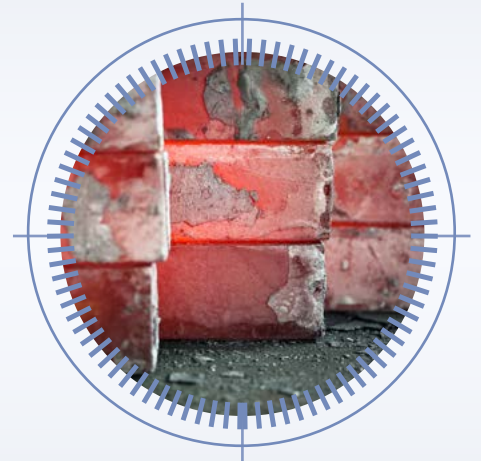


# METRONOR METROLOGY

SOLUTIONS FOR THE CASTING  
AND MACHINING INDUSTRIES

VERSION 5.02

- Reduce scrap
- Minimize cast weight
- Guarantee material cover
- Eliminate scribing of parts
- Improve product quality
- Deliver product faster
- Use CAD data
- Reduce CNC machining time
- Increase production efficiency



CREATING VALUES

**Create faster, accurate patterns**

A correct pattern is a starting point for all successful casting projects, but can also be a bottleneck in terms of time and cost.

- Metronor's instant feedback in pattern creation makes it a fast one-shot process;
- Metronor checks patterns directly to customer-supplied CAD data, avoided any uncertainty on interpretation of drawings;
- Metronor compensates CAD data so the pattern includes effects of thermal expansion during pour and chemical processes.

**Reduce scrap - add value**

Guarantee sufficient excess material for machining on every part you ship.

Add optimized set-up marks for machining to help your customers improve machining efficiency, reduce scrap and increase profits.

Your product becomes more valuable to your customer, allowing you to improve margins.

**Eliminate scribing parts**

Metronor makes scribing parts a thing of the past.

The new method is 10 times faster, much more accurate - and you don't need the skill required to be good at scribing. Nor do you need expensive lay-up tables that take up valuable shop space.



**Reduce delivery time - save cost**

Time is money. And saving time may open new opportunities to customers with tight deadlines.

Avoiding test pours and trial series saves you time and money.

**Reduce material and machining costs**

The profit margin of a casting series can be razor thin. Excess material must be kept to a minimum to keep metal costs down, particularly for expensive alloys.

Metronor provides machining set-up marks to make good parts even with very little excess material, and optimizes each process step to make sure the geometry is right - the first time.

The cumulative knowledge helps reduce the necessary material coverage on new product runs and helps increase margins.

**Avoid trial-and-error**

Casting is a complex process. For short series, the trial-and-error takes most of the time - and incurs most of the cost.

Metronor enables you to minimize and even eliminate trial-and-error. Verifying each process step, the probability of success is maximized. And so are profits.



PROCESS SOLUTIONS

**Rapid alignment**

SOLO helps you efficiently align objects accurately to each other:

- Mold and die placement into presses or transfer equipment;
- Core placement in molds;
- Insert placement in molds;
- Part placement in fixtures or onto machine beds.

SOLO ensures consistent positioning throughout all process steps, and helps you avoid the expense of verifying from your final product if positioning was correct - or not.

**Set-up for machining**

Challenges to accurate set-ups:

- Not enough material during machining;
- Crashing CNC programs due to excess material;
- Improper alignment of the cast part.

**SOLO's Excess material best-fit**

Excess Material Best-Fit ensures optimal material coverage. If there is a problem, you will know - before you start the machine.

**Use CAD data**

Most products are designed in CAD. These CAD models are the ultimate truth of geometry, as they define the entire part.

SOLO easily taps into this resource. Simply load the CAD model on to the system and, as you measure, each point is compared to the CAD model.

**Tool and part verification**

SOLO checks the geometry of any object:

- Patterns, pattern mold & models;
- Molds, before & after baking;
- Shells, as cured & after baking;
- Dies, as-manufactured & as worn;
- Cores, core-patterns & core-molds;
- Inserts, insert-molds & patterns;
- Castings as removed, and during cooling & coating removal.

SOLO automatically compensates for shrinkage, etching and chemical milling, heat treat scale loss and material.

**Fast and easy pattern checks**

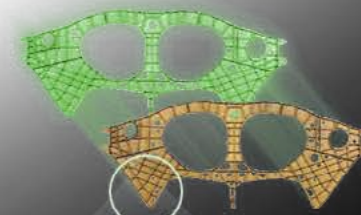
Check patterns to your customer's CAD data for instant verification, with or without automatic compensation for thermal expansion and etching allowance.

Measure while you sand, machine or build and get instant feedback on how much material still needs to come off.

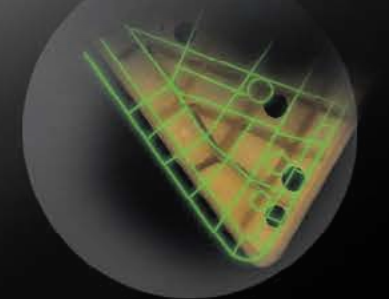
Align pattern modules accurately and efficiently by strapping the probe onto one of the parts - the system continuously tells you how to move to get the alignment right.

Is the casting good?  
Is there enough material?  
How to align the part for machining?

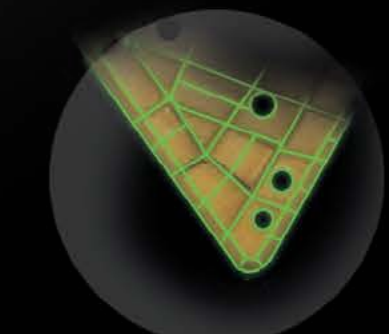
**Excess Material Best-Fit**



**Step 1:** SOLO measures the part and compares to CAD.



A typical best-fit evenly distributes the errors. But this also results in areas with too little material.



**Step 2:** run Metronor's Excess Material Best-Fit.

Excess Material Best-Fit *does not allow* negative material. So coverage is guaranteed. And it provides optimized set-up marks for machining. Automatically.

The result is confidence a good part will be machined.

**THE RIGHT TOOL**

**The right tool**

SOLO is ideal for casting applications

- Extremely easy to use, a shop-floor tool
- Quick and easy to move, few minutes setup
- Powerful software with the tools you need
- Flexible to check what interests you (the hand-held probe reaches in the deepest cavity, even on large castings)
- Portable to inspect "where is, as is" (no need to move heavy parts, dies or molds to inspection rooms)
- No moving parts to degrade over time

A proven track-record in tough environments. SOLO will provide sterling services for years to come.

**Simple to learn, easy to operate**

SOLO was designed to be used by shopfloor craftsmen. Basic system operation is learned in a day or two, and full capability on complex CAD operations within a week. Craftsmen will quickly be fully capable and adding even more value to you operation.

SOLO is a tool for shop-floor craftsmen - providing you the additional tools to excel.

**Large jobs and small - with ease**

Castings come in all sizes, and the tools and equipment used for castings are often much bigger than the finished parts themselves.

To be efficient, SOLO handles very large volumes in a single set-up. In the standard configuration, maximum size is 10m (30'), and this can be expanded to 30m (100').

**Patented principle, easy to understand**

SOLO's principle is smart and patented. A special camera observes the measurement probe. The direction to the image determines the direction to the probe, and the size of the image determines the distance to the probe.

**Infrastructure**

SOLO is completely self-contained, and can be put to immediate use on your shop-floor. It runs from normal mains power, and has extremely low servicing requirements.

Even using CAD files requires no infrastructure. Simply request CAD surface files on diskette or CD from your customer and you are operational.

**Robust, rugged and reliable**

SOLO is portable measurement system designed to be an efficient tool for ensuring correct geometry throughout complex manufacturing processes.

SOLO is designed for use on the shop-floor and in tough environments. Our service record shows that SOLO performs reliability in this environment - year after year.

**Portable and easy to move**

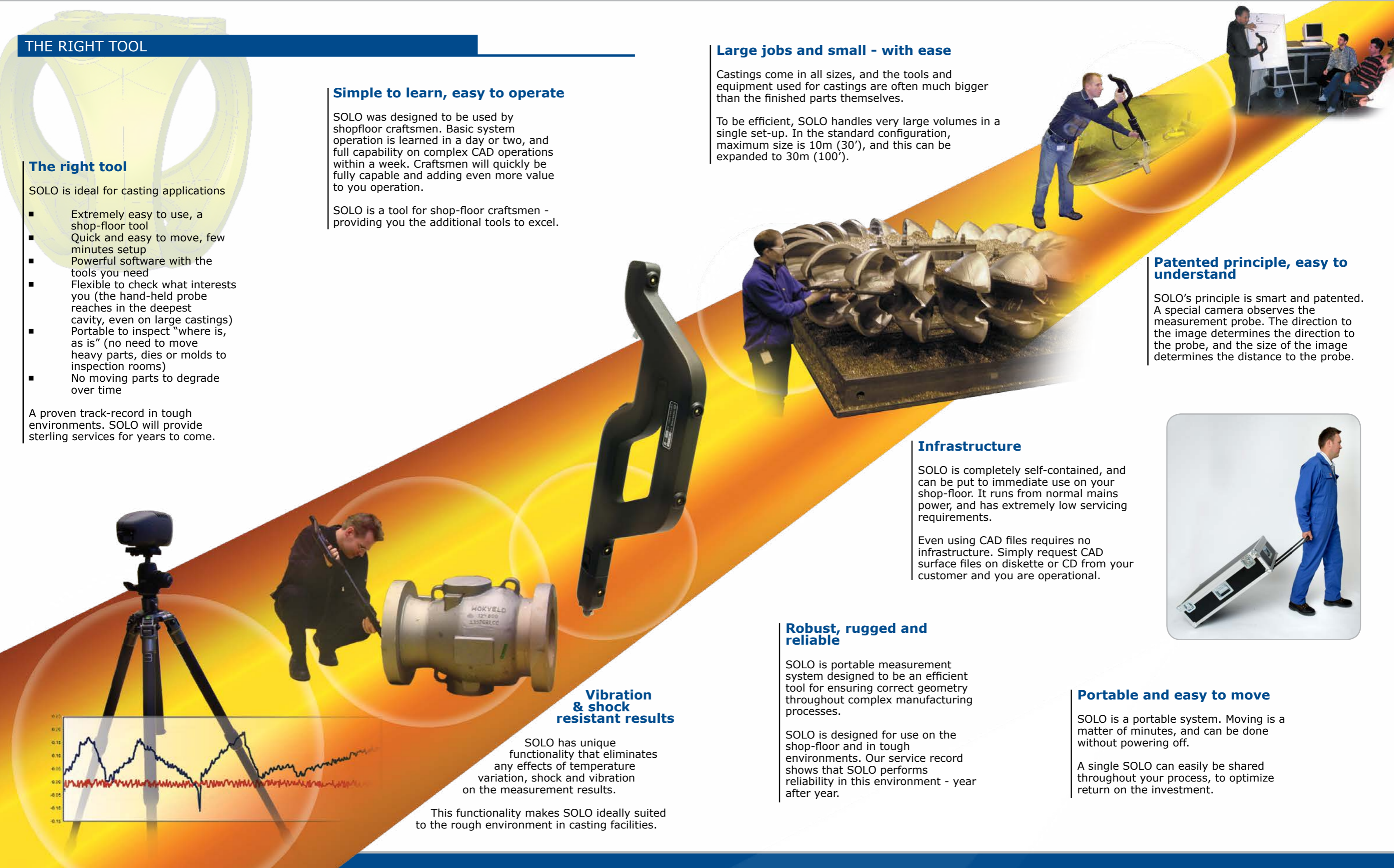
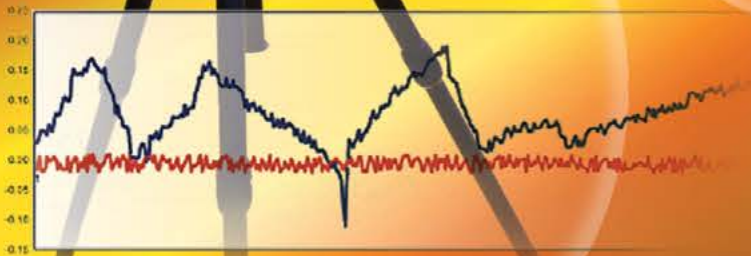
SOLO is a portable system. Moving is a matter of minutes, and can be done without powering off.

A single SOLO can easily be shared throughout your process, to optimize return on the investment.

**Vibration & shock resistant results**

SOLO has unique functionality that eliminates any effects of temperature variation, shock and vibration on the measurement results.

This functionality makes SOLO ideally suited to the rough environment in casting facilities.



## ACHIEVEMENTS

### Solution: Titanium forgings

Wyman-Gordon produces the largest titanium forgings in the world. Each piece is extremely expensive, so scrap rates must be kept to a minimum - and so must the chance for machining set-up mistakes. Their achievements:

- System paid for by parts salvaged with Excess Material Best-Fit
- Guaranteeing excess material by providing optimized set-up points for the machining of all products



### Solution: Wind energy hubs

With blade lengths now exceeding 80m (260') wind energy generators hubs are large, critical components. Vestas is a leading supplier of hubs to worldwide blade producers. By using SOLO they:

- Salvaged previously scrapped hubs with Excess Material Best-Fit
- Reduced scrap rates on new product
- Secured geometries on 100% of product



### Solution: Ship propellers

Ship propellers are challenging to manufacture. Metronor is proud that leading companies like Rolls Royce Naval Marine and Wärtsilä selected SOLO for their processes. Their achievements:

- Guaranteed propeller shapes match CAD design
- Minimized excess material & guarantee cover
- Aligned each blade optimally for machining
- Avoided Expensive templates for final inspection



## ABOUT METRONOR AS

Metronor is a privately held ISO9001:2008 certified high technology company headquartered outside Oslo, Norway. Metronor has developed a range of high accuracy, large volume, portable electro-optical coordinate measuring systems that provide excellent return on investment for our customers as well as facilitate a highly efficient dimensional management of their manufacturing processes.

Metronor's Industrial Systems Business Unit provides a range of measuring systems to a variety of industries worldwide, either through trusted partners or directly through offices in the US, Germany and China. The flexible and robust nature of the systems enables them to be applied to a multitude of different applications within automotive, casting and machining, mold and die, energy and other transport and heavy industries. The systems are considered especially valuable when used for large measurement volumes, to optimize processes and in challenging environments.

Metronor's Military Systems Business Unit provides a custom MIL-STD 3D and 6D boresighting system and solution. The product line includes systems for boresighting/harmonization of various airborne and ground based weapon system platforms. HarmoLign also allow for full alignment/harmonization of Helmet Mounted Display and Sight tracker systems, making it a complete solution for the Military industry.

More information at [www.metronor.com](http://www.metronor.com) and [www.harmolign.com](http://www.harmolign.com)

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