2016 Global Industrial CT Systems Company of the Year Award
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Background and Company Performance

Industry Challenges

Globally, computed tomography (CT) metrology is still in a nascent state in terms of market adoption. Despite the technology’s game-changing potential, high costs and technical limitations restrict its adoption. Technical challenges with ensuring data accuracy, scanning speeds, automation, composite inspection, and multi-material complexity weaken the demand for CT metrology systems.

Another key challenge to their adoption stems from the difficulties in sustaining revenue growth in a market characterized by high price sensitivity at all industry levels. A key area of improvement is spreading market awareness by helping customers understand the benefits of adopting a CT system. Although the perception that CT systems mainly act as research tools is changing gradually, there is still a lack of awareness about the advantages of using CT technology for the production environment. This is mainly due to the fact that most CT systems are still very slow (leading CT systems take 30–45 minutes for scanning and reconstruction, depending on the resolution requirement). Production environments, on the other hand, require faster inspection systems to maintain high manufacturing efficiency and productivity. There is thus a need for inline CT systems supporting higher scanning speeds, and a superior detection of defects in the production environment.

Moreover, the industry needs CT solutions that can combine a high degree of automation with a high degree of accuracy, a major prerequisite for production lines. Most end users require precise data and automated inspection with a simplified workflow for identifying the part, initiating the CT scanning process, quickly acquiring the data, and verifying results. Thus, there is a clear need for solutions that enable the inspection of objects with detectors for both non-destructive testing (NDT) and metrology of complex inner and outer structures. Moreover, despite technological advances enabling CT systems to scan with much higher speed, the reconstruction of images is impacted by scatter artifacts. This creates a need for image quality enhancement.

Industry participants need to work together to overcome these technical challenges to revolutionize the dimensional metrology space, thereby increasing the technology’s market adoption and eventually leading to the replacement of conventional systems such as coordinate measuring machines and other three-dimensional (3D) scanners.

Visionary Innovation and Performance and Customer Impact

Addressing Unmet Needs

To address key unmet customer requirements in the current global CT scanning systems market, GE Inspection Technologies (GE) offers a portfolio of innovative, value-adding products (including its v|tome|x c HS industrial CT scanner and speed|scan CT 64) that
enable scanning with high accuracy and speed. With its profound technological expertise and many years of business experience, GE leverages its NDT technology to design CT systems that are focused on providing the high precision of a fan beam CT system with the increased throughput of cone beam CT inspection at minimal operational costs.

Over the years, GE has sustained its market growth by providing support for superior wall thickness analysis for high-density parts and materials. The company has developed its solution portfolio to cover materials such as steel and aluminum as well as provide multi-material support. Unlike many of its competitors the company is strongly focused on offering a comprehensive solution and designing path breaking technologies to support automotive and aerospace samples and materials such as light metal objects, steel, plastics, ceramics, and distinctive alloys. The next-generation CT scanners from GE provide customers with a comprehensive inspection solution that incorporates a high degree of flexibility for failure analysis, production, and research and development (R&D).

**Implementation of Best Practices**

Striving to take CT technology to the next level for data automation in the production environment, GE has introduced its phoenix v|tome|x c 450 HS industrial CT scanner and further developed its speed|scan CT 64 in 2015. The v|tome|x c HS industrial CT scanner is the first of its kind to support high throughput in the industrial production environment. It is a highly automated, compact, and 450 kilovoltage (KV) CT system combined with a 40 x 40 cm GE DXR 250 digital detector with v|tome|x c supports applications for NDT and 3D metrology with a measurement accuracy of 20+L/100 µm.

Demonstrating its unique capabilities to appropriately meet market needs, GE seeks to consolidate its leading position in the CT industry by leveraging this product for making significant progress in reducing scatter radiation. To minimize scatter radiation over the reconstructed image with increased accuracy and speed for detailed failure analysis, GE uses a flat panel detector cone beam CT instead of a line detector. Moreover, v|tome|x has introduced a CT scan with a different approach though its scatter|correct and quick|pick capabilities. The quick|pick module has been developed by GE for automated blade batch examination that enables CT scans of 25 blades within 2 hours without any operator intervention. scatter|correct provides end users with the same resolution that can be obtained by using the time-consuming (usually taking more than hour) line detectors while streamlining the scanning process by 10 to 100 times. The scatter|correct hardware/software module enables relatively fine surface detection and precisely measures wall thicknesses for high-density materials. This unique proposition distinguishes GE from other leading participants in the industry and enables users to enhance the image quality, improve the precision of failure analysis, and easily compare 3D computer-aided design (3D CAD) models with the acquired information. In a nutshell, scatter|correct enables a significant reduction in scatter artifacts with a flat cone beam CT. The company has introduced on November 2015 its compact CT system phoenix v|tome|x m metrology edition now also available with this unique scatter|correct technology. The
scanner is widely used by metrology labs and industrial process controls because of its 300 kV / 500 W microfocus scanning capability offering a measurement accuracy of 4+L/100 µm. This is the very first industrial microCT scanner with scatter|correct technology incorporated to automatically eliminate scatter artifacts. The scatter|correct technology allows users to reach to low scatter artifact quality levels never reached previously in the CT industry with traditional cone beam microCT.

With the introduction of speed|scan CT 64–channel data acquisition, customers can conduct NDT and metrology with only one CT scan. The system is designed to provide improved performance, more than 100 times higher than other traditional industrial fan beam CT systems, and a rapid sample throughput rate. speed|scan CT 64 enables scanning in down to 15 seconds and parallel 3D volume evaluation within two minutes, which ensures high efficiency in the production environment. The product can be used for 100% 3D NDT as well as dimensional production control of medium-to-large light metal castings and composites. speed|scan CT 64 allows for a maximum sample size of 600 mm in diameter and 900 mm in length.

Price/Performance Value

The key to success for any company lies in offering the best price performance ratio for its customers. GE’s solutions exhibit striking differentiation from conventional CT systems and can be used for almost all applications in research and production environments. Many of these also lead to highly disruptive innovations. Original equipment manufacturers (OEMs) in automotive and aerospace industries widely appreciate the price performance value offered by GE’s CT systems that reduce maintenance and ownership costs while improving inspection quality and productivity for high-throughput industrial applications.

The simplified workflow offered by GE’s solutions provides customers with a significant value addition. It is best demonstrated by the ease of use guaranteed by v|tome|x’s one-button batch processing feature that ensures a strong focus on task execution for rapid data acquisition and high scanning speed, 3D analysis, and automatic defect detection algorithms for both NDT and metrology. The value proposition of GE’s v|tome|x c HS system with the quick|pick module and the one-button CT option represents a disruptive technology that facilitates an increased adoption of CT technology in the production environment by addressing the need for faster inspection systems to maintain high manufacturing efficiency and productivity. Offering a simplified and fully automated workflow with minimal operator intervention and training across the entire CT analysis process without any additional robot arm requirement, GE’s advanced CT system platform provides a price performance advantage to increase the repeatability of CT results while minimizing operational costs. According to the company, the simplified workflow enabled by GE’s CT systems allows a single operator to simultaneously control up to four systems instead of just one CT system.
**Customer Ownership Experience**

GE places strong emphasis on sustaining its leadership position for applications in key vertical markets such as automotive and aerospace. GE has historically catered to these industries, particularly addressing their requirements in the manufacturing space. Committed to providing its customers with an enhanced customer ownership experience through the life span of its CT products, GE has leveraged a proven technology to design a wide range of product packages and modules. The company offers, for example, an optional phoenix datos|x 2.3 CT software package for a fully automated workflow that minimizes the operator time and risk of errors with a high repeatability of CR results. The phoenix datos|x software automates the total CT process chain. All CT process including scanning, reconstruction, and evaluation analysis of failures can be fully programmed and performed automatically supporting high performing 3D measurements using the software solution. The new software package allows users to conduct failure analysis to be performed considerably faster, raising productivity, and minimizing operator influence.

**Customer Purchase Experience**

GE has ensured a best-in-class customer purchase experience for its flat panel cone beam CT systems for industrial applications. The company has a burgeoning customer base for its v|tome|x c HS industrial CT scanner.

According to Frost & Sullivan, GE’s CT system is uniquely designed to correct the surface image detection generated by scatter radiation using the scatter correct module. This enables the measurement of highly precise and small thicknesses with high-density materials including small- and medium-sized steel castings, large and complex light metal castings, and hard-to-penetrare multi-material objects.

GE offers a highly customizable user interface for automatic defect recognition and 3D visualization and analysis of complex inner geometries, which is extremely useful for serial inspection and production control processes.

**Brand Equity**

According to Frost & Sullivan’s benchmarking analysis, GE’s success in the CT systems market is largely driven by its effective implementation of its end-user-centric strategies. F&S research indicates that GE continues to be the leading provider of CT dimensional metrology solutions, with a market share of about 24% in 2014.

According to Frost & Sullivan’s analysis, the strong brand loyalty enjoyed by GE derived from its know-how and capability to optimize system performance and ensure continuity of supply. While several CT system vendors buy components such as generators, panels, tubes and CT acquisition/reconstruction software from other vendors, which is a clear constraint in terms of control of the supply chain, GE ensures the smooth replacement of
its tubes and panels without affecting the performance of the system. A thorough understanding of operators’ needs further increases the company’s brand equity.

Conclusion

As technology evolves, CT metrology equipment is expected to provide manufacturers not only with a means of inspection, but also with valuable insights into the production process. GE has consolidated its market leadership with the launch of its v|tome|x c HS industrial CT scanner in 2015. The solution offers a simplified and automated workflow, high cost-effectiveness, and improved scanning speed to control the output of many production lines. GE has also made significant progress to reduce scatter artifacts while ensuring high quality standards with its flat panel cone beam CT system. The company has introduced its compact CT system phoenix v|tome|x m metrology edition now also available with this unique scatter|correct technology.

With its strong overall performance, GE Inspection Technologies has earned Frost & Sullivan’s 2016 Company of the Year Award for its contributions to the CT systems market.
Significance of Company of the Year

To win the Company of the Year award (i.e., to be recognized as a leader not only in your industry, but among your non-industry peers as well) requires a company to demonstrate excellence in growth, innovation, and leadership. This kind of excellence typically translates into superior performance in three key areas: demand generation, brand development, and competitive positioning. These areas serve as the foundation of a company’s future success and prepare it to deliver on the two criteria that define the Company of the Year Award (Visionary Innovation & Performance and Customer Impact).

Understanding Company of the Year

As discussed above, driving demand, brand strength, and competitive differentiation all play a critical role in delivering unique value to customers. This three-fold focus, however, must ideally be complemented by an equally rigorous focus on visionary innovation to enhance customer value and impact.
Key Benchmarking Criteria
For the Company of the Year Award, Frost & Sullivan analysts independently evaluated two key factors—Visionary Innovation & Performance and Customer Impact—according to the criteria identified below.

**Visionary Innovation & Performance**
- Criterion 1: Addressing Unmet Needs
- Criterion 2: Visionary Scenarios Through Mega Trends
- Criterion 3: Implementation Best Practices
- Criterion 4: Blue Ocean Strategy
- Criterion 5: Financial Performance

**Customer Impact**
- Criterion 1: Price/Performance Value
- Criterion 2: Customer Purchase Experience
- Criterion 3: Customer Ownership Experience
- Criterion 4: Customer Service Experience
- Criterion 5: Brand Equity

Best Practice Award Analysis for GE Inspection Technologies

**Decision Support Scorecard**
To support its evaluation of best practices across multiple business performance categories, Frost & Sullivan employs a customized Decision Support Scorecard. This tool allows our research and consulting teams to objectively analyze performance, according to the key benchmarking criteria listed in the previous section, and to assign ratings on that basis. The tool follows a 10-point scale that allows for nuances in performance evaluation; ratings guidelines are illustrated below.

**RATINGS GUIDELINES**

The Decision Support Scorecard is organized by Visionary Innovation & Performance and Customer Impact (i.e., the overarching categories for all 10 benchmarking criteria; the definitions for each criteria are provided beneath the scorecard). The research team confirms the veracity of this weighted scorecard through sensitivity analysis, which
confirms that small changes to the ratings for a specific criterion do not lead to a
significant change in the overall relative rankings of the companies.

The results of this analysis are shown below. To remain unbiased and to protect the
interests of all organizations reviewed, we have chosen to refer to the other key players as Competitor2 and Competitor3.

DECISION SUPPORT SCORECARD FOR COMPANY OF THE YEAR AWARD

<table>
<thead>
<tr>
<th>Company of the Year</th>
<th>Visionary Innovation &amp; Performance</th>
<th>Customer Impact</th>
<th>Average Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE Inspection Technologies</td>
<td>9.2</td>
<td>9.0</td>
<td>9.1</td>
</tr>
<tr>
<td>Competitor2</td>
<td>8.9</td>
<td>8.7</td>
<td>8.8</td>
</tr>
<tr>
<td>Competitor3</td>
<td>8.6</td>
<td>8.4</td>
<td>8.5</td>
</tr>
</tbody>
</table>

**Visionary Innovation & Performance**

**Criterion 1: Addressing Unmet Needs**
Requirement: Implementing a robust process to continuously unearth customers’ unmet or under-served needs, and creating the products or solutions to address them effectively.

**Criterion 2: Visionary Scenarios Through Mega Trends**
Requirement: Incorporating long-range, macro-level scenarios into the innovation strategy, thereby enabling “first to market” growth opportunities solutions.

**Criterion 4: Implementation of Best Practices**
Requirement: Best-in-class strategy implementation characterized by processes, tools, or activities that generate a consistent and repeatable level of success.

**Criterion 3: Blue Ocean Strategy**
Requirement: Strategic focus in creating a leadership position in a potentially “uncontested” market space, manifested by stiff barriers to entry for competitors.

**Criterion 5: Financial Performance**
Requirement: Strong overall business performance in terms of revenues, revenue growth, operating margin and other key financial metrics.

**Customer Impact**

**Criterion 1: Price/Performance Value**
Requirement: Products or services offer the best value for the price, compared to similar offerings in the market.

**Criterion 2: Customer Purchase Experience**
Requirement: Customers feel like they are buying the most optimal solution that addresses both their unique needs and their unique constraints.
Criterion 3: Customer Ownership Experience
Requirement: Customers are proud to own the company’s product or service, and have a positive experience throughout the life of the product or service

Criterion 4: Customer Service Experience
Requirement: Customer service is accessible, fast, stress-free, and of high quality

Criterion 5: Brand Equity
Requirement: Customers have a positive view of the brand and exhibit high brand loyalty

Decision Support Matrix
Once all companies have been evaluated according to the Decision Support Scorecard, analysts can then position the candidates on the matrix shown below, enabling them to visualize which companies are truly breakthrough and which ones are not yet operating at best-in-class levels.

DECISION SUPPORT MATRIX FOR COMPANY OF THE YEAR AWARD
The Intersection between 360-Degree Research and Best Practices Awards

**Research Methodology**

Frost & Sullivan’s 360-degree research methodology represents the analytical rigor of our research process. It offers a 360-degree-view of industry challenges, trends, and issues by integrating all 7 of Frost & Sullivan's research methodologies. Too often, companies make important growth decisions based on a narrow understanding of their environment, leading to errors of both omission and commission. Successful growth strategies are founded on a thorough understanding of market, technical, economic, financial, customer, best practices, and demographic analyses. The integration of these research disciplines into the 360-degree research methodology provides an evaluation platform for benchmarking industry players and for identifying those performing at best-in-class levels.
Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices

Frost & Sullivan Awards follow a 10-step process to evaluate award candidates and assess their fit with select best practice criteria. The reputation and integrity of the Awards are based on close adherence to this process.

<table>
<thead>
<tr>
<th>STEP</th>
<th>OBJECTIVE</th>
<th>KEY ACTIVITIES</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Monitor, target, and screen</td>
<td>Identify award recipient candidates from around the globe</td>
<td>• Conduct in-depth industry research • Identify emerging sectors • Scan multiple geographies</td>
<td>Pipeline of candidates who potentially meet all best-practice criteria</td>
</tr>
<tr>
<td>2 Perform 360-degree research</td>
<td>Perform comprehensive, 360-degree research on all candidates in the pipeline</td>
<td>• Interview thought leaders and industry practitioners • Assess candidates’ fit with best-practice criteria • Rank all candidates</td>
<td>Matrix positioning all candidates’ performance relative to one another</td>
</tr>
<tr>
<td>3 Invite thought leadership in best practices</td>
<td>Perform in-depth examination of all candidates</td>
<td>• Confirm best-practice criteria • Examine eligibility of all candidates • Identify any information gaps</td>
<td>Detailed profiles of all ranked candidates</td>
</tr>
<tr>
<td>4 Initiate research director review</td>
<td>Conduct an unbiased evaluation of all candidate profiles</td>
<td>• Brainstorm ranking options • Invite multiple perspectives on candidates’ performance • Update candidate profiles</td>
<td>Final prioritization of all eligible candidates and companion best-practice positioning paper</td>
</tr>
<tr>
<td>5 Assemble panel of industry experts</td>
<td>Present findings to an expert panel of industry thought leaders</td>
<td>• Share findings • Strengthen cases for candidate eligibility • Prioritize candidates</td>
<td>Refined list of prioritized award candidates</td>
</tr>
<tr>
<td>6 Conduct global industry review</td>
<td>Build consensus on award candidates’ eligibility</td>
<td>• Hold global team meeting to review all candidates • Pressure-test fit with criteria • Confirm inclusion of all eligible candidates</td>
<td>Final list of eligible award candidates, representing success stories worldwide</td>
</tr>
<tr>
<td>7 Perform quality check</td>
<td>Develop official award consideration materials</td>
<td>• Perform final performance benchmarking activities • Write nominations • Perform quality review</td>
<td>High-quality, accurate, and creative presentation of nominees’ successes</td>
</tr>
<tr>
<td>8 Reconnect with panel of industry experts</td>
<td>Finalize the selection of the best-practice award recipient</td>
<td>• Review analysis with panel • Build consensus • Select winner</td>
<td>Decision on which company performs best against all best-practice criteria</td>
</tr>
<tr>
<td>9 Communicate recognition</td>
<td>Inform award recipient of award recognition</td>
<td>• Present award to the CEO • Inspire the organization for continued success • Celebrate the recipient’s performance</td>
<td>Announcement of award and plan for how recipient can use the award to enhance the brand</td>
</tr>
<tr>
<td>10 Take strategic action</td>
<td>Upon licensing, company may share award news with stakeholders and customers</td>
<td>• Coordinate media outreach • Design a marketing plan • Assess award’s role in future strategic planning</td>
<td>Widespread awareness of recipient’s award status among investors, media personnel, and employees</td>
</tr>
</tbody>
</table>
About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best in class positions in growth, innovation and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best practice models to drive the generation, evaluation and implementation of powerful growth strategies. Frost & Sullivan leverages almost 50 years of experience in partnering with Global 1000 companies, emerging businesses and the investment community from 31 offices on six continents. To join our Growth Partnership, please visit http://www.frost.com.