13/11/19

# SMART TECHNOLOGY INITIATIVES AT SONA COMSTAR

CII Smart Manufacturing Summit 2019 New Delhi

SONA COMSTAR

# SONA COMSTAR – An Overview

**Headquartered in Gurgaon, India**

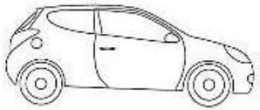
**2100 Employees**

**Revenue: $210 mn**

**Products: Differential Assemblies, BSG, Bevel Gears, Starter Motors**

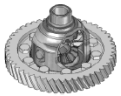
| | Driveline Business | Electrical Business |
|---|---|---|
| **Presence** | India | India, China, USA, Mexico |
| **Products** | Precision Forged Gears, Differential Assemblies, E-Axles, Spur Gears | Belt Starter Generator (BSG), Starter Motors, BLDC motors, Alternators |
| **Revenue (FY19)** | $104 mn | $106 mn |
| **Employees** | ~1200 | ~900 |
| **Manufacturing facilities** | 4+2 under commissioning | 4 |
| **Certifications** | IATF 16949, ISO14001, OHSAS 18001, TPM, ENMS ISO 50001 | IATF 16949, ISO 14001, OHSAS 18001, ASES, Ford-Q1, JLR-Q, VQE |
| **Major Customers** | AAL, Daimler, Dana, John Deere, Linamar, Mahindra, Maruti Suzuki, TAFE, Tata Motors | Ashok Leyland, Aston Martin, Ford, Geely, JLR, Renault Nissan, Tata Motors, Volvo, |
| **Sister Company** | **Sona BLW Prazisionschmiede GmbH** \| Revenue: $300 mn \| Product: Bevel Gears, Monoblock Gears \| 3 Plants in Germany and 1 plant in Hungary | |

# Our Products – A Summary



## Passenger vehicles

Differential bevel gears



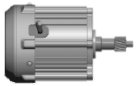
Differential assemblies

Crown gear drive set

Precision forged speed / Transmission gear

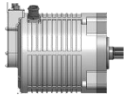
Starter motors

Alternators



BLDC Motors

48V BSG Air/Liquid/Hybrid Cooled



Traction Motors

## Commercial vehicles

Differential bevel gears

Engaging sleeves

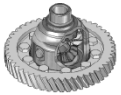
Forged sun & planet gears

Ready for assembly parts for truck inter axle differential

24V Starter Motor

## Off-highway vehicles

Differential bevel gears



Differential assemblies

Non-differential bevel gears

Parts for Portal Axle / Front Wheel Drive

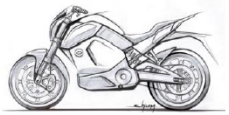
Spiral Bevel Set

24V Starter Motor

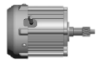
## Three Wheelers

E-axle

BLDC Motors



## Two Wheelers



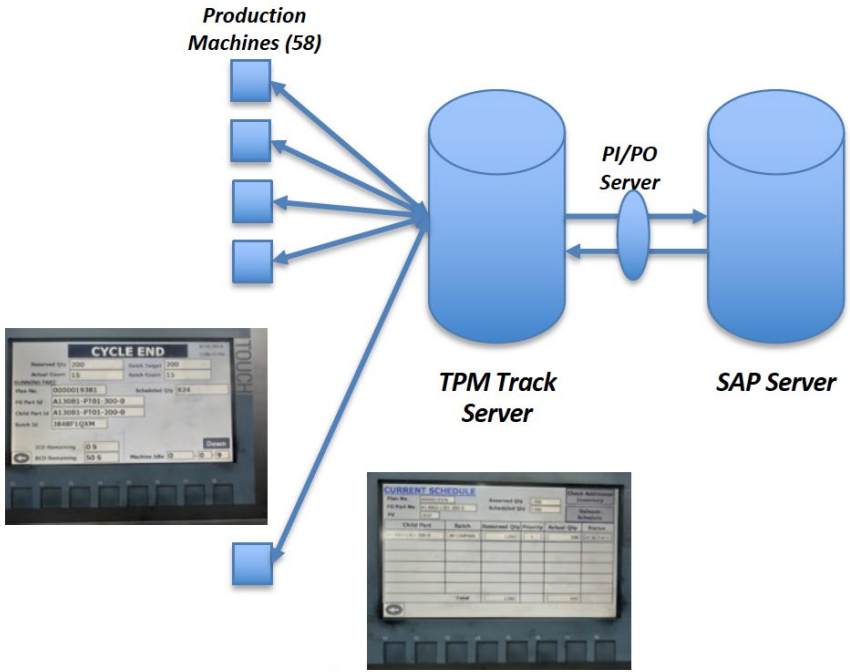
BLDC Motors

Wheel hub BLDC Motor

# Application of Smart Technologies in SONA COMSTAR

- Improving Efficiency of Assets:
  - Real-time Shop-Floor Data Capture and Analytics.
  - Inventory Tracking and Traceability.
  - Machine Analytics and Prediction.
- Improving Quality of Products:
  - AI-based Visual Inspection.
  - Automated Process Control.

# Real-time Shop-floor Data Capture and Analytics



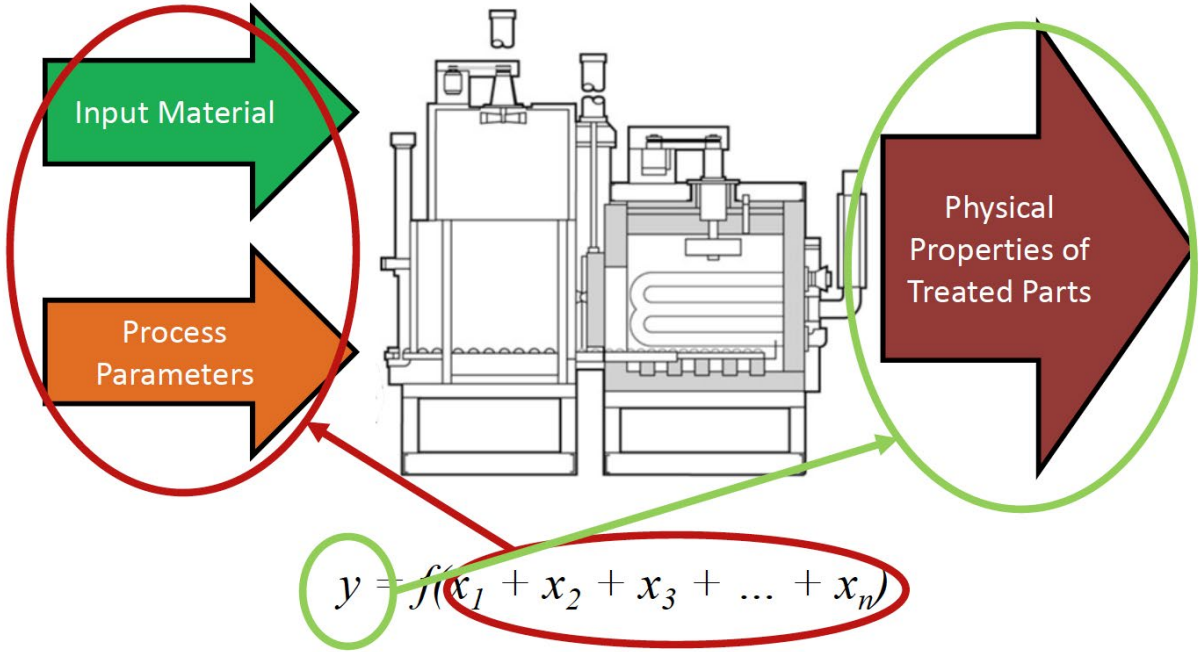

- About 60 machines connected to the 'TPM Track Server'.
- Communicates with the machines in real-time.
- TPM Track Server communicates with the SAP Server in real-time for planning and inventory information. Uploads production data every 30 minutes.
- Accurate and near-real-time production and downtime data is available in SAP.
- Concerned managers get alerts through text messages on their mobile phones.
- Supports Andons, analytics, and dashboards.

# AI-based Visual Inspection

- We engage 36 skilled inspectors to visually inspect 75~80 K gears every day.
- The system under development uses convoluted neural network to detect visual defects with over 99% accuracy.
- Once implemented, we can expect:
  - Higher confidence in passed parts.
  - Reduced manpower.
  - Improvement in the performance as the system learns as customers become more demanding in their acceptance standards.

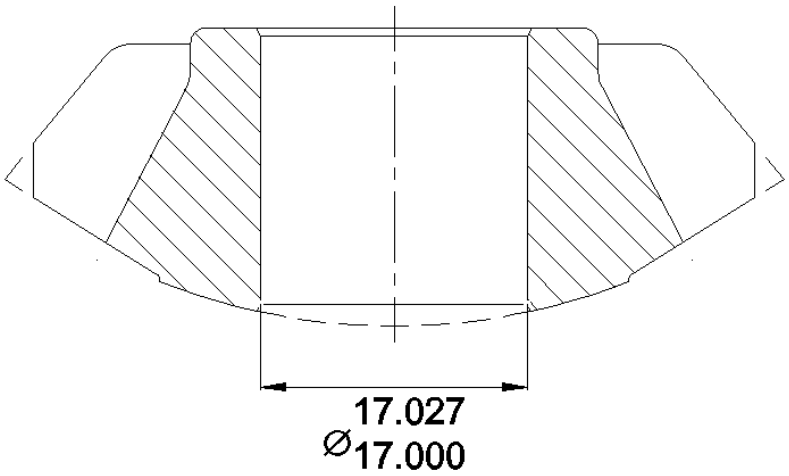
# Heat Treatment Process Control

- Determination of process parameters to realize desired properties of treated parts based on the function f modelled from 10 years' historical data of $x_j$ and y.
- Adjust the process parameters to realize consistent physical properties of the treated parts even with small variation in the input material composition.

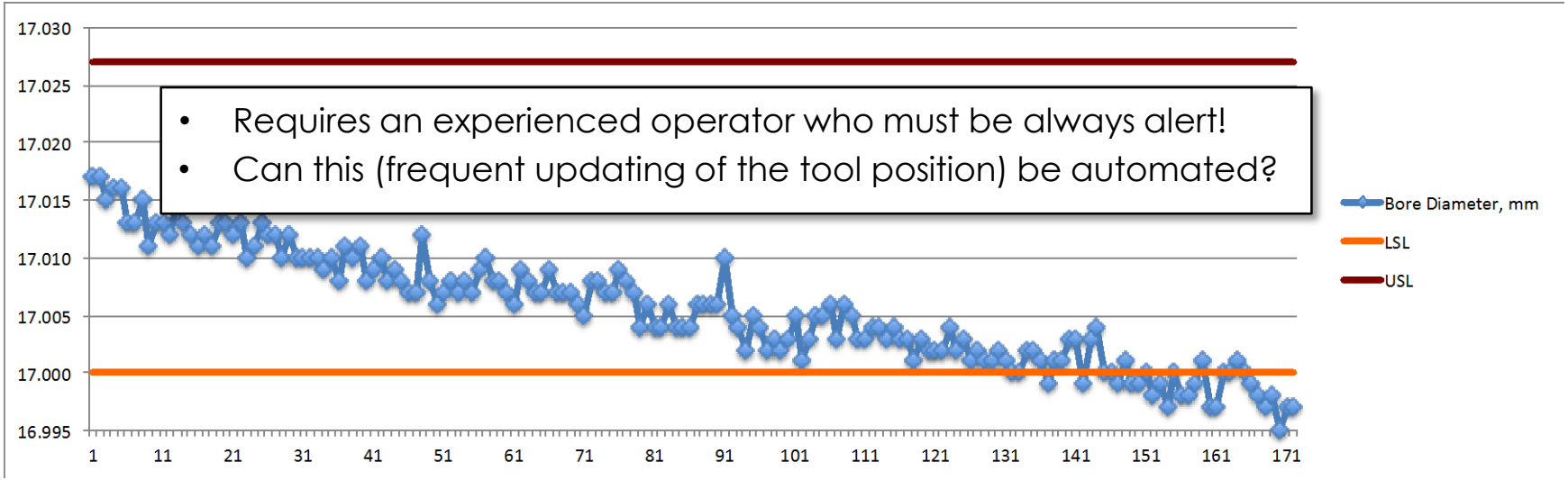


# An Use Case

- Part: Differential Bevel Gear
- Parameter: Bore Diameter
- Specification: $17^{H8}$ (17.000 ~ 17.027) mm
- Measurement: By air gauge, taken across the length of the bore; the minimum value taken as the measure while making sure out-of-roundness and taper is below $3\mu$, each.
- Machine: Muratec Twin Spindle CNC Turning



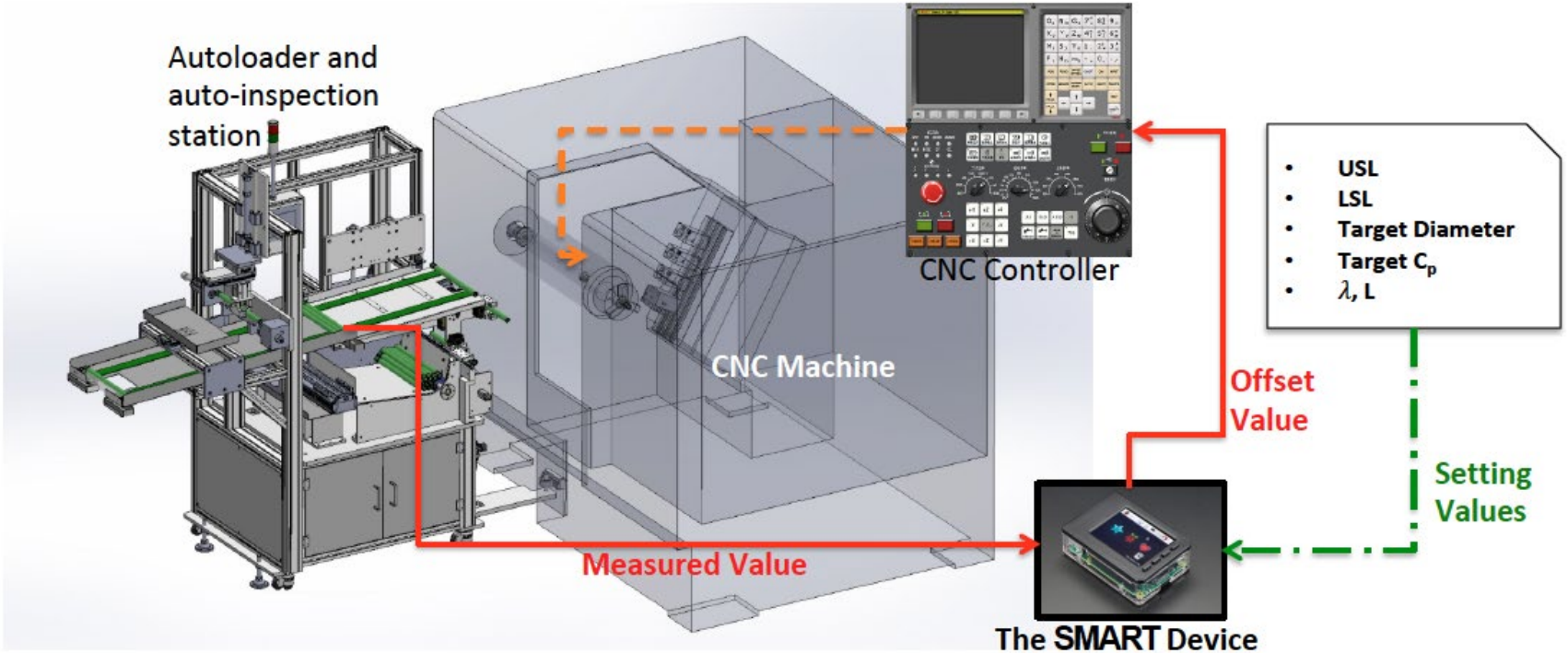
# The Problem Statement




- Requires an experienced operator who must be always alert!
- Can this (frequent updating of the tool position) be automated?

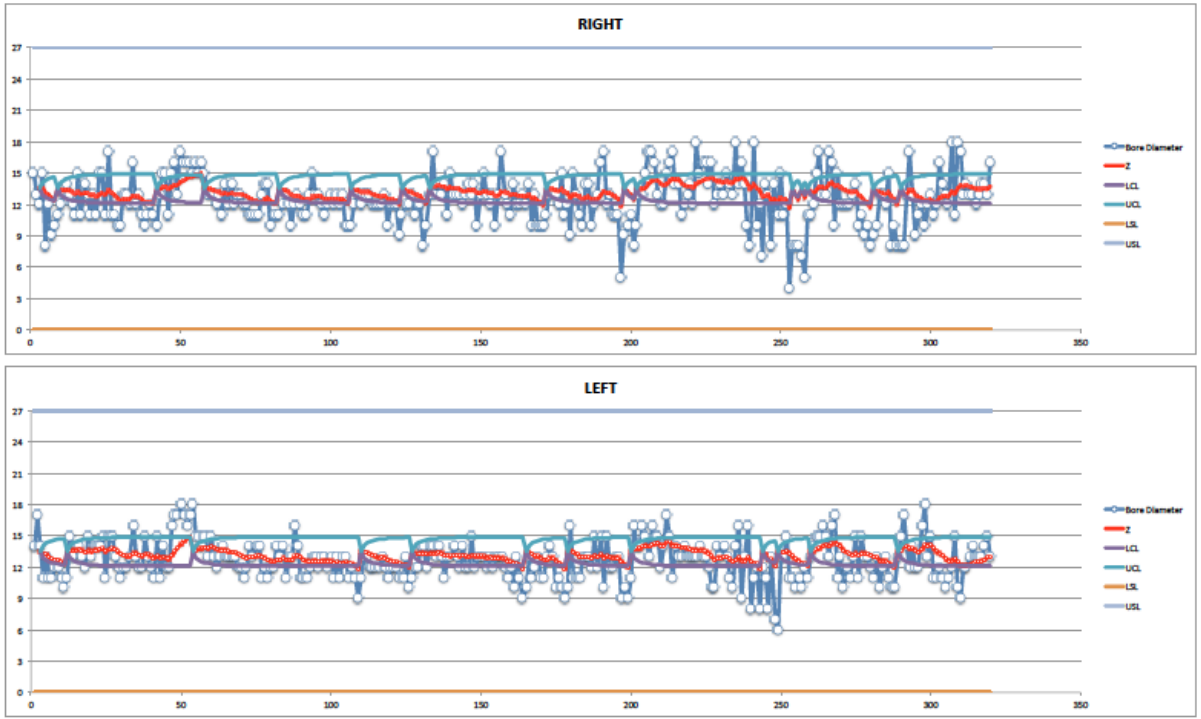
- The diameter of produced parts continuously reduces as a result of the tool wear.
- The operator manually enters a value—called 'offset'—in the CNC controller to correct the tool position so the parts stay within the specifications.

# Solution: The SMART* Device




* SONA Machine Adjustment Reckoning Tool

# Results of the SMART Device




| | RIGHT | LEFT |
|---|---|---|
| Cum Offset | 18.474 | 13.540 |
| Mean | 12.481 | 12.684 |
| Target | 13.500 | 13.500 |
| $C_p$ | 1.9324 | 2.3526 |
| $C_{pk}$ | 1.7866 | 2.2105 |
| Min | 4.0000 | 6.0000 |
| Max | 18.0000 | 18.0000 |
| LSL | 0.0000 | 0.0000 |
| USL | 27.0000 | 27.0000 |

# Proposed SMART 2.0

- Collect other process parameters (in real-time):
  - Ambient temperature
  - Hardness of the blank
  - Spindle motor current
  - Vibration and noise at the spindle bearing
  - Coolant flow and temperature
  - …
- Create a new model based on these additional attributes.
- Machine should also alert when the tool is due for change.
- Optimize tool life, process capability, and cycle time.

# The Key Success Factors

- The modern developments in data acquisition, data storage, connectivity, and analytics have driven implementation of these smart technologies in manufacturing companies.
- However, the key success factors are far beyond merely the investment in technology.
- This is a revolution. To succeed, companies need to take five steps before embarking on this journey.

# 1. People First

- Don’t forget about the systems already in place.
- Employees should understand and accept the need for the change and how they will be contributing to it.
- Actions needed to put people first:
  - Training and education of employees.
  - Incentivizing the rollout.
  - Carrying out activities to promote the transformational intent through clear and widespread communication.

# 2. Clarify ‘Why’

- Don’t get caught up in the ‘what’ and ‘how’ of digital transformation without addressing the ‘why’.
- Set clear objectives.
- Have a full understanding at the organizational level of what the end goals look like.

# 3. Establish a Common Understanding

- Beware of the buzz words that people do not understand:
  - IIoT, Smart Factory, ML, etc.
- Ensure no confusion in people's minds about what exactly digitalization means.

# 4. Create Success Stories

- Pick quick wins to gain knowledge and confidence.
- Think big, but start small.
- Take up a ‘pilot project’ that requires minimum resources and has a very high probability of success.
- One success story can be ‘snow-balled’ into many more.

# 5. Equip the Team for the Change

- It is normal for employees to be nervous about the change.
  - Fear of unknown
  - Belief that there is no personal reward
  - A clash of KPIs
  - A climate of distrust
  - Fear of failure
  - Worries about job security
- Leadership must address adequately these concerns by providing appropriate support and training.

# Recap – Five Steps Before You Take the Digitalization Journey

1. People First.
2. Clarify ‘Why’.
3. Establish a Common Understanding.
4. Create Success Stories.
5. Equip the Team for the Change

# Thank You!