

JABIL
OPTICS

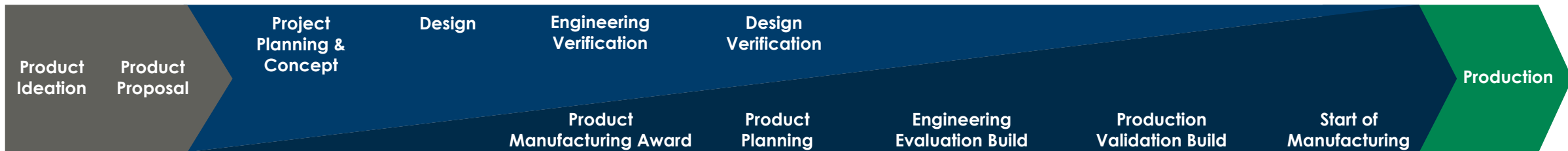
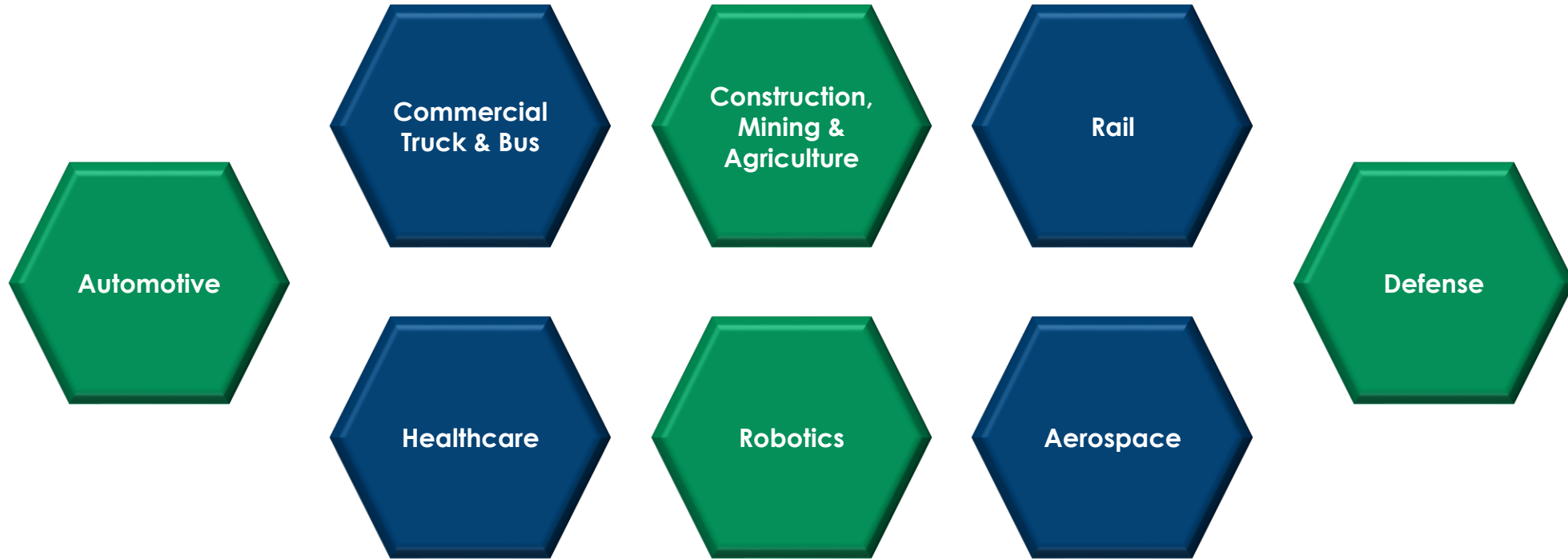


OPTICS EXPERTISE AT ITS BEST

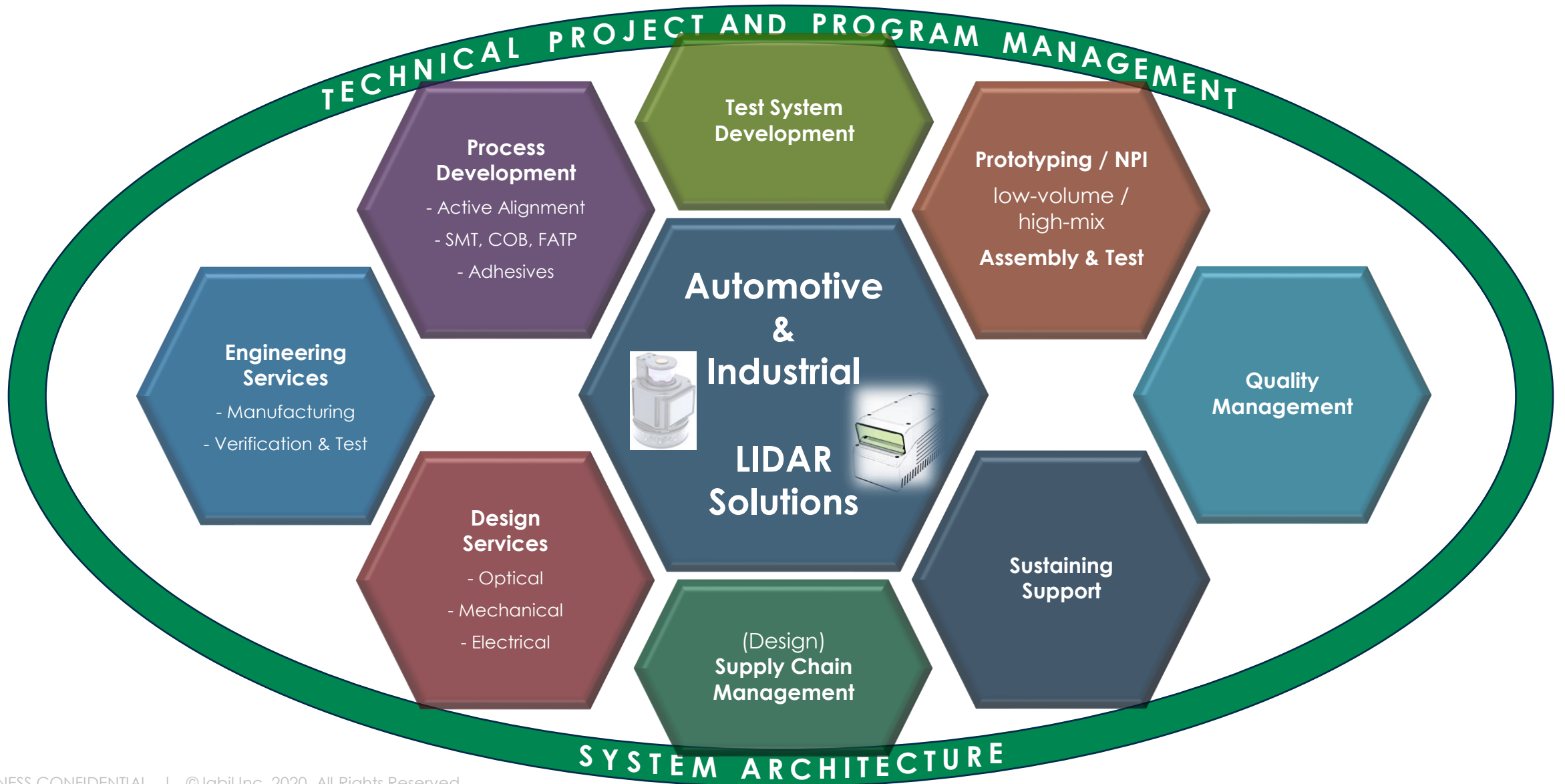
EPIC Online Technology Meeting on
LIDAR 2.1 Applications for 2021

Simon Schwinger
Business Development
March 15, 2021

(SELECTION OF) INDUSTRIES WE SERVE & WITH POTENTIAL FOR **LIDAR** APPLICATIONS



JABIL: DELIVERING VALUE ON THE WAY TO COMPLETE LIDAR SOLUTIONS



APPLYING JABIL'S WORKCELL-LEVEL COMPETENCIES FOR LOW-VOLUME / HIGH-MIX PRODUCTION



JABIL Optics Engineering

- **World leader in design / engineering** of
 - Optical
 - Opto-electronical
 - Opto-mechanicalSub-assemblies & systems
- **200+ skilled engineers** provide solutions for most challenging requirements
- **20+ success stories** ranging from start-ups/ blue chips to matured corporations
- **15+ years experience** in right-sizing **manufacturing solutions**

JABIL Optics Creation Center (JOCC)

- Leveraging **Jabil's high-volume manufacturing expertise** for **low-volume / high-mix applications**
- Thoroughly assessing
 - **Product performance** objectives
 - Design & process **risks**
 - Design **documentation**
 - **Total cost of quality**
 - Expected production volumes
 - Production **methods, processes & equipment**
 - **Supply chain** orchestration

ROBOTS WILL BECOME MAJOR ENABLERS OF AUTOMATION WITH LARGE ECONOMIC IMPACT

INDUSTRIAL ROBOTICS MARKET

Stand-alone
Articulated

Stand-alone
Gantry / Linear / Cartesian

AGVs / AMRs

Exoskeletons

Market Overview



~\$48B

The market is expected to grow by a CAGR of **~20%** through 2024.



Key Challenges

- Software standards – interoperability between providers – burden on buyer
 - Software interoperability consortium
 - ~100 AMR companies building ‘nearly’ identical hardware
- AMRs are expensive
 - RaaS is a response
- Limitations in 3D sensing
 - Jabil Omnidirectional sensor
- Indoor / outdoor operation
 - Sensing
 - IP rating
- Collaborative robots
 - Accelerating human / robot interaction
- Perception of AMR's replacing humans vs. supporting humans
 - COVID-19 impacting worker safety, productivity, availability
 - Workforce availability

JABIL provides capabilities

From design to dust

Cameras
(2D, 3D, depth)

Additive
Manufacturing

Printed Electronics

Time-of-Flight
(ToF)

Automation

Sensors / IoT

LIDAR

Cloud / 5G

FATP

Projectors

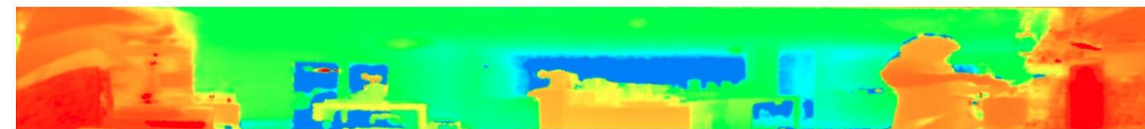
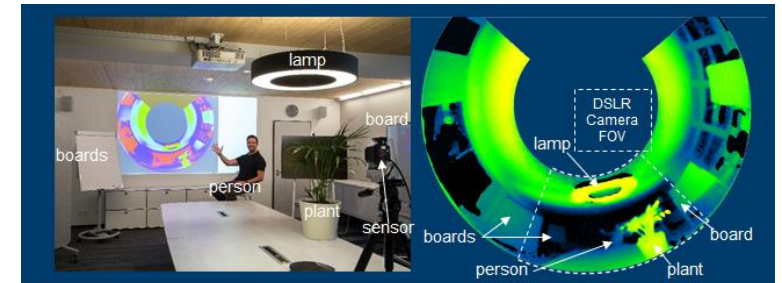
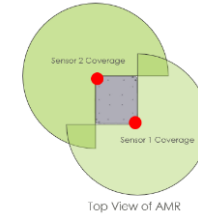
Active Alignment

Precision
Mechanics



Omnidirectional Sensing Solution

- Jabil's Omnidirectional Sensor, based on **time-of-flight technology**, captures **depth information** in a **radial format**, removing the need for multiple independent sensors on robotics platforms. With its **large field of view**, the innovative solid-state sensor supports state-of-the-art **object detection** and **collision avoidance** algorithms.



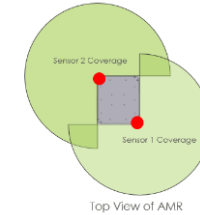
https://www.jabil.com/dam/jcr:66b00e86-778a-4315-9ff8-65110bcade95/JABIL_ORBITAL_SENSOR_BROCHURE.pdf

Omnidirectional Sensing Solution

- FoV | **HFOV: 270° VFOV: 60°**
- Frame Rate | **30fps** (ToF imager)
- Power Input | 24V / 0.6A average
- Resolution | 640x480 pixels
- Processor | NXP iMX8M-Mini
- Wavelength | **850nm / (940nm)**
- Detection Range | **up to 5m**
- Dimension | Height: ~125mm Width: ~95mm
- Touch Display | 320x240 pixels
- Interface | Ethernet/USB2.0/WiFi/Bluetooth/SD
- **Patent Portfolio** | **System, optics, control**
- Custom Designed Lens by JABIL



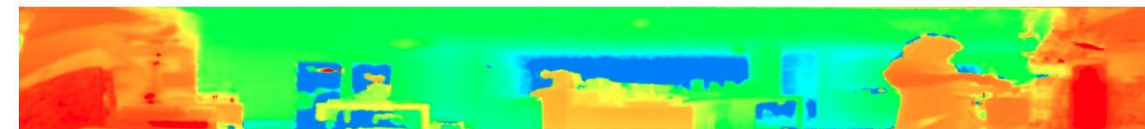
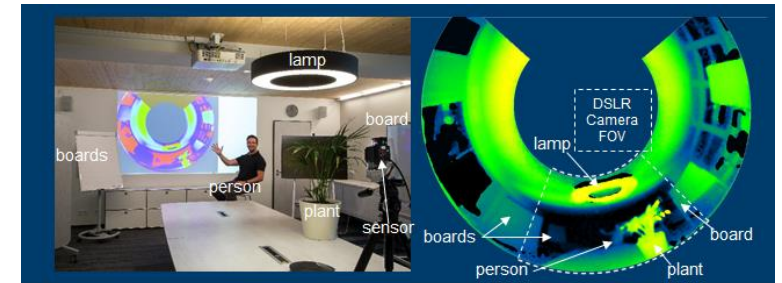
Sensors positioned cornerwise on an AMR



Top View of AMR



Side View of AMR

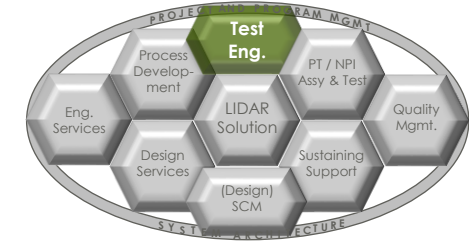


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• Challenges in Test Engineering / System Testing

- Alignment towards large distances – tips & tricks
 - Optical delay lines
 - Foldings (optical beam)
- Handling of large dynamic ranges (high-power light sources vs. detection signal)
- Operating / environmental tests for entire modules, e.g.
 - Salt spray / salt fog test
 - Leakage testing
- Tendency toward higher complexity in interfacing (additional testing required)
 - Customer know-how vs. supplier system knowledge
 - Test / measurement results <> SW post processing (customer)
- Dedicated Active Alignment strategies required

„Active Alignment is a closed loop, precision assembly technique that uses a device’s functional output as feedback in order to determine the optimal relative positioning of components during assembly.“



AT JABIL WE STRIVE TO MAKE ANYTHING **POSSIBLE** AND EVERYTHING **BETTER**



Markets We Serve



Our Ability to Execute



240K

Employees



100+

Locations



27,000

Supply Chain Partners



53.9M sf

Manufacturing Space



400+

Brands



27.3B

FY20 Revenue

THANK YOU



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JABIL

MADE **POSSIBLE.**
MADE **BETTER.**