing, and more
- Single or multiple Digital Readout display to efficiently build fixtures and jigs
- Audio feedback to hear the sounds of the probing and scanning session

PolyWorks|Talisman also allows users to read messages and answer questions.



## Enjoy peace of mind

### Total confidentiality guaranteed

PolyWorks|Talisman is designed to guarantee total confidentiality under all circumstances:

- No proprietary information saved on the mobile device
- Encrypted communication
- No connection to Internet or any other computer
- Possibility to explicitly restrict usage to a predefined list of mobile device IDs

PolyWorks|Talisman offers ultimate security characteristics required for ultraconfidential setups.



# Our technical support philosophy

## A partner in your success

Industrial manufacturing organizations worldwide face a common challenge: they are expected to put new, high-quality products into production rapidly and at a low cost. As your 3D metrology software partner, our mission is to maximize the benefits that 3D metrology can bring to your product-engineering cycle and manufacturing quality to help your organization meet its business objectives.

To achieve our mission, we have taken technical support to an unprecedented level on the market. In partnership with our network of software support partners, we deploy a technical support team that has vast experience in industrial metrology, product engineering, and product manufacturing. This team is composed of 100 highly skilled application specialists who speak 20 different languages and who live in 19 countries. We have also implemented a customer support philosophy that goes beyond traditional software support: We take the time to understand your process, and we analyze your requirements before advising you about the optimal solution to resolve your measurement challenges. Our mission is only completed when your measurement task is successfully achieved.

## The PolyWorks support/maintenance package

To accompany our customers during their first year of use, we automatically include one year of support/maintenance with every purchase of a new PolyWorks license. After the first year is completed, a support/maintenance contract can be purchased annually.

### One year of support/maintenance includes:

- New major PolyWorks releases launched throughout the year
- Monthly intermediate releases that include software enhancements, bug fixes, and plug-in updates
- Assistance from our technical support team by e-mail and telephone
- Access to the Technical Support Zone

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SmartGD&T™

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