3980 Ranchero Drive Ann Arbor, MI 48108-2775
734-761-8989 Fax 734-761-9193 www.coherix.com

High-Definition Metrology and Vision Application Note #09-10

Large-Part Precision 3-D Full-Surface Measurement – Surface "Stitching"

The Powertrain Challenge

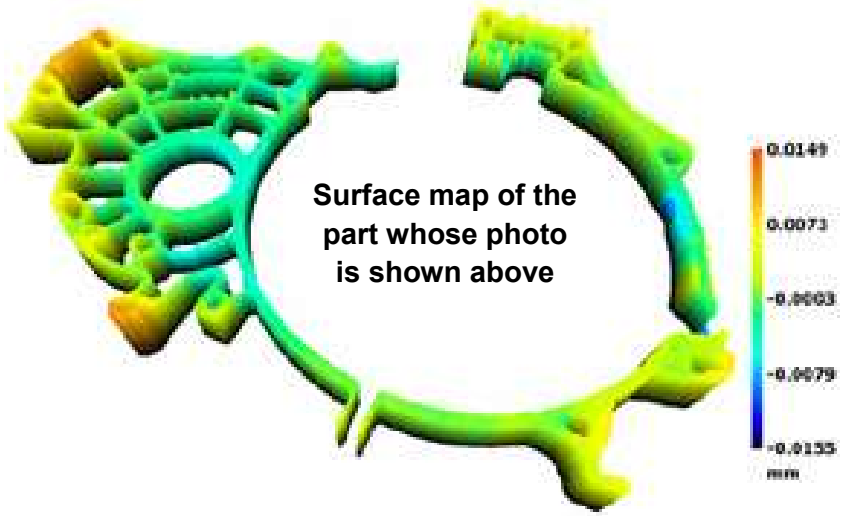
Large parts, as well as smaller ones, need to be measured precisely to ensure accurate fit, avoid leakage and identify defects or mis-located features.

To produce timely feedback for process control and avoid scrap, measurement of the entire machined surfaces must be accomplished in minutes and produce immediate, clear visual identification of the nature and location of any surface dimensional or finish issues.

The Metrology Need

Older measurement methods suffer from an inherent lack of ability to provide fast measurement, complete surface coverage and high-definition display of surface characteristics. The result of their use is obscure and sparse numeric data that does not provide understanding of machine or process issues until many more defective parts have been produced with likely the same uncorrected problems. Measurements are needed for the entire machined surfaces, and that are available in minutes. Displayed characteristics must be immediately interpretable to guide remedial actions such as adjustments or tool changes.

The Measurement Requirements



Surface map of the part whose photo is shown above

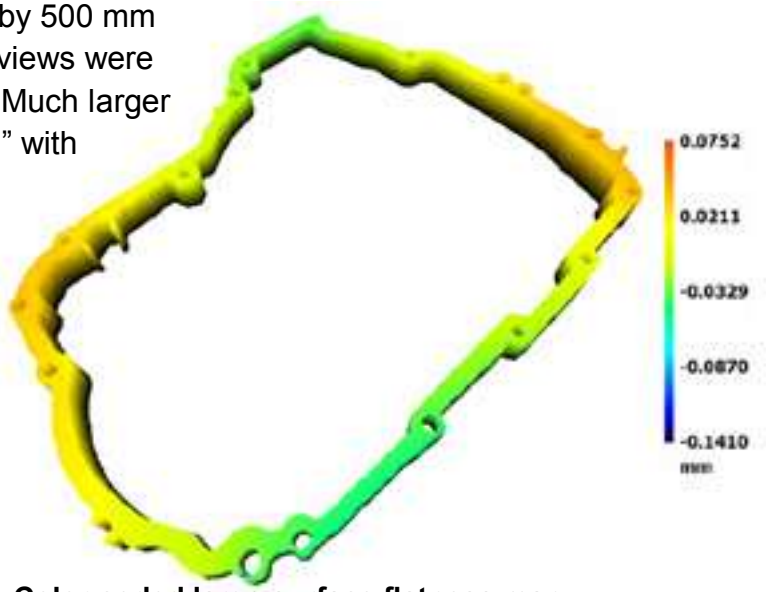
It is especially important to be able to accurately measure the global flatness, the flatness of particular local or zones, the waviness, and the defects in the milled surfaces of large parts. Micron-level accuracy and repeatability are essential. Complete surface coverage is required to ensure that any deviations or defects are found. The waste from producing such large parts out of tolerance is naturally particularly high, so that quick, visually obvious and complete information is needed that is readily-actionable. Savings from using ***ShaPix*** that prevents just a single part "spill" event can exceed the cost of the metrology system.

The Coherix Solution

The ***Coherix ShaPix Surface Detective***™ produces a height map with a resolution of 44 surface samples per square millimeter throughout the specified surface area of interest. Overall flatness, local or zone flatness, waviness, multi-surface geometric relationships such as parallelism, and other surface characteristics can be measured. Proprietary high-precision 3D correlation algorithms are used to "stitch" together partial surface views and form a complete height map of the large part surface to micron-level accuracy. Part surfaces of more than 540,000 square millimeters (6 square feet) can be readily mapped in the standard ***Coherix ShaPix Surface Detective*** measurement system cavity and larger surface areas up to 1,600,000 square millimeters (16 square feet) are possible in ***ShaPix Engine System*** models.

The *ShaPix* Results

The **ShaPix Surface Detective**™ shows, in an immediately obvious visual form, the flatness and the relationships of surfaces across the entire part. The machined surface of the transmission case shown here is approximately 450 mm by 500 mm in dimension (18" by 20"). Four (4) ShaPix views were "stitched" to produce the surface hologram. Much larger surfaces can also be automatically "stitched" with ***ShaPix's*** unique 3D processing software.



Color coded large surface flatness map

The *ShaPix* system set-up operator can also select local zone measurements, color-coded surface waviness maps, and W_{void} "virtual gasket" surface leakage susceptibility maps for a gasket bead path, multiple selected patches or traces or across the entire part surface.

The Powertrain Value Delivered

ShaPix provides quality assurance of the dimensional characteristics of complete large milled or ground nominally planar surfaces, as well as multiple part surfaces when coplanarity, parallelism, thickness variation, pocket depth or other surface relationships are critical. The "bottom line" value delivered includes higher product quality, tighter process control, reduced scrap, avoidance of wasted production costs, reduced maintenance costs, and increased customer satisfaction. Taken altogether, these directly lead to increased market share, sales and profitability.