

## MEDICAL INNOVATION: ULTRASOUND/ECHOCARDIOGRAM (MEDICAL DEVICE: DIAGNOSTIC)

**Physicians:** Inge Edler, Carl Hellmuth Hertz, Karl Theo Dussik, Wolf-Dieter Keidel, D.H. Howry, John Wild, Ian Donald, G.H. Mundt, W.F. Hughes  
**Industry:** Siemens, U.S. Navy

### Situation

***Tens of millions of soft-tissue diseases left undiagnosed each year***

Until the middle of the twentieth century, physicians had no non-invasive means of imaging and accurately diagnosing illnesses in the heart and the soft tissues in the body. By contrast, X-rays had been developed in the late 19<sup>th</sup> century, and were used regularly to diagnose bone injuries and deformations. Yet doctors had no good options when it came to evaluating possible diseases in the heart and in other important organs of the body such as the liver, kidneys, spleen, gall bladder, breast, and prostate, among others, and, importantly, were unable to diagnose problems in unborn children.

As a result, tens of millions of soft-tissue diseases went undiagnosed each year worldwide, leading to a much diminished life expectancy. Also, diagnoses that were made by physicians very often failed to detect the precise medical conditions present, leading to poor treatment and, in some cases, unnecessary surgeries that failed to cure patients of the diseases that actually ailed them.

### Physician-Industry Collaboration

***A battlefield technology harnessed to save lives***

Like many important medical innovations in the twentieth century, ultrasound and echocardiography were discovered by physicians working with engineers to leverage existing military technologies for the benefit of patients. In the mid-18<sup>th</sup> century, scientists discovered that flying bats used the reflected echoes of inaudible, high-frequency sounds to navigate. This discovery eventually led to the development of sonar technology to detect enemy submarines in World War I, and the U.S. Navy's rollout of the first radars to detect enemy airplanes in the Second World War.

While Austrian physician Karl Dussik and German physicist Wolf-Dieter Keidel pioneered the use of the same reflected-wave technologies in the brain and heart in the 1940s, their applications were of limited use. At the same time, Swedish heart doctor Inge Edler became frustrated by the lack of diagnostic technologies for heart conditions, and, in the early 1950s was introduced to a talented physicist, Carl Hellmuth Hertz, who shared his passion for finding a way to use ultrasound for medical applications.

The two approached the Siemens company, which was a leader in sound technologies. In October 1953 they recorded the first moving pictures of the heart. The age of medical ultrasound and echocardiography had officially begun, and the promise it held in the coming decades was unimaginable.

### Innovation Benefits

## ***High resonance and image fidelity allow for pinpoint diagnoses***

Building on the work of Edler and Hertz with Siemens, other pioneers such as D.H. Howry, John Wild, Ian Donald, G.H. Mundt, and W.F. Hughes took a rudimentary product to where it has evolved today -- a simple diagnostic device that is used painlessly to detect and analyze not only diseases of the heart, but just about every major medical condition involving soft tissue. It is also used for therapeutic purposes, especially with certain muscular injuries, and obstetricians use ultrasound to check for fetus size, location and movement, as well as to keep track of fetal breathing and heartbeat.

The high resonance and image fidelity of the present technology, including 3D, 4D and real-time imaging, enables physicians to make precise, pinpoint diagnoses of diseases of the heart, blood vessels, kidneys, liver, and other organs in patients of all ages, thereby saving tens of millions of lives and preventing unwanted or inappropriate surgeries. The ultrasound imaging business in the United States alone generates economic benefits in the billions of dollars.

## **Patient Benefits**

### ***A simple test reveals a deadly disease***

Mary F. of North Carolina was 50 years old in 2006 when she began to notice much more fatigue in her daily routine than she had ever felt previously.

One Sunday morning that year, she was having coffee with her husband when he noticed an advertisement for a free medical clinic offering diagnostic echocardiograms. Her husband urged her to go get checked out.

Sitting for a 15-minute, painless echocardiogram, Mary got the results from the clinic physician almost in real-time: she suffered from mitral-valve prolapse and regurgitation. She was counseled to see a cardiologist right away. Within a month, Mary underwent a number of follow-up tests and had her valve surgically repaired shortly thereafter.

Now back in good health, Mary's life is back to normal. She enjoys golf, walking, cooking and playing with her newborn grandson. "That diagnosis saved my life, she said. "If I hadn't had an echocardiogram, I never would have found the problem and might have died a few months later from congestive heart failure," she said.