REDEFINING PRODUCT DEVELOPMENT WITH 3D-SCANNING & POLYWORKS
GE APPLIANCES – GOOD THINGS, FOR LIFE.
At GE Appliances, we make life better by designing and building the world’s best Appliances.

GEA has electrified and modernized life for more than 125 years with our legacy of invention.
EMPLOYEES

Approximately 12,000 WORLDWIDE
Including 6,000 IN LOUISVILLE

FRENCH DOOR REFRIGERATORS MADE IN AMERICA
SIDE-BY-SIDE REFRIGERATORS MADE IN AMERICA
TOP FREEZER REFRIGERATORS MADE IN AMERICA

GE APPLIANCES a Haier company

Made in AMERICA

MEET OUR AMERICAN MADE PRODUCTS

By investing over $1 billion dollars in new plants, equipment and technology, insuring the manufacture of many of our new products and upgrading employee training, we have recommitted ourselves to making great American-made appliances.

LEARN MORE
<table>
<thead>
<tr>
<th>Design (Plan)</th>
<th>Build (Do)</th>
<th>Verify (Check)</th>
<th>Execute (Act)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Master CAD Data</td>
<td>Tooling Design</td>
<td>CMM Model Base Inspection</td>
<td>Real Time Quality Control</td>
</tr>
<tr>
<td>GD&amp;T and Model Based Definition</td>
<td>Tool Validation / Simulation</td>
<td>In-Process Functional Gaging</td>
<td>Automated 3D Inspection</td>
</tr>
<tr>
<td>Design Validation / Variation Analysis</td>
<td>Tool Validation / Digital Archiving</td>
<td>Optical 3D Scanning</td>
<td>Quality Data Management</td>
</tr>
</tbody>
</table>
APPLICATIONS AT GE APPLIANCES

200+ studies this year…

- Part and Assembly Inspection
- Large Scale Digital Assembly Studies (using Photogrammetry)
- Prototype Build Inspection
- Tooling Inspection
- Part and Tooling Digital Archiving
- Reverse Engineering / CAE Simulation
- Volume, Foam Studies, Warp Analysis
- Data Capture for VR Rendering
PART / ASSEMBLY INSPECTION
REFRIGERATOR DIGITAL ASSEMBLY

Outer Door Deviation

Frame Door Deviation

Case Flange Deviation
REFRIGERATOR PROGRAM DEVELOPMENT

DG Prototype Build - October 2016

Production Build - June 2017

DG Prototype

DC Prototype

Pre-Production

Production
LINEAR ACTUATOR ASSEMBLY

Actuator Assembly

CT Scan of Assembly

Gear Rack Section

Blue = CAD
Orange = SCAN
WASHER BASKET RUNNOUT

Basket High Side

Basket Assembly

Basket Low Side

Basket Bottom

Scan to Tool Digital Assembly

Section View of Tool
TRANSMISSION DRIVE TORQUE

Bearing Axis Projection

Bearings
TRANSMISSION DRIVE TORQUE

Bearing Misalignment

Upper Bearing Tilt

Lower Bearing Tilt
DISHWASHER SHAFT SEAL

Blue = CAD
Orange = SCAN
CLEARANCE / INTERFERENCE
ICEBOX DOOR GASKET COMPRESSION

Virtual Assembly Scans

Cross Section

Gasket Compression Color Plot

Actual Compression

Nominal Compression

Blue = CAD
Red = Icebox SCAN
Orange = Door SCAN
RANGE BURNER DIGITAL ASSEMBLY CLEARANCE

Lower Gas Channel Clearance

Upper Gas Channel Clearance
PART THICKNESS / VOLUME
DISHWASHER TUB THICKNESS

Traditional Thickness Analysis

3D Thickness Analysis
DIGITAL ASSEMBLY VOLUME ANALYSIS

Icebox Virtual Assembly Scans

Volume Calculation
REVERSE ENGINEERING
REVERSE ENGINEERING

STL Data

Developed CAD Data

STL Data

Developed CAD Data

3D Print of STL

Part
AS-BUILT PART ANALYSIS

Thicknes Analysis

Draft Angle Analysis
SIMULATION
MOLDFLOW SIMULATION VALIDATION

Moldflow Predicted Shape

Part to Moldflow Comparison

Scan Data
COMPUTATIONAL FLUID DYNAMICS

CFD Model using Scan Data

Fan → Scan Data
TOOLING AND EQUIPMENT
STAMTEC 1100 PRESS (HANDYSCAN)
TOOLING ANALYSIS AND DIGITAL ARCHIVING

Clearance Analysis - Lower

Clearance Analysis - Upper

Part Digital Golden Sample

Tool Digital Golden Sample
VIRTUAL REALITY
VR CRAFTSMANSHIP RENDERING

Product → Scan Data → VR Rendering
VR CRAFTSMANSHIP RENDERING

- STL Data
- VR Rendering with Flystick
- Flystick
- NURBS Surfacing
QUESTIONS?