



Thinking Ahead for Domestic Solid State Lighting Manufacturing

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What Do Our Customers Expect from SSL Solutions

- Sustained and Consistent Illumination Performance
 - Little or No Maintenance Required Throughout the Expected Service Life of the Product



- Predictable Economic Performance
 - High Reliability / Low Risk Illumination Performance Throughout the Installed Life of the Product



General SSL Opportunities

- The Ability to Address Illumination Challenges in More Ways Than Before
 - More Products and More Product Configurations
 - Illumination performance Optimizing
 - Economic Fine Tuning

Optimized Balance = Lowest Total Cost of Ownership



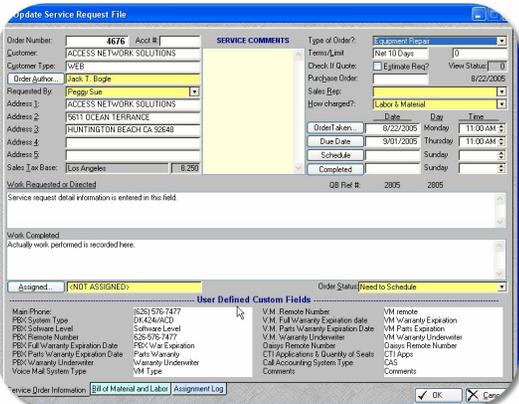
Resulting Manufacturing Challenges

- Avoiding Heavier/Expensive Inventory
 - Keeping Inventory in Lowest Common Denominator Form
 - No Sub-Assemblies or Finished Goods Inventory



Resulting Manufacturing Challenges

- Requires Expeditious Order Processing and Product Build
 - More Robust Enterprise Resource Planning
 - Reducing Lead Times
 - Increased Order-to-Cash Velocity



Resulting Manufacturing Challenges

- Requires Optimized Manufacturing Space Utilization
 - Low Manufacturing Space to Throughput Ratio
 - Flexible Manufacturing Technologies
 - Supports Rapid Innovation
 - Supports a “Future Proof” Manufacturing Philosophy



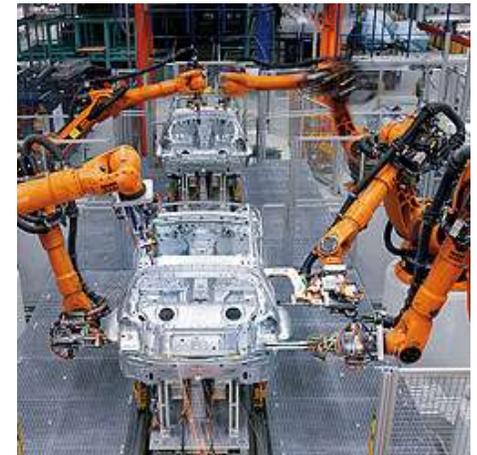
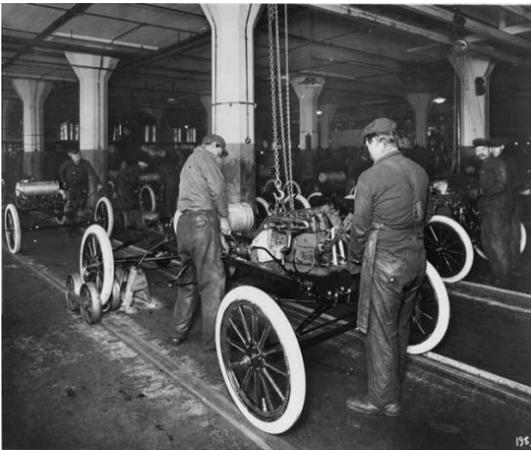
What Will the Products of the Future Look Like?

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- **New Form Factors**
- **Smaller Volumetrically / Lighter Weight**
 - With Illumination Performance Improvements; Brightness Control, etc.
- **Less LED Material at Higher Power???**
 - Using Wave Guide Systems/Technologies???
- **More LED Material at Lower Power???**
 - Cheaper and Better LEDs
 - Less Heat...
- **More Housing Material Options**
 - Plastics... Low Environmental Impact Options
- **As Close to One Highly Reliable Circuit Board as Possible**
 - Fully Populated for all Possible Functionality (Less SKUs)
 - Programed at Factory or During Installation (Commissioning)
 - Populated as Needed (More SKUs, More Inventory Challenges)
- **Many SKUs Created from Very Few BOMs...**
 - Highly Consolidated Product Platforms

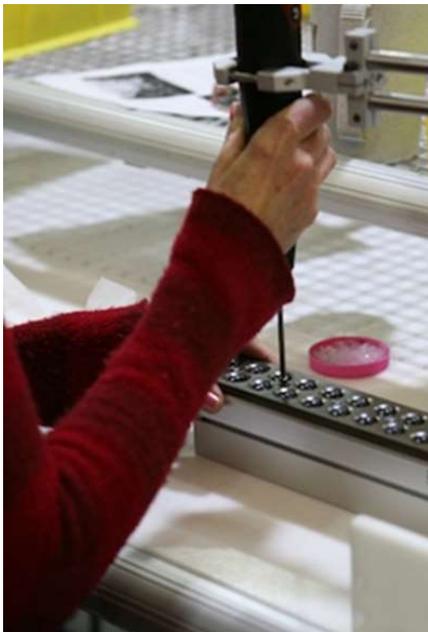
Is More Automation the Answer?

- Speed and Accuracy
 - Predictability
 - Quality Assurance
- Specialized Automation vs. Flexible Automation
 - Avoid Automation Investments that Confine Innovation Potential and Product Lifecycle Management
 - Product Lifecycles Will Be Shorter by Comparison
 - Industry Wide Innovation Will Occur at an Accelerated Rate



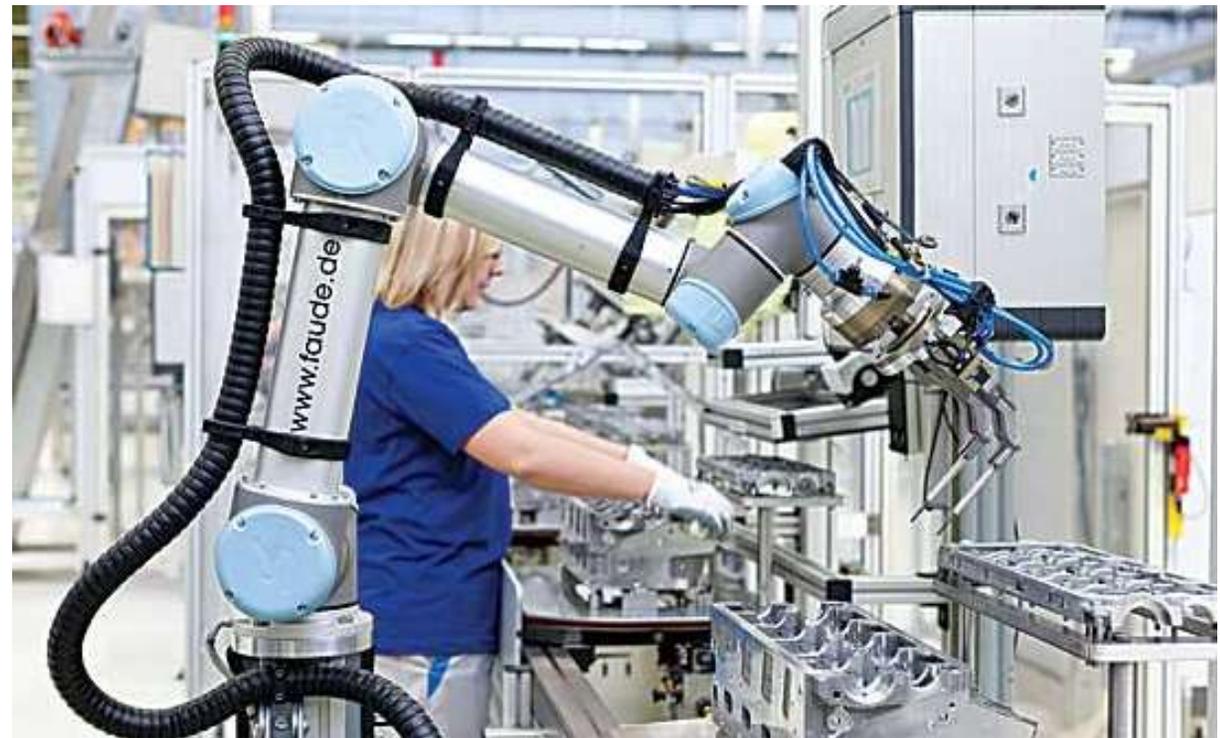
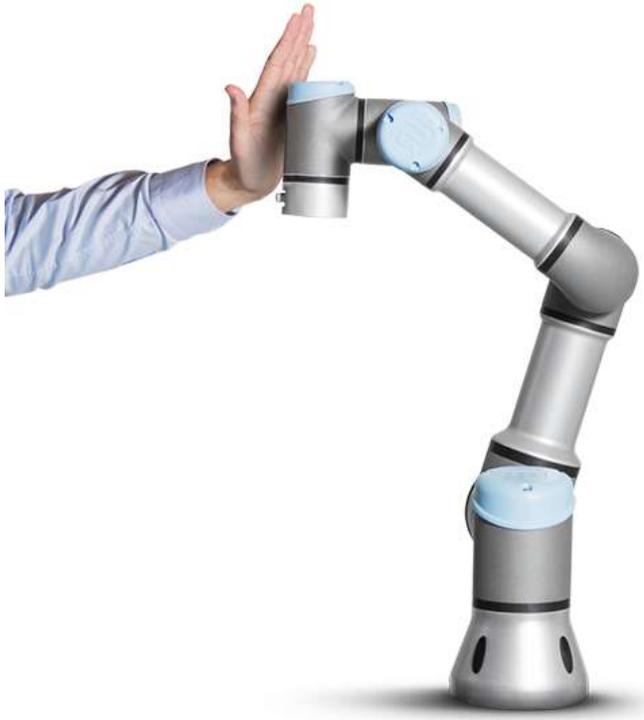
Is More Automation the Answer?

- DFMA for Low Cost or No Automation Requirements?
 - Simplified Full Mechanical Assemblies
 - Avoid Processes Cure Times, Heating, etc...



Integration of Humans With Automation

- Sensor Driven Robotics
 - Safe / Sensor Rich Environment (no cages, light curtains, etc.)
 - Reduced Repetitive Motion Activity Risks
 - Flexible



“In-Process” Performance and Quality Validation

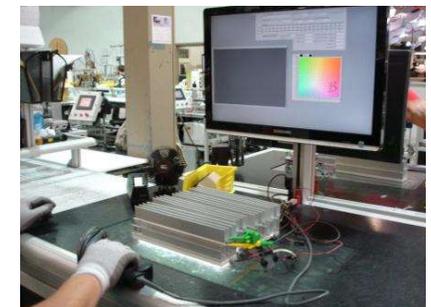
Goals

- Verify and Document Performance Metrics as Part of the Manufacturing Process
- Identify conditions that may lead to performance compromises or failures

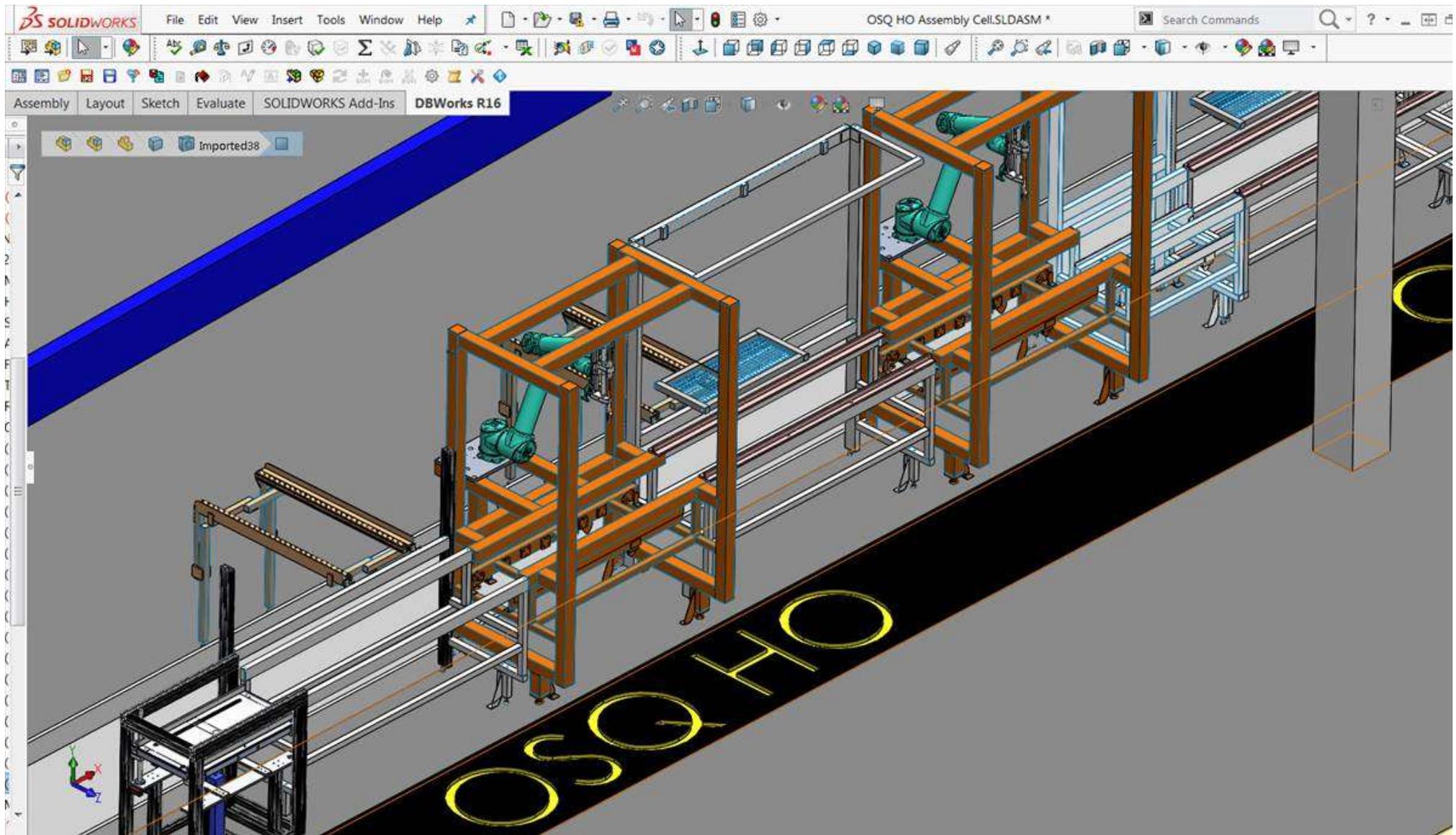


Examples:

- Leak Testing
 - Photometric Testing (Color and Absolute Intensity)
 - General Mechanical Integrity Testing
 - Etc.
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- Done With No Compromises In Assembly Time
 - Data Tied to / Embedded in the Luminaire Serial Number



Rapid Work Cell Design and Implementation



Can US Manufacturing Be Globally Competitive?

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- Potential Risks of Offshore Manufacturing
 - Transportation Risks
 - Dynamic Workforce
 - Quality Control Challenges
 - Tariffs
 - Economic Uncertainty...



Can US Manufacturing Be Globally Competitive?

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- Potential Opportunities for US Manufacturing
 - Global Products (compared to incumbents)
 - Universal electrical compatibility (not locally defined)
 - Broad compliance possibilities
 - Workforce Stability Through Investment in Employees
 - Evolving Technology
 - Growth Industry
 - Very Low Market Penetration
 - Insource All Human Resource Demands
 - Attract, Cultivate, Retain...
 - Availability of Materials and Manufacturing Technologies



Thank You for Your Time and Attention

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