

Novel Engineering Drives First Wireless, Cassette-Size Digital Radiography Detector

A Behind-the-Scenes Look At An Industry First

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It's no secret that healthcare providers want a fast, easy way to convert x-ray rooms from film to digital radiography (DR). Existing technologies required compromise: Traditional DR systems necessitate room renovations, while existing portable DR detectors either need downtime for battery charges or use a cable that hampers productivity and positioning. Computed radiography (CR) is simple to install, but it does not have the productivity of DR due to the extra time required to read and then erase each CR plate.

A wireless, cassette-size DR detector could marry all the advantages of DR technology with the convenience of CR. In addition to being compact, the detector would have to be durable and lightweight to improve working conditions for technologists and reduce fatigue. It would also need to offer removable, rechargeable batteries to allow continuous use.

For years engineering challenges hindered the development of this ideal solution. Most existing DR detectors are two to three times the spatial volume of a traditional cassette. Reducing the image area could help accommodate all the needed components, but then imaging applications would be limited. Designing a cableless, cassette-size detector demanded not just a compact form factor but also development of extremely efficient, compact onboard battery power and wireless communications.

Carestream Health took on the challenge of developing this new technology and succeeded by combining novel engineering with dogged determination. The company, which has long been a market leader in digital imaging solutions, has applied for seven new patents in the design of its CARESTREAM DRX-1 System*, the industry's first wireless, 14 x 17 inch (35 x 43 cm) cassette-size detector, which is also lightweight and durable.



The detector contains a glass sensor panel less than 1 mm thick, imaging components, a removable, rechargeable battery and wireless communications technology. A specially designed multi-battery charger ensures that batteries are always available. The detector is packaged with a low profile operator console that provides preview images for quality review and can communicate studies to a PACS, printer and other networked devices.

Innovation at Work: Building a Cassette-Size, Wireless Detector

Carestream Health overcame this product's engineering challenges with the following innovations:

- 1) High-density circuitry with small form factor components.** This detector packages enormous functionality in a thin format. It incorporates a glass sensor panel, scintillator, powerful computer, radio, battery, and power management electronics in a volume that normally houses an intensifying screen and a sheet of film. Product developers identified high-density, low-profile components along with incorporating over 5,000 connections to the sensor panel.
- 2) A rigid system that protects the thin glass sensor panel and isolates components from the exterior casement.** Carestream Health engineers studied laptops and other electronic equipment designed to withstand being dropped and jarred and spent months conducting analytical modeling and materials testing. Special materials were selected that cushion components against a drop on the flat side, a corner or edge.
- 3) A high-capacity, long-lived removable battery.** Lithium ion batteries used in many laptop computers could not meet the demands of this application. Instead engineers worked with high-capacity lithium polymer technology, which provides greater power and longer life. The detector is designed to capture and process up to 90 images, which represents over four hours of use with an average imaging workload. A low noise power supply was also a requirement and this is delivered through unique noise canceling and suppression circuitry. A multi-unit charger ensures that fully charged batteries are always available.
- 4) Mechanisms that quickly activate the detector while minimizing power needs.** The detector uses an amorphous silicon transistor array, which required the development of new operating modes and calibration algorithms. To conserve power, specific sections of the detector are always in a standby mode. Areas with high power requirements are activated quickly for each exposure, and shut down immediately after the image is captured.
- 5) Dual-site image processing that is performed by the detector and at the capture console.** More intelligence is built into the detector to reduce the overhead of wireless data transfer. The system provides rapid viewing of low-resolution images for quality control while also delivering rapid transmission of full-resolution images to the operator console. If there is a temporary loss of wireless communication, the image can be stored on the detector and then a removable cable can be used to transfer image data to the console.
- 6) The detector verifies that it is ready before the tube is fired.** To prevent accidental or inaccurate exposures, the detector cannot be used when it is not ready to take an exposure. If the detector is not ready, an interlock mechanism prevents the exposure signal from passing to the generator. This avoids inaccurate or repeat exposures. When the battery gets low, a message is displayed on the console to prompt the user to load a charged battery.



Broad Application Base

The new detector is ideal for a broad base of imaging services providers including: radiology departments, emergency rooms and operating suites; outpatient imaging centers; portable exams at hospitals and nursing homes; orthopedic practices; multi-physician clinics; urgent care centers and others.



Compelling Benefits for Providers and Patients

The DRX-1 system delivers compelling benefits for both healthcare providers and patients. It allows facilities of all sizes to achieve the flexibility and productivity offered by DR technology. This increased efficiency can help existing staffs handle growing patient workloads. And since the new detector is up to 30 percent lighter than other portable DR detectors, its use can reduce fatigue and deliver added convenience for technologists.

Patients also can benefit as smaller hospitals and clinics or those in rural areas gain a smooth transition from film to digital imaging for general radiography procedures. These images can be captured in seconds and transmitted to remote radiologists and clinicians for immediate diagnosis and treatment. Moving images instead of patients is always beneficial, allowing subtle or difficult cases to be reviewed by specialists hundreds of miles away.

Traditional DR technology has delivered patient care benefits for years. The affordability and streamlined implementation offered by the CARESTREAM

DRX-1 System will extend these benefits to a much broader base of providers—and all the patients they serve.

**The CARESTREAM DRX-1 System information is provided for planning purposes. Commercial availability is pending submission to, and clearance by, the FDA and other regulatory agencies.*

“The overall impression of the system is absolutely outstanding. Of course from a clinician’s point of view, one of the most important aspects of any system is the quality of the images it produces. In this respect, we have no problems — the image quality is very good.”

Prof. Thomas Vogl, Director, Department of Diagnostic and Interventional Radiology, University Hospital of Frankfurt

“The DRX-1 detector’s ability to fit into standard x-ray equipment will make it an affordable, easy digital transition for all types of imaging applications. Wireless communication is a huge benefit because a cable can get tangled and stepped on—and it’s an asset for infection control.”

Rick Perez, BS, RT, CRA, Administrative Director, Winthrop University Hospital, Mineola, N.Y.