



## ***Notes and Thoughts***

By Tony Giovaniello, President, Shasta EDC

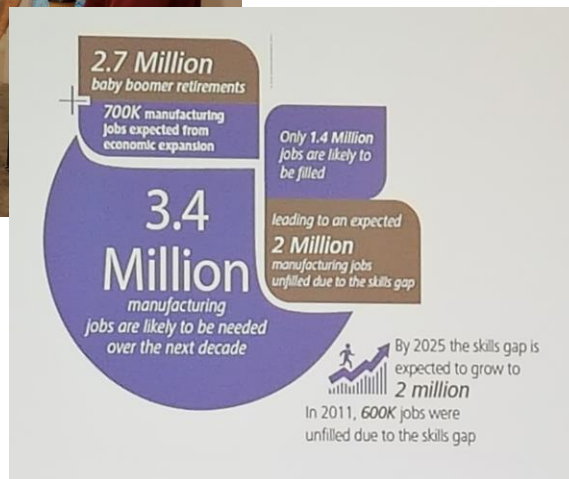
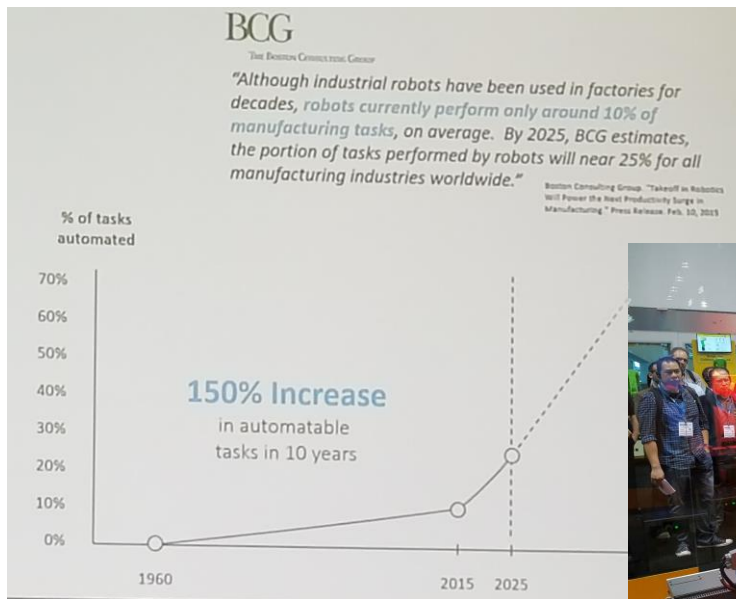
### Smart Manufacturing Conference MDM West 2017

Anaheim Convention Center  
February 7-9, 2017



Link to 28 Presentations from the MDM West, Smart Manufacturing Conference  
Anaheim Convention Center, Feb 7-9, 2017

<https://drive.google.com/drive/folders/OB645E3CjVrs8d0lqTjBTskhKTjQ?usp=sharing>



## **Collaborative Robots:**

### ***People using robots to improve productivity, safety, consistency, and learning***

By Tony Giovaniello, President, Economic Development Corporation of Shasta County

#### **Background:**

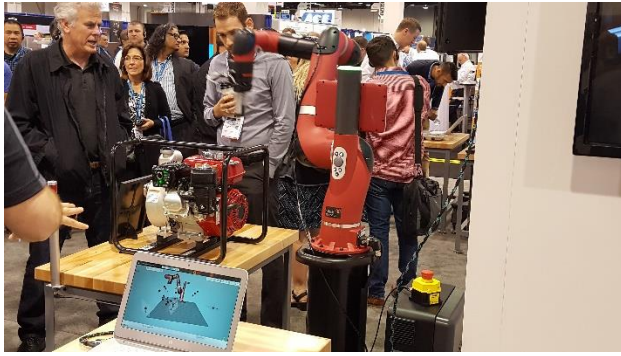
First, a “Prime Objective” of the Shasta EDC is job growth in the manufacturing and technology sectors. This is our key focus. However, the recruitment, retention, and expansion of our companies is equally important. There is obviously a symbiotic relationship between employer and employees. However, from time to time there are talent gaps that emerge and technologies that force us to rethink our approaches to business. Data shows that the number of manufacturing jobs are declining, and the jobs that remain are shifting to a mixture of the traditional and tribal knowledge around manufacturing and a blend of technical knowledge that helps to augment current manufacturing with the practical application of emerging technologies. Over the next ten (10) years, the use of robots will substantially increase, and simultaneously, the gap between willing and able workers and job openings will widen. Even though there will be less, but better paying positions, there may not be enough workers to fill these openings. Some of this is caused by socialization that has branded manufacturing as an “older” profession. In reality, manufacturing provides great career opportunities. In any case, more robots will be used in manufacturing, and if the talent gap is not closed, this could escalate even faster. Although we will continue to focus on workforce development to fill these jobs, we must also promote the adoption of robots, in appropriate applications, to insure our ability to compete and attract new companies.

#### **Article:**

As the cost of collaborative robots declines and their capability increases, it will be difficult not to include this technology in our manufacturing and warehouse operations. These devices, and the associated sensors and grippers are becoming more capable and adaptable. In addition, there are standards emerging that provide for interchangeability of grippers and sensors, all easily programmed to meet a specific purpose. This flexibility also allows manufacturers to quickly redeploy these robots to perform other task as orders arrive, markets change, or as operational processes evolve. Many people believe that robots replace people. Robots allow people to perform more valuable activities, and ones that are best suited for critical thinking which is where humans excel. If you need specific tasks performed consistently, robots can be an ideal solution.

Today’s collaborative robots are designed to work with and among people. When no people are in proximity, they operate at their highest speed. When humans approach, the robots sense this proximity and slow to approximately 10% of that speed, or some other speed as programmed. If there is actual contact with a person or a thing that is not programmed, the robots will immediately stop. The speeds and automatic stopping provides for human safety.





Another benefit of robots, and their sensors, is their ability to capture lots of data that would not be possible for people. Therefore, where data collection is critical to process improvement, a robot can be a wonderful solution. There are questions about how much data to capture. One school of thought is to collect every piece of data possible, even if it is not currently used. The thinking is that at some point, that data may be useable for a yet to be determined purpose.

However, there is a cost in collection, processing, and storage of this data. The other school of thought is to collect and process only the data for which you have a need today. Collect and process that data at the Edge (as close to the collection point as possible). Do not expend resources to transmit and store that data for future use, as the expense will be high and the likelihood of future use may not be very high. The thinking is focus on continuous improvement related to the issues you can identify today and you can always adjust as you move forward.

Robots can perform many menial tasks that are not so appealing to people, such as final inspection. There was a demonstration of a collaborative robot inspecting a small engine. It used sensors and cameras to check switch positions, wire connections, tension and integrity of connections of tubing and wiring, etc. The robot could even change switch settings to insure they were set to the default position for shipment to the customer.

In this application, not only could they accurately and consistently perform the tasks, but they could also collect the data that could be used by manufacturing to come up with solutions so that process injected defects could be permanently eliminated.

The most interesting application of collaborative robots was in a fabrication environment. A high skilled machinist, capable of programming and running complex jobs and equipment, had six (6) robots working with him in a cell. Each robot placed raw material into a CNC Mill, then the robot initiated the CNC milling operation. Once the process was complete, the robot opened the mill, removed the completed part, and placed it in a slot designated for transport to the next process step. The skilled CNC operator programmed and managed the robots, as well as setting up and programming the CNC machines. The productivity of the highly skilled worker was amplified six times, or more, by use of robots. That CNC operator was now more valuable than ever to his company.



Yes, there are many that worry that robots will reduce the number of jobs in our community. However, ultimately, we'll have to compete with other communities that deploy new technology. It is better to lead the way, so let's be the expert, build the capability of our workforce and its productivity by deploying technology. In the end, we'll produce more and be more attractive to new companies.

Let us not live in fear, but reach for the stars. Let's be a leader in these new approaches so that we can provide jobs and opportunity for our community and youth for decades to come.

## Turning Data into Action in the Supply Chain (IOT)

Sensors and Robotics allow for the collection of more data

- Data → Information
- Information → Analysis
- Analysis → Action
- Action → Supply Chain Improvements

All on a more integrated basis, but integration also may open up opportunities for Security Issues

Who handles data?

- When is too much...too much?
- Filtering at the edge, just capture what you need, rather than investing in lots of IT
- Focus on change
- Normalize data

Ownership/Privacy is an issue...Who owes it? Does more than one party owe it?

- Subject
- User
- Organization
- Product Maker
- Insurance Company

Data is an Asset

Focus on desired business outcomes, not technological possibilities

Work backwards to determine sensors, connectivity and the filtering on the edge

Pain Points

- New dimensional knowledge required by manufacturing engineers
- Now need sensor and connectivity knowledge

Training needs

## Smart Manufacturing – Rethink Collaborative Robots

Costs declining due to STD. parts

4.0 Vision

Force Sensors

Bar code itraceable

Skilled labor deficit

Agility

Mass customization

Repurposing is now easier

Shorter product life cycles drive more human training

Small footprint

No specialist requirement to train robots

Quality inspection w/cameras and force sensors

Remote monitoring available

Robot group collaboration now supported via SW and Connectivity

Smart Manufacturing – Universal Collaborative Robots

- Working close to people
- Power and force limitations create the safety
- Depending on the end effector and the working environment i.e. sharp objects

Traditional vs. Collaborative

- Dirty, dangerous, heavy. Different applications used traditional robots

Smart Manufacturing – Omron/Adept

- Mobile robots
- Cost effective especially if 3 shift 7 x 24 operation, 1 year ROI
- In warehouses, very cost effective due to employee turnover of 44%/year

# Machine Vision – 3D Vision for Robotics

Single camera

Stereo cameras

- Snapshot 3D
- Multi-Image 3D
- Point Cloud Data

Textures Help

- If no textures, add light scan

Time of Flight

- Returned light analysis

Advances

- Acquisition speeds
- Resolution and accuracy
- Size of data

3D Image S/W will emerge in mobile phones

3D S/W will work in both 3D and 2D apps

AI = Machine Learning, now being referred to as “deep learning”

Genicam 3D STD for transfer of 3D imaging

Biggest growth may be in:

Inspection

Presence/Absence

Surface flaws

Bad welds

Location and Guidance

- Positioning
- Guidance
- Better for collaborative environment

3D printing reconstruction based on 3D imaging

Great strides over the next 5 years

# Machine Learning and Robotics

## Panelists

- Machine vision expertise
- Analytics to make decisions
- Purpose optimization and AI

Goal to assist humans

Gathering more data than humans can

Predictive maintenance

Cheaper sensor allows for expanded use

Identify patterns that humans can act on

Focus on a specific problem, issue or opportunity

Infrastructure, network, etc. must support the added traffic and processing power needs

IOT allows you to add devices to measure your processes with robots. Drives Improvement.

Machine learning engine – Big data (This was an alternative view vs. Collect and on the Edge -Only collect what you need)

- Storage
- Processing
- Needed to capitalize

Role of humans:

Amazon – big robot user, but still hiring rapidly

Supervised and unsupervised learning

If machines become self-aware than it might be a concern

Cost, danger, quality, consistently are all factors when comparing robots to humans in various operations

Compliance and Governance

Will affect aerospace and satellite manufacturing adoption

High volume vs. Collaborative Robots (Working Alongside Humans vs> Replacing Humans)

- Does machine learning offer opportunities for simple advances in quality or productivity
- Gathering data on servers and performing detailed analysis over large volumes
- The analysis can focus on data inconsistencies even if minor. These nuggets are minable. Then can adjust or add cameras or sensors to uncover the next opportunity.
- Machines can see patterns that humans cannot.



- Retrofitting current plants?
- Onsite data centers or cloud
- Need space, room, and processes that might limit or slowdown machine learning process.
- Some older robots use analog rather than digital data
- Data is the key!

## Security for IOT

25B connected devices by 2020

200 sensors in today's cars – will be 1000s in a few years

More IOT on the edge = more security vulnerability

Breakables? New Grippers providing for safety with delicate items

STD Microprocessors drive costs down, but the known architectures create security vulnerability

PLC was not subject to these vulnerabilities

Use identities for every component, process and transaction as you setup your management systems

Deploy trust analysis – what are your trustworthy devices/connections

FIDO authentication

- Open source is good, but can also create a security issue