FROST & SULLIVAN

ZIEHM IMAGING RECEIVES THE 2023 ENABLING TECHNOLOGY LEADERSHIP AWARD

Identified as best in class in the European mobile C-arms with flat panel detector for the intraoperative imaging industry

Best Practices Criteria for World-Class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each award category before determining the final award recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. Ziehm Imaging excels in many of the criteria in the Mobile C-Arm for the intraoperative imaging space.

AWARD CRITERIA	
Technology Leverage	***Customer Impact***
Commitment to Innovation	Price/Performance Value
Commitment to Creativity	Customer Purchase Experience
Stage Gate Efficiency	Customer Ownership Experience
Commercialization Success	Customer Service Experience
Application Diversity	Brand Equity

Image Quality and Exposure as the Main Industry Challenges

Image quality tends to degrade over time despite image intensifiers' ability to provide high quality. However, flat panel detectors (FPD) displays offer higher contrast resolution with additional grayscale, minimal image degradation, and negligible geometric distortion, which explains why many C-arm providers are shifting from traditional image intensifiers to FPDs.

> *"As the first company to successfully introduce a fully digital mobile C-arm system with flat-panel technology and attain significant market penetration, Ziehm is the undisputed market leader. As of 2022, Ziehm Imaging has 13 offices and more than 800 employees, and it has demonstrated its industry leadership by setting up a total of 22,000 C-arms since its foundation."*
>
> ***- Dr. Bejoy Daniel,***
> ***Senior Industry Analyst,***
> ***Healthcare & Life Sciences***

Simultaneously, the industry seeks ways to minimize dose exposure, recognizing the importance of dose management and appropriate treatment. Organizations such as the International Commission in Radiology Protection (ICRP) and the European ALARA Network spread awareness about dose minimization and prepare guidelines for the medical use of X-rays. Indeed, clinicians' exposure to radiation while working with surgical C-arms is a serious issue. A study in the American Journal of Roentgenology observed elevated risks of brain cancer, breast cancer, and melanoma among technologists who performed fluoroscopically guided interventional procedures.[1]

[1] March 2016, American Journal of Roentgenology 206(5):1101-1109, DOI:10.2214/AJR.15.15265

Ziehm Imaging, an acknowledged innovation leader for mobile C-arms and the market leader in Germany and many other European countries, offers C- Arms for intraoperative imaging with the desired image quality at minimal dose levels.

An Alternative Low-cost Fluoroscopic System to Replace Image Intensifiers

The combination of a charge-coupled device (CCD) image sensor and an image intensifier forms a radiology imaging unit (RIU) for X-ray imaging and C-arms. However, image intensifier tube producers have discontinued their production, making CCD RIUs obsolete. As the demand for high-end features continues, the industry moves away from image intensifiers and toward FPDs, giving rise to FPD-based technologies such as amorphous silicon (a-Si), complementary metal-oxide semiconductor (CMOS), and indium gallium zinc oxide (IGZO).

> *"Despite IGZO detectors being next to CMOS detectors in terms of performance, Frost & Sullivan considers that IGZO FPD's expected price point with larger panel options positions them better to replace the obsolete CCD RIUs."*
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The problems with an a-Si are the relatively high electronic noise and the significant image lag, both undesirable in fluoroscopy and 3D CT imaging. CMOS FPDs support signal detection with low read noise, lower doses, and an advantage in resolution, speed, and sensitivity. However, this alternative is not affordable, as single sensors produce a high cost for larger panels. Ziehm Imaging's IGZO innovation possesses high-performance, low-cost thin film transistors (TFT) that truly differentiate its product. This and cost makes the Ziehm Imaging C-arms integrating mix of performance IGZO FPDs an ideal choice.

As the first company to successfully introduce a fully digital mobile C-arm system with flat-panel technology attaining significant market penetration, Ziehm Imaging is the undisputed market leader. As of 2022, the company has 13 offices and more than 800 employees, and it has demonstrated its industry leadership by setting up a total of 22,000 mobile C-arms since its foundation. In addition, Ziehm Imaging registered its C-arms integrating IGZO FPDs with a CE-mark as of October 2022. In particular, the company has demonstrated great success since the launch of this technology, with a total of 21unit shipments for mobile IGZO-based C-arms.

Delivering Cost-effective and Improved Detector Panel Resolution at a Lower Dose

Ziehm Imaging's IGZO based products have a smaller pixel matrix than the a-Si TFT alternative and have more sensitive pixels so that the FPDs can provide faster, improved resolution cost-effectively and at a lower dose. Despite IGZO detectors being quite similar to CMOS detectors in terms of performance, Frost & Sullivan considers that the IGZO FPD's expected price point with larger panel options positions them better to replace the obsolete CCD RIUs. Furthermore, Ziehm Imaging's IGZO detector option can also be a cost-efficient alternative to their successful and premium CMOSline systems.

Ziehm Imaging's Products Provide an Excellent Customer Experience with Several Applications

The Ziehm usability concept enables the seamless combination of hardware features and integrated software functionalities, improving process efficiency and ensuring standardized quality levels in the

operating room. Additional features such as the SmartDose concept and advanced active cooling (AAC) help optimize safety for surgeons, staff, and patients. SmartDose helps display the smallest anatomical areas in the highest image quality and reduces doses with intelligent pulse regulation thanks to its unique monoblock generator.

Regarding operating room (OR) efficiency and its enhancement, Ziehm Imaging's partnerships are its key differentiator, enabling versatile combinations with navigation systems by Brainlab, Stryker, and other major players in the navigation and robotic surgical guidance industry. In addition, Ziehm Imaging's agreements and partnerships with market leaders in the OR space, as well as several university hospitals, help it enhance 2D and 3D imaging and therapies. This is how the company has managed to cater to cardio and vascular interventions or provide equipment like its fully motorized Ziehm Vision RFD Hybrid Edition, which works in all classical fluoroscopic applications like orthopedics, trauma, or spine, among many others.

Finally, while Ziehm Imaging has received very positive feedback for its image quality, Frost & Sullivan highlights the fact that Ziehm Imaging's customers also praise the easy setup process that its product offers.

Conclusion

With existing manufacturers switching to IGZO panel production to create safer conditions for clinicians, the intraoperative imaging industry is poised to replace current solutions with IGZO panels and implement them on a larger scale. Frost & Sullivan believes that this tendency, combined with Ziehm Imaging's balance of performance and cost, their expected price point with multiple sized panel options, and features such as the SmartDose concept and advanced active cooling will finally replace the obsolete CCD RRIUs mobile C-arms. Ziehm Imaging, with its IGZO technology, will undoubtedly remain one of the heavy hitters in the intraoperative imaging industry.

For its strong overall performance, Ziehm Imaging is being recognized with Frost & Sullivan's 2023 European Enabling Technology Leadership Award in the mobile C-arms with flat panel detector for the intraoperative imaging industry.

What You Need to Know about the Enabling Technology Leadership Recognition

Frost & Sullivan's Enabling Technology Leadership Award recognizes the company that applies its technology in new ways to improve existing products and services and elevate the customer experience.

Best Practices Award Analysis

For the Enabling Technology Leadership Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

Technology Leverage

Commitment to Innovation: Continuous emerging technology adoption and creation enables new product development and enhances product performance

Commitment to Creativity: Company leverages technology advancements to push the limits of form and function in the pursuit of white space innovation

Stage Gate Efficiency: Technology adoption enhances the stage gate process for launching new products and solutions

Commercialization Success: Company displays a proven track record of taking new technologies to market with a high success rate

Application Diversity: Company develops and/or integrates technology that serves multiple applications and multiple environments

Customer Impact

Price/Performance Value: Products or services provide the best value for the price compared to similar market offerings

Customer Purchase Experience: Quality of the purchase experience assures customers that they are buying the optimal solution for addressing their unique needs and constraints

Customer Ownership Experience: Customers proudly own the company's product or service and have a positive experience throughout the life of the product or service

Customer Service Experience: Customer service is accessible, fast, stress-free, and high quality

Brand Equity: Customers perceive the brand positively and exhibit high brand loyalty

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The Growth Pipeline Engine™

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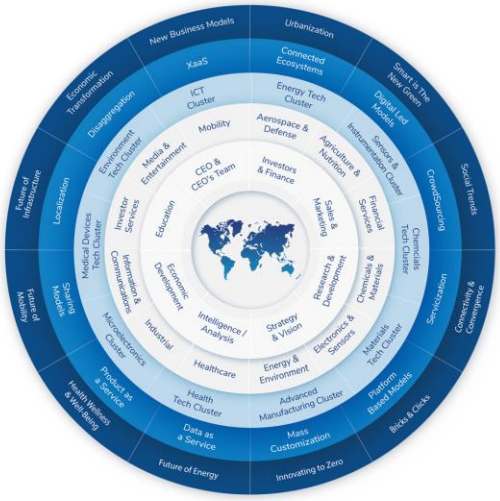
Key Impacts:

- **Growth Pipeline:** *Continuous Flow of Growth Opportunities*
- **Growth Strategies:** *Proven Best Practices*
- **Innovation Culture:** *Optimized Customer Experience*
- **ROI & Margin:** *Implementation Excellence*
- **Transformational Growth:** *Industry Leadership*

The Innovation Generator™

Our 6 analytical perspectives are crucial in capturing the broadest range of innovative growth opportunities, most of which occur at the points of these perspectives.



Analytical Perspectives:

- Mega Trend (MT)
- Business Model (BM)
- Technology (TE)
- Industries (IN)
- Customer (CU)
- Geographies (GE)