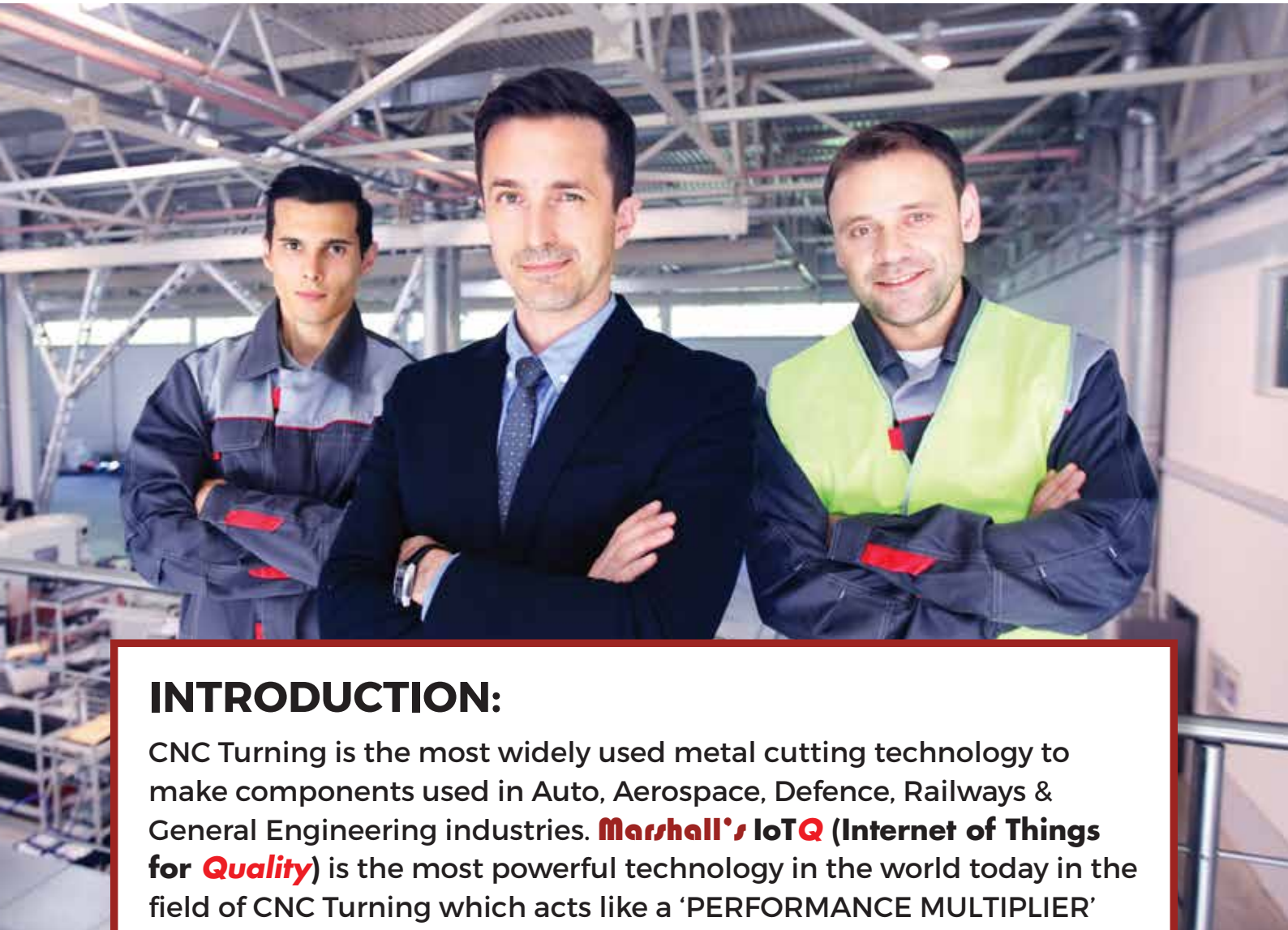





'Internet of Things for *Quality*'



INTRODUCTION:

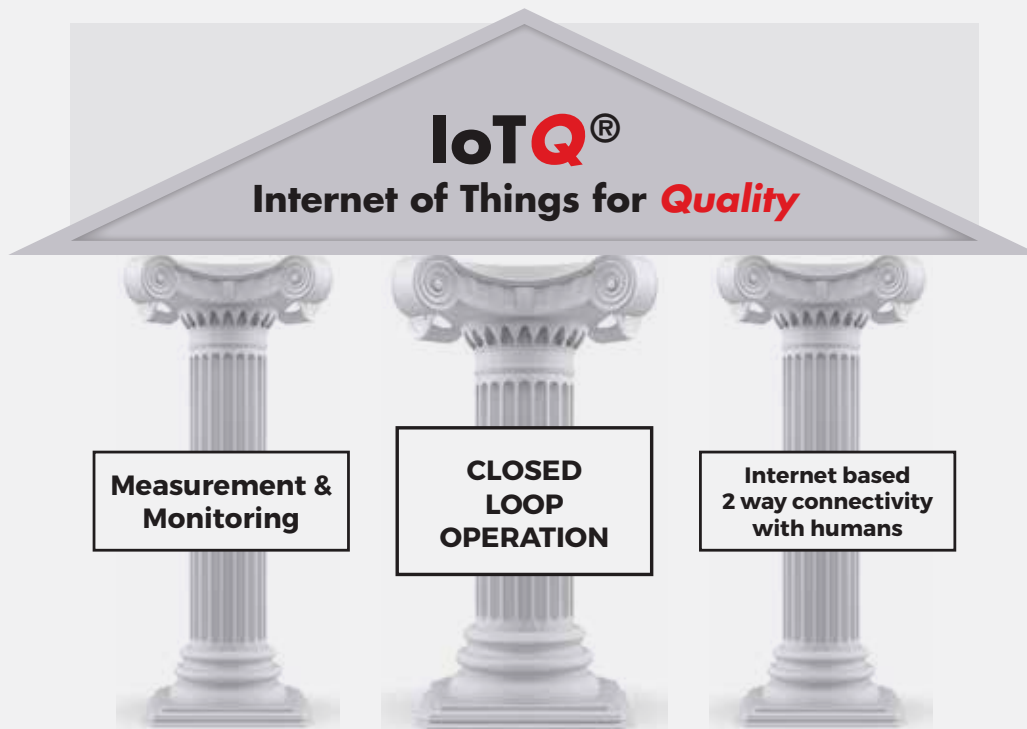
CNC Turning is the most widely used metal cutting technology to make components used in Auto, Aerospace, Defence, Railways & General Engineering industries. **Marshall's IoTQ (Internet of Things for *Quality*)** is the most powerful technology in the world today in the field of CNC Turning which acts like a 'PERFORMANCE MULTIPLIER' for each IoTQ enabled machine. The multiplication is because of quantum jumps in the following areas:

- **Zero defect quality** with **SmartCorrect®** (Patent Applied)
- **Much higher productivity** with **TMACH** by  (USA)
- **Longer machine life & OEE** with machine health monitoring & predictive maintenance with **SmartChek®** (Patent Applied)
- **Tool Insert life optimization** with **SmartInsert®** (Patent Applied)

'Smart Technologies to **TRANSFORM** your Machine Shop'

At the core of IoTQ is Marshall's CLOSED LOOP Technology which uses embedded *'Intelligence'* & **Marshall's SmartCorrect®** to take automatic corrective actions after auto-analysis of data (without any human intervention).

A. THREE PILLARS OF IoTQ



1.	2.	3.
<p>Measurement & Monitoring:</p> <ul style="list-style-type: none"> • Dimensional measurement • Insert wear measurement • Tool load monitoring • Machine Health monitoring • Vibration monitoring • Coolant pressure & flow monitoring 	<p>Closed Loop Operation:</p> <ul style="list-style-type: none"> • Auto-correction of tool offsets • Tool life management, retirement of worn tools & actuation of sister tools • Adaptive Control in machining • Corrective action for Machine health problem 	<p>Internet based 2 way connectivity with humans:</p> <ul style="list-style-type: none"> • Quality information • Tool Life trends & Consumption information • Productivity & OEE information • Machine health & predictive + preventive maintenance information.

B. IoTQ: OPERATING SYSTEM

Marshall's **'SmartCorrect'**® Gauging stations are at the heart of the IoTQ operating system.

It has 2 way communication with the **'Smart'** CNC Lathe and also with humans through remote server or cloud.



EXAMPLES OF REMOTE HUMAN INTERVENTIONS

- In case the data from **'SmartCorrect'**® shows abnormal variations, it can be remotely shut down for investigation. The Gauging Station Screen will flash message "Shut Down for Investigation"
- In case of detection of any abnormality in working of machine (eg. Higher spindle vibrations or higher axis current under no load conditions) it will be stopped and it's Screen will show message "Stopped for Health Check"

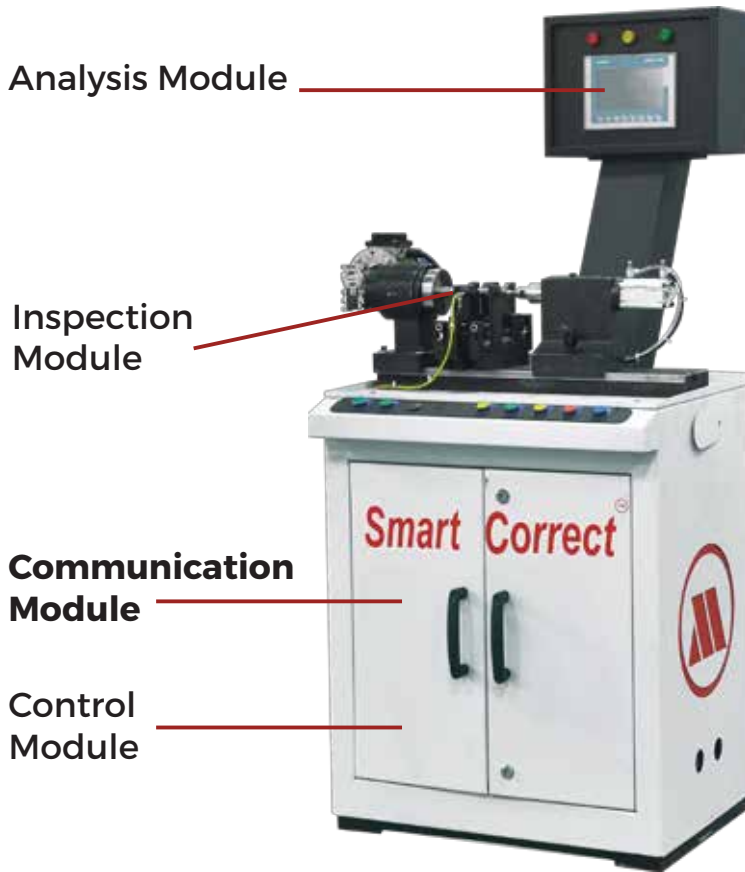


*'Smart Technologies to **TRANSFORM** your Machine Shop'*

SmartCorrect® The heart of IoTQ®

Facilitates 3 Vital Functions:

#1 **Auto-Correction** of Tool offsets to ensure Zero Defect Production.



#2 **SmartInsert®** technology for Tool insert life optimization & activation of “Sister” tools.

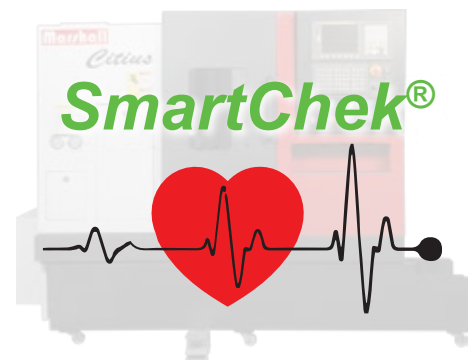
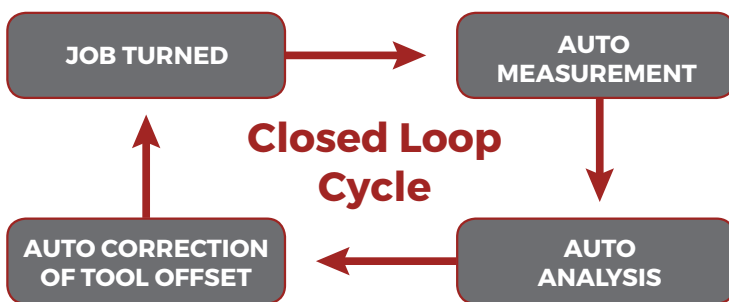
RESULTS:

- Upto 30% extra tool life
- Much Higher OEE

#3 **SmartChek®** technology for regular automatic machine health checks & accident detection.

RESULTS:

- Predictive Maintenance ensures much longer life.
- Immediate remote detection of Accidents & Corrective action initiation
- Automatic transmission of required information to concered person.



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