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Carestream Health's Engineering Team Delivers World's First Wireless, Cassette-Size Digital Radiography Detector

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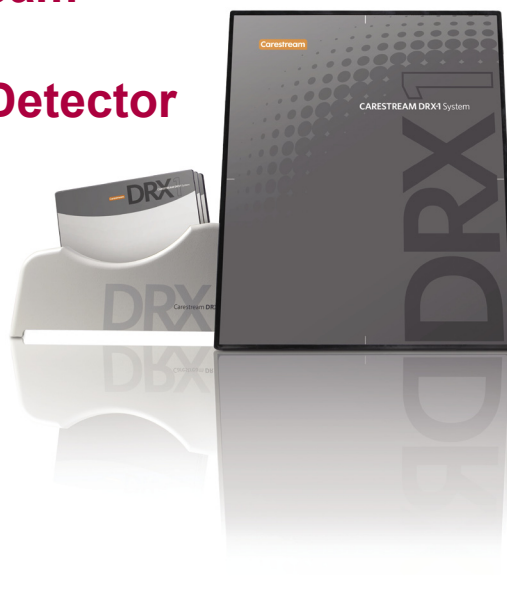


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Carestream Health's Engineering Team Delivers World's First Wireless, Cassette-Size Digital Radiography Detector

by Paul Taillie, Bill Wendlandt, and Tim Wojcik



Projection x-ray remains the most common diagnostic imaging procedure in today's world of healthcare practice. Advances in digital imaging technology have delivered improved diagnostic quality and service provider productivity, but have been unaffordable to many facilities. Carestream Health, Inc. has addressed this issue by introducing a novel digital radiographic imaging system that delivers high performance at substantially lower cost than competing systems. Customer interest in the product has been remarkable, and the Rochester Business Journal recently recognized the DRX-1 team with a "Health Care Innovation Award."

Introduction:

Projection x-ray imaging has been practiced for more than 100 years and remains the most common diagnostic procedure, with more than 1 billion studies conducted annually. User efficiency, coupled with maximum image quality at the lowest possible patient dose, are key system attributes for radiography.

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 does not have the productivity of DR due to the extra time required to read out and erase each image from the CR plate.

A new wireless, cassette-size DR detector with rechargeable batteries was conceived by the team that would offer imaging providers all the advantages of DR without these drawbacks. In addition to being compact, the detector also needed to be durable and lightweight to improve working conditions for technologists and reduce fatigue.

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 wireless, cassette-size detector demanded not just a compact form factor, but also development of extremely efficient, compact onboard battery power and wireless communications.

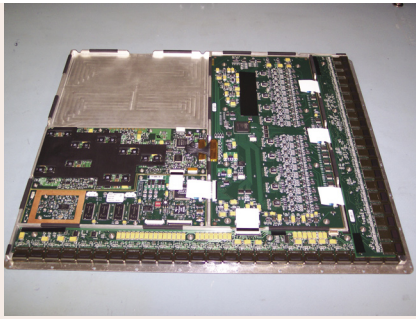
A group of Carestream Health engineers took on the challenge of developing this new technology—and succeeded by combining novel engineering with dogged determination. The company, which has long been a market leader in digital imaging solutions, has applied for seven new patents in the design of its 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 an amorphous silicon glass sensor panel less than 1 mm thick; image signal capture and conversion 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 Picture Archiving and Communication System, laser printer and other networked devices.

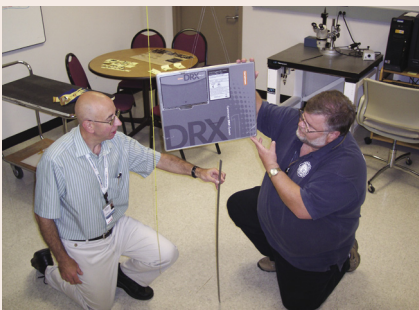
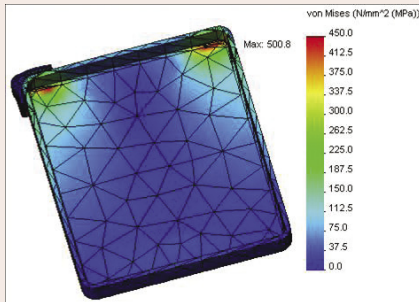
Innovation at Work: Building a Cassette-Size Wireless Detector

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. A significant part of product development involved identifying high-density, low-profile components along with incorporating over 5,000 TAB 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's engineers studied laptops and other electronic equipment that are designed to perform despite being dropped and jarred. Special materials were selected that can withstand a drop on either the flat side or a corner or edge. The company's engineers spent months conducting analytical modeling and materials testing to develop a durable frame that both resists exterior damage and cushions interior components.



3) A high-capacity, long-life, removable battery. The engineering team selected a high-capacity lithium polymer technology battery, which provides required power and charge life. The detector is designed to capture and process up to 70 images, which represents 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 and delivering high image quality. The detector uses an amorphous silicon photosensor and 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 when an exposure is required 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) Wireless Control and Data Communication. Synchronization of the detector with the x-ray source and the transfer of sub-sampled preview images, along with the full resolution 16 Mbyte images, are accomplished through an integrated IEEE 802.11n protocol radio.

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 will 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, as is 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. □

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