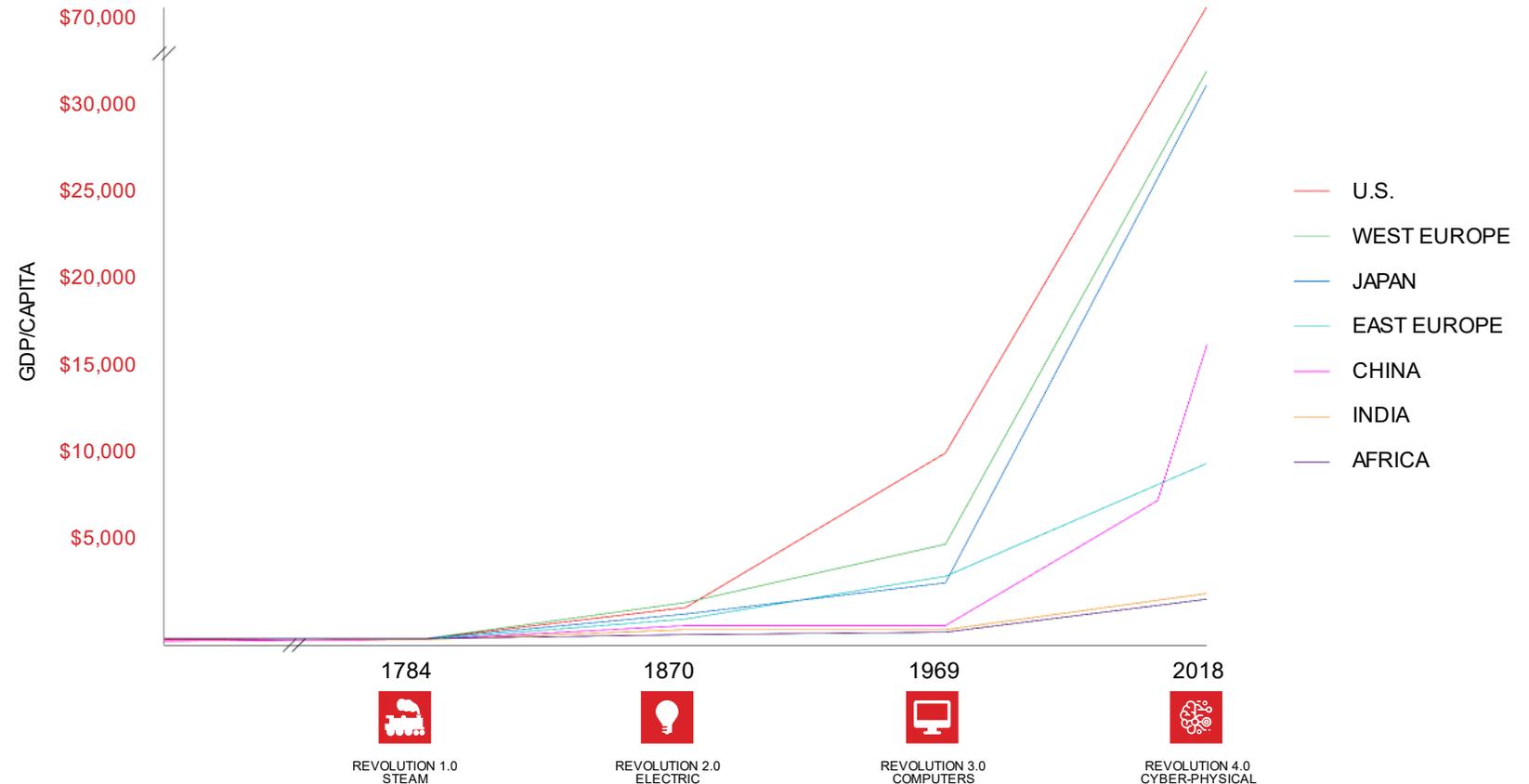# MxD Overview

Berardino E. Baratta
Senior Director, Technology Strategy

INDUSTRY 4.0 IS POISED TO GENERATE UNPRECEDENTED WEALTH

- Three revolutions exploited **mechanical leverage**

- The fourth revolution ushers in **cognitive leverage**

GDP/CAPITA

$70,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000

U.S.
WEST EUROPE
JAPAN
EAST EUROPE
CHINA
INDIA
AFRICA

1784	1870	1969	2018
REVOLUTION 1.0 STEAM	REVOLUTION 2.0 ELECTRIC	REVOLUTION 3.0 COMPUTERS	REVOLUTION 4.0 CYBER-PHYSICAL

MxD HELPS MANUFACTURERS MAKE SENSE OF THE DIGITAL NOISE

A VISION FOR U.S. MANUFACTURING

EVERY PART BETTER THAN THE LAST

251,774 U.S. MANUFACTURING FIRMS

~164,000 Small Manufacturers
< 20 Employees

~83,000 Mid-Size Manufacturers
20 < Employees < 500

3,813 Large Manufacturers
>500 Employees

THESE COMPANIES OFTEN DO NOT HAVE THE TIME OR RESOURCES TO DEDICATE TO DIGITAL MANUFACTURING

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MxD leverages collective expertise to solve problems too large for any one organization

MxD TIER 1 & 2 INDUSTRY PARTNERS

TIER 1

TIER 2

MxD TIER 3 INDUSTRY PARTNERS

300 Below
3rd Dimension
Accu Solve Group
ACE Clearwater
Advanced Dimensional Management LLC (MBD360)
Advanced Engineering Solutions USA Inc (AES)
AE Machines
Aegis Software
Alta Via Consulting
Altizon
AMI Global
Anark Corporation
Applied Automation Technologies
Applied Optimization Inc
aPriori Technologies, Inc.
APX Labs, Inc.
ARC Advisory Group
ARC Precision
Aria Insights (formerly CyPhy Works)
Aris Technology
Arthur D. Little Inc.
Arysen Corporation
Astronautics Corporation of America
Atlas Tool Works
Aunalytics
Ausco, Inc.
Authenticiti
Authentise, Inc.
Aztec Plastic Company
BASF
Beacon Interactive
BEET
Belden Tools Inc.
Big Kaiser

Bio Supply Management Alliance
Bluvision
Capvidia
Cast21
CGTech
CH Hanson
Chicago White Metal Casting
ChromoLogic (COVISUS)
CimData, Inc.
Cimetrix
C-Labs Corporation
ClearBlade
ClearObject
Collins Aerospace (formerly Rockwell Collins)
Composite Solutions and Digital Manufacturing LLC
Computer Aided Technology (CATI)
Connected Global Factory (SearchLite)
Craig Technologies
CreateASoft
Cullerton Group
CyberPoint International
Daqri
Design Interactive Inc.
Design Mill
Devbridge Group, LLC
Dimensional Control Systems
DMR International
Dozuki
DP Technology Corp
Ductmate Industries Inc
EC Solutions
E-gineering
Ekta Flow LLC
Electric Imp

Electro-Matic Ventures (formerly RAF Automation)
EMNS Inc (GSQA)
Engineering USA (formerly Hyla Soft, Inc.)
Entrigna
Erwin Junker Machinery, Inc.
ESI North America
Eural USA
Factory Physics
Factory Right, LLC
Fast Radius
Feralloy Corporation
FlexLab
FlexLink Systems Inc (Coesia)
Fomoro AI
Forcam
Formlabs
Forward Capital Fund
Fraight Inc.
Future Way Designs
Galois
Genesis Systems Group, LLC
Global Data Sciences
Godwin Global
Halock Security Labs
Hapco Inc
Harbec, Inc.
Hertzler
HL Precision Manufacturing, Inc.
iBASEt
Identify 3D
Imprimis, Inc.
Industrial Measurement Systems
Industrial Network Systems (INS)
Integris Group LLC
Intel
International TechneGroup

Incorporated (ITI)
iSynergy Inc
ITAMCO
ITRI International Inc.
Janeiro Digital
Kent Displays
Knoldus
L & J Omnico AGV
LMI
Lonsberry Engineering
Luna Lights
Machine Metrics Inc.
MachiningCloud
MakerSweet
MAL USA
Manpower Group Public Sector Inc.
Mantel Technologies
Manufacturing Laboratories
Marshall, Gerstein & Borun LLP
Mastercam (CNC Software Inc)
Materials Data Management, Inc.
Mechdyne Corporation
MetaMorph, Inc.
MFG.com
Midwest Composite Technologies
Mitutoyo
ML Design Technologies
Montronix
MSC Software Corp.
Nimbis
Northwest Analytics
Notiphy
Omative
OneFire
Opex Systems
OPS Solutions
Optimax Systems

OptiPro Systems
Orion Quality Software
Parallel Works
Physna LLC
Predictronics Corporation
Procter & Gamble
Product Development & Analysis (PDA-LLC)
ProMANAGE
ProPlanner
PTC, Inc.
PUNDITAS LLC
Quality Tools & Abrasives Inc.
QuesTek Innovations LLC
Quisitive
RCM Industries, Inc.
Rescale Inc
Retologic
Sage Clarity LLC
SantosHuman Inc
SBP Consulting Inc.
Scientific Forming Technologies Corp
Scope Technologies US Inc.
Scytec
SensrTrx
Sentient Science
Sibley Machine and Foundry Corp
SightCall
Sigmaxim Inc.
Sigmetrix
SIMBA Chain
SimInsights
Simio
Sivyer Steel Corporation
Soothsayer Analytics
SPIRE
Star Lab Corp

STEP Tools, Inc.
Superior Joining Technologies
Supply Dynamics
SWARM Engineering
Tech Soft 3D, Inc
TechSolve
The Innovation Machine
The Lucrum Group
The Northridge Group
ThingWeaver Solutions
Third Wave Systems
Transco Products
Tru-Fab Technology
Tucker Innovations Inc.
Tulip
Twin City Die Castings
TYGES International
United Electric Corporation
Universal Technical Resource Services
VANTIQ
VIMANA (formerly Manufacturing Systems Insights, Inc.)
Visible Assets
Vision Three
Visi-Trak Worldwide
Weasler Engineering Inc
Wes-Tech Automation Solutions
Wiegel Tool Works
Wrightwood Precision Products
Xcelgo
Xometry (formerly MakeTime)
Zuken USA Inc.

M**x**D ACADEMIC PARTNERS

Arizona State University (ASU)
Auburn University
Case Western Reserve University
Gateway Technical College
George Mason University
Georgia Tech (Georgia Tech Research Corp.)
Indiana University (IU)
Iowa State University (ISU)
Metropolitan State University of Denver
Missouri University of Science and Technology
North Carolina State University
Northeastern University
Northern Illinois University (NIU)
Northwestern University
Ohio State University
Oregon State University (OSU)
Pennsylvania State University (PSU)

Purdue University
Rochester Institute of Technology (RIT)
Texas State University
University of Alabama-Birmingham (UAB)
University of Central Florida
University of Cincinnati
University of Illinois-Chicago (UIC)
University of Illinois-Urbana Champaign (UIUC)
University of Iowa
University of Kentucky
University of North Carolina – Charlotte (UNCC)
University of Texas at Austin (UT)
University of Washington
Vanderbilt University
Virginia Tech
Wayne State University

MEMBERS ENGAGE WITH THE INSTITUTE IN THREE KEY WAYS

WORKSHOPS

Topic-focused sessions where partners engage in solution oriented discussions to drive projects and investments.

PROJECTS

Collaborative R&D focused on reduction to practice and business impact

TESTBEDS

Creating an experiential manufacturing environment to demo, test & prove a wide variety of DM&D technologies

COMPLETE DIGITAL MANUFACTURING DEMONSTRATION

DISCRETE TESTBED

OBJECTIVE

Provide a flexible venue for our members to test digital technology related to discrete manufacturing.   Provide a low cost method to generate data streams on a regular basis for analytics use cases.

STATUS

- All mechanics including CAD, CAM, washer, metrology, and digital fingerprinting complete
- Display gantry complete
- All data stream capture complete
- Analytics package(s) integrated

DATA STREAMS

- CNC temperature
- CNC vibration
- CNC current
- Ambient temperature
- Washer water turbidity
- Washer pump current
- Token weight
- Ambient humidity
- Ambient light intensity
- Washer water temperature
- Washer water level
- Token diameter
- Token thickness
- Digital fingerprint

PROJECT PORTFOLIO

63
PROJECTS

$90M+
INVESTED

FOCUSED ON **REDUCING**
R&D TO PRACTICE

PRODUCT DEVELOPMENT

Smart Printed Circuit Board Digital Factory

AI Design Advisor (Launching)

Direct CAD to CNC

FUTURE FACTORY

Integrated Part Variation Management

Automated CNC Process Planning Software: CNC-RP

Sensor kits and machine vision for legacy equipment

CYBERSECURITY

Cybersecure Dashboard

Benchmarking DFARS Compliance

National Center for Cybersecurity in Manufacturing (Launching)

SUPPLY CHAIN

Real-time Supply Chain Visibility through Predictive Analytics

Scheduling & Control for Real-time Optimization of Factory Operations

MBE Across the Supply Chain

PROJECTS TRANSLATE TO REAL WORLD RESULTS
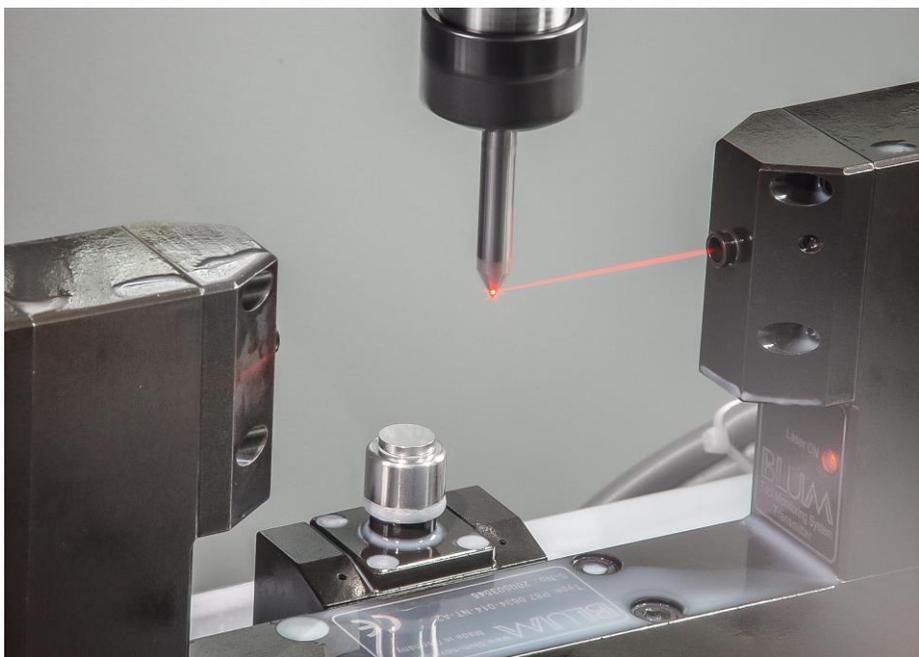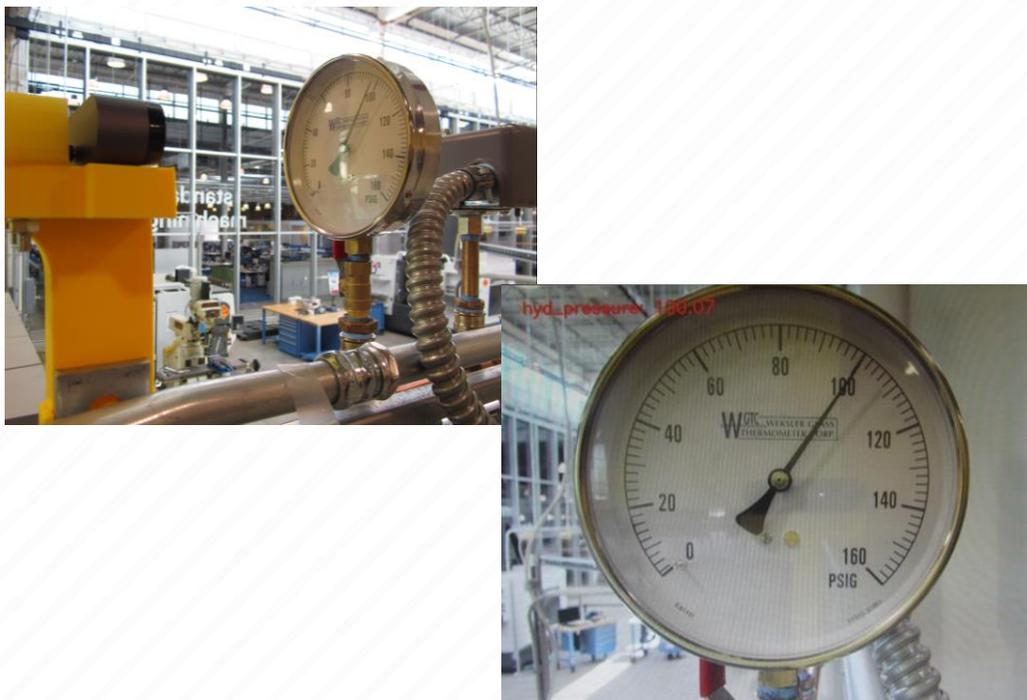

"Integrated Manufacturing Variation Management"

Nearly 100% reduction in scrap!
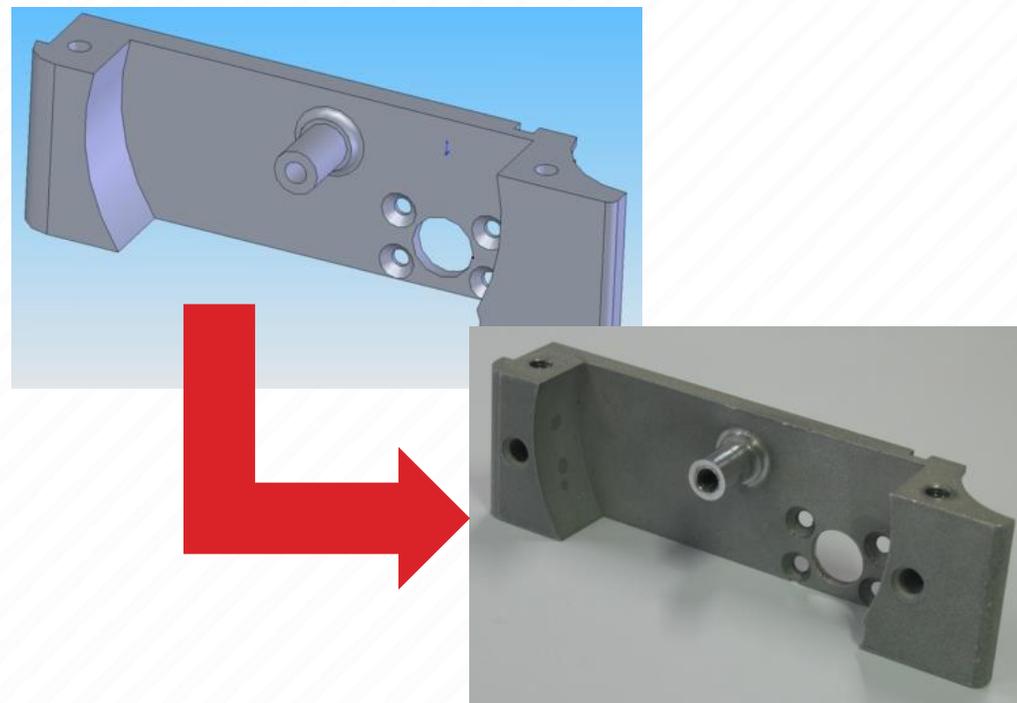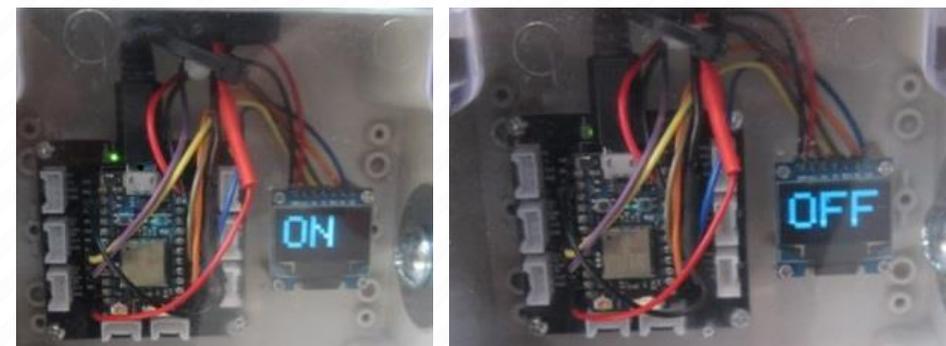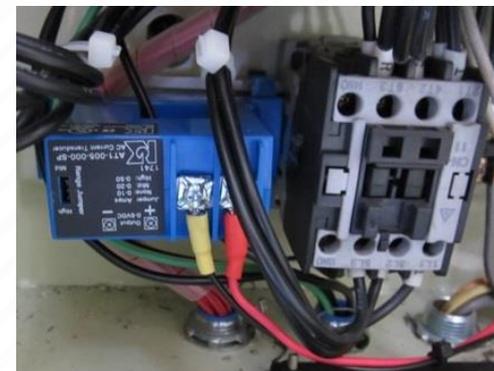
"Bringing Push-Button Manufacturing to CNC Milling"

Over 95% reduction in process planning time!

SIMPLE SOLUTIONS ARE EFFECTIVE

"Cameras Capture Digital Info from Legacy Machines"

Reduce costly down time!

"Digitizing Legacy Machines"

Deeper understanding of current systems!

TECHNOLOGY AUGMENTS WORKFORCE

"Augmented Reality Work Instructions"

Increased workforce flexibility!

"Virtual Reality Workforce Training"

Immersive training from anywhere!

35% OF ALL CYBER-ESPIONAGE ATTACKS IN THE U.S. ARE TARGETED AT THE **MANUFACTURING SECTOR**
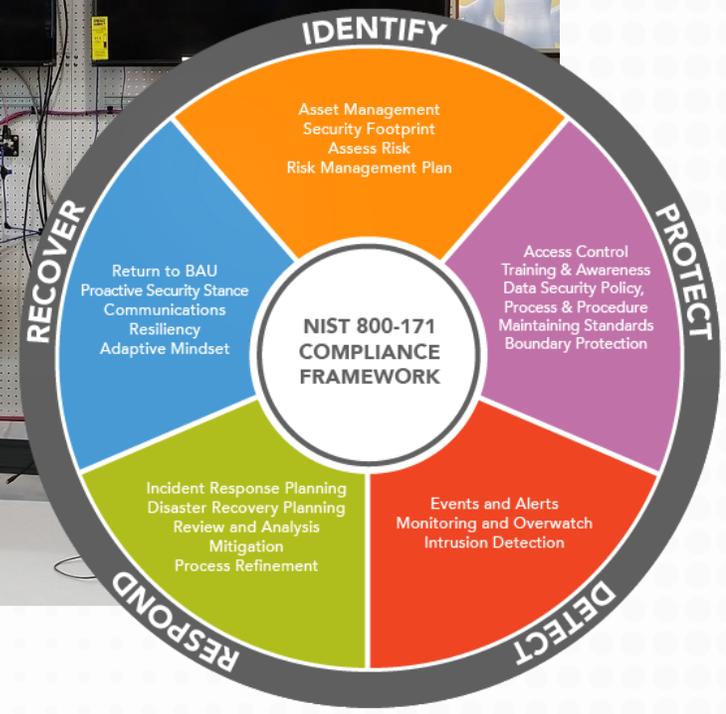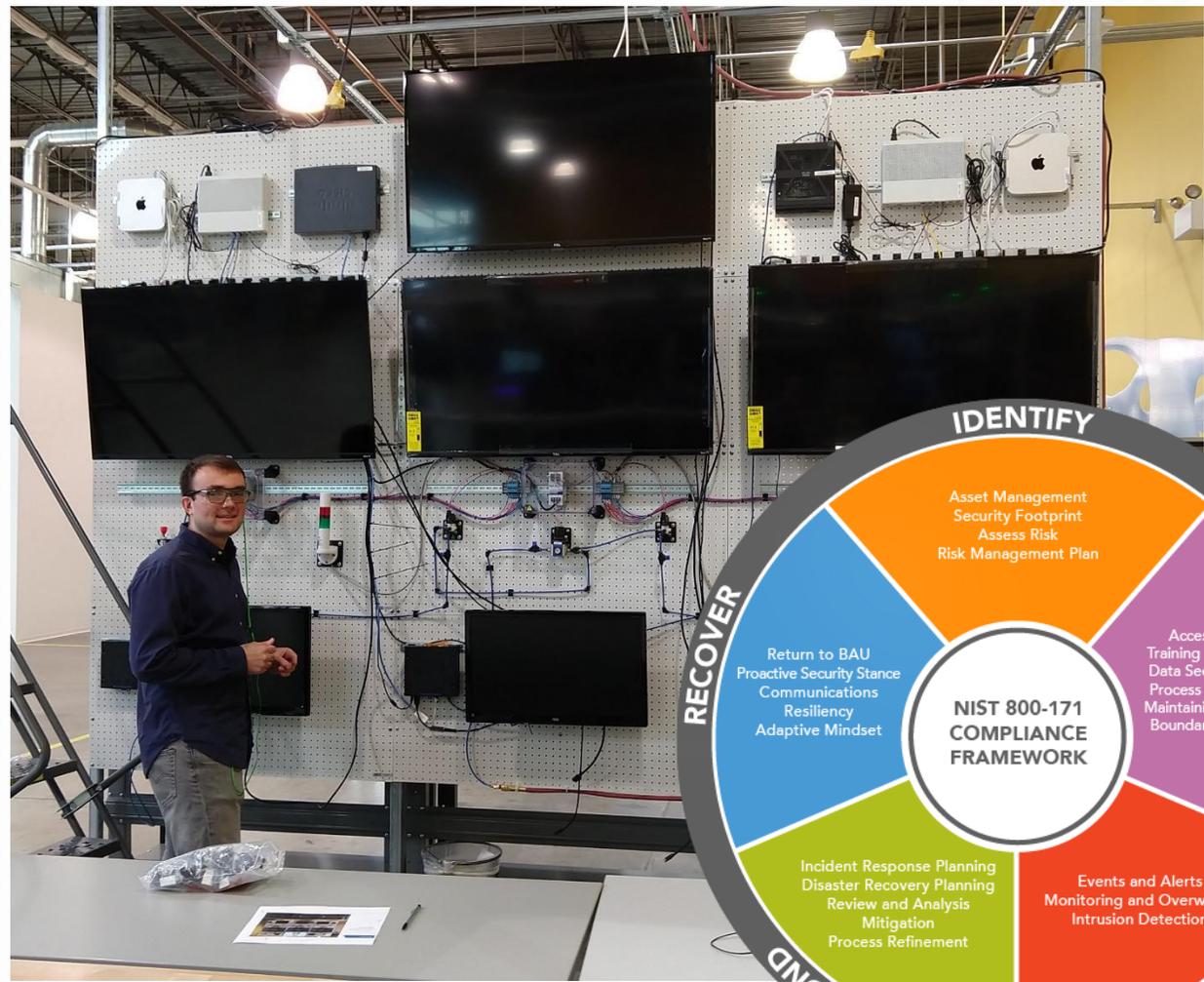
CYBERSECURITY FOR MANUFACTURING

Workforce Development

Awareness Building

Low-Cost Solution Development & Technology Adaptions

Workforce Development Efforts Focused On Addressing Industry and Government Needs

Foundational Programs

Jobs Taxonomy

- **Report identifying 165 data-centric jobs necessary for the future of manufacturing**
- **Used by MxD corporate partners to inform hiring decisions**

Partners: ManpowerGroup, MxD industry and academic members

DM&D 101-Series

- **10-part MOOC featuring digital manufacturing and design technologies**
- **Certificate issued upon completion of the program**

Partners: University at Buffalo, Coursera

Ongoing Programs

IGNITE: Mastering Manufacturing

- **Curriculum development program at the high school level**
- **Pilot will consist of 3 years of hands-on advanced manufacturing skills training, including a focus on cybersecurity programming**

Partners: LIFT, America Makes, Amatrol, Waukegan High School

Digital Capabilities Workshops

- **Workshops to help industry understand where the application of digital technologies can improve their operations**

Partners: John Deere, IMEC (IL MEP)

Future Programs

Jobs Taxonomy 2.0

- **Building off the current taxonomy, but with a focus on cybersecurity roles including the identification of those roles and the roadmaps to achieving those roles**

Partners: ManpowerGroup

Internship Program

- **Working with regional partners to develop a formal MxD apprenticeship program**
- **Interns will help on the factory floor and receive hands-on experience with cutting-edge digital technology design and implementation**

Partners: To be finalized

MxD HELPS U.S. MANUFACTURERS MAKE EVERY PART BETTER THAN THE LAST

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@MxDInnovates