US - historia

Od Rayleigha'a do 4D

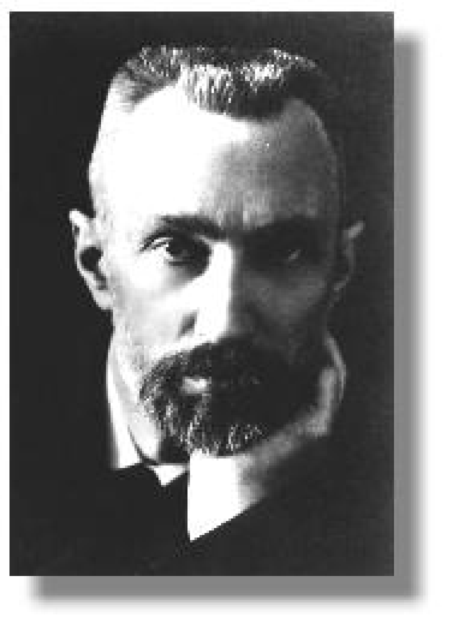
http://www.ob-ultrasound.net/history1.html

1877 - Opis fal dźwiękowych –Rayleigh'a

Lord Rayleigh

Theory of Sound was published in two volumes during 1877-1878. Volume I covers harmonic vibrations, systems with one degree of freedom, vibrating systems in general, transverse vibrations of strings, longitudinal and torsional vibrations of bars, vibrations of membranes and plates, curved shells and plates, and electrical vibrations. Volume II covers aerial vibrations, vibrations in tubes, reflection and refraction - of plane waves, general equations, theory of resonators, Laplace's functions and acoustics, spherical sheets of air, vibration of solid bodies, and facts and theories of audition. His other extensive studies are reported in his Scientific Papers - six volumes issued during 1889-1920. He has also contributed to the Encyclopaedia Britannica

http://www.ob-ultrasound.net/rayleigh.html



1880 - generacja ultradźwięków

piezo-electric effect in certain crystals was discovered by Pierre Curie and his brother Jacques Curie in Paris, France in **1880**

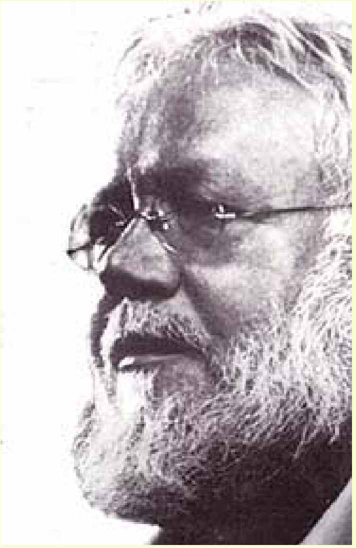
They observed that an electric potential would be produced when mechanical pressure was exerted on a **quartz crystal** such as the Rochelle salt (sodium potassium tartrate tetrahydrate). The reciprocal behavior of achieving a mechanical stress in response to a voltage difference was mathematically deduced from thermodynamic principles by physicist Gabriel Lippman in **1881**, and which was quickly verified by the Curie brothers. It was then possible for the generation and reception of '**ultrasound**' that are in the frequency range of millions of cycles per second (megahertz) which could be employed in echo sounding devices. Further research and development in piezo-electricity soon followed.

http://www.piezo.com/history.html

1914 sonar

Alexander Belm

Reginald Fessenden



Underwater sonar detection systems were developed for the purpose of underwater navigation by submarines in World war I and in particular after the **Titanic** sank in **1912**. Alexander Belm in Vienna, described an underwater echo-sounding device in the same year. The first patent for an underwater echo ranging sonar was filed at the British Patent Office by English metereologist **Lewis Richardson**, one month after the sinking of the Titanic. The first working sonar system was designed and built in the United States by Canadian Reginald Fessenden in **1914**. The Fessenden sonar was an electromagnetic moving-coil oscillator that emitted a low-frequency noise and then switched to a receiver to listen for echoes. It was able to detect an iceberg underwater from 2 miles away, although with the low frequency, it could not precisely resolve its direction.

1915 hydrofone

Paul Langévin

Powerful high frequency **ultrasonic** echo-sounding device was developed by emminent French physicist Paul Langévin and Russian scientist **Constantin Chilowsky**. They called their device the 'hydrophone'. The **transducer** of the hydrophone consisted of a mosaic of thin quartz crystals glued between two steel plates with a resonant frequency of 150 KHz. Between 1915 and 1918 the hydrophone was further improved in classified research activities and was deployed extensively in the surveillance of German U-boats and submarines. The first known sinking of a submarine detected by hydrophone occurred in the Atlantic during World War I in April,1916.

1928 defektoskop ultradźwiękowy - koncepcja

Yet another parallel and equally important development in ultrasonics which had started in the 1930's was the construction of pulse-echo ultrasonic metal flaw detectors, particularly relevant at that time was the check on the integrity of metal hulls of large ships and the armour plates of battle tanks.
The concept of ultrasonic metal flaw detection was first suggested by Soviet scientist **Sergei Y Sokolov** in **1928** at the Electrotechnical Institute of Leningrad. He showed that a transmission technique could be used to detect metal flaws by the variations in ultrasionic energy transmitted across the metal. The resolution was however poor. He suggested subsequently at a later date that a **reflection method** may be practical.

Sokolvo, S.Y. (1929) On the problem of the propagation of ultrasonic oscillations in various bodies. Elek. Nachr. Tech. 6:454-460.

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1935 radar

Robert Watson-Watt

The first practical RADAR system (Radio Detection and Ranging, and using electromagnetic waves rather than ultrasonics) was produced in **1935** by another British physicist Robert Watson-Watt,

Such radar systems had been the direct precursors of subsequent 2-dimensional sonars and medical ultrasonic systems that appeared in the late 1940s.


Metal flaw detector in use **
(Kretztechnik, Austria)

1941 defektoskop ultradźwiękowy

The equipment suggested by **Sokolov** which could generate very short pulses necessary to measure the brief propagation time of their returning echoes was not available until the 1940s. Early pioneers of such reflective **metal flaw detecting devices** were **Floyd A Firestone** at the University of Michigan, and **Donald Sproule** in England. Firestone produced his patented "supersonic reflectoscope" in **1941** (US-Patent 2 280 226 "Flaw Detecting Device and Measuring Instrument", April 21, 1942).

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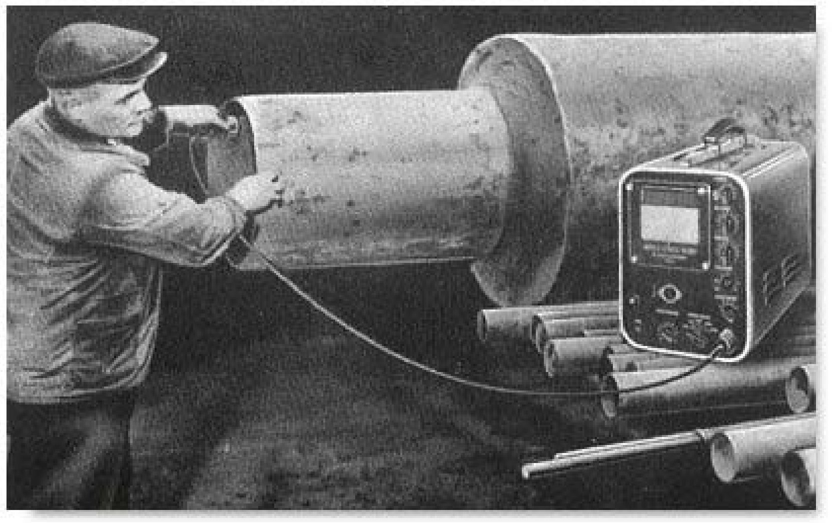

defektoskop ultradźwiękowy - początki

Early pipe testing with Krautkrämer apparatus (1950s)

The key-persons, Floyd Firestone, Donald Sproule and Adolf Trost had no knowledge of each other as they worked strictly in secret. Not even their patent-applications were published. Sproule and Trost used transmission-technique with seperate transmitter- and receiver-probes. Trost invented the so-called "Trost-Tonge". The 2 probes were contacted on opposite sides of a plate, held in same axis by a mechanical device - the tonge - and coupled to both surfaces by continuously flowing water. Sproule placed the 2 probes on the same side of the workpiece. So he invented double-crystal probes. He used this combination also with variing distance from each other. Firestone was the first to realize the reflection-technique. He modified a radar instrument and developed a transmitter with short pulses and an amplifier with short dead-zone. Sproule eventually gave up the transmission method and filed a patent in 1952 entitled "the improvements in/ or relating to apparatus for flaw detection and velocity measurement by ultrasonic echo methods". .

Karl Theo (Theodore) Dussik

1942 hyperphonography

t was around similar times in the **early 1940s** that ultrasound was used experimentally as a possible **diagnostic tool** in medicine. Karl Theodore Dussik, a neurologist/psychiatrist from the University of Vienna, **Austria** was regarded as the **first** physician to have employed ultrasound in medical diagnosis.

Dussik, together with his brother Friederich, a physicist, attempted to locate brain tumors and the cerebral ventricles by measuring the transmission of ultrasound beam through the skull. The Dussiks presented their experiments in their papers in **1942** and in **1947** introduced the term "hyperphonography". They used a through-transmission technique with two transducers placed on either side of the head, and producing what they called "ventriculograms", or echo images of the ventricles of the brain.

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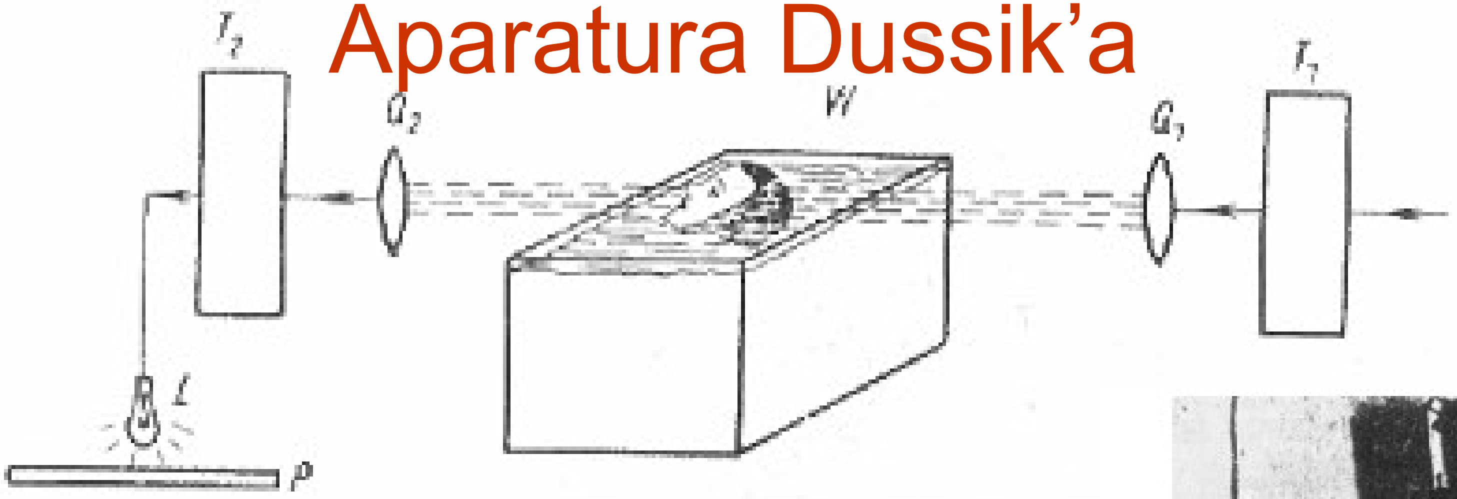
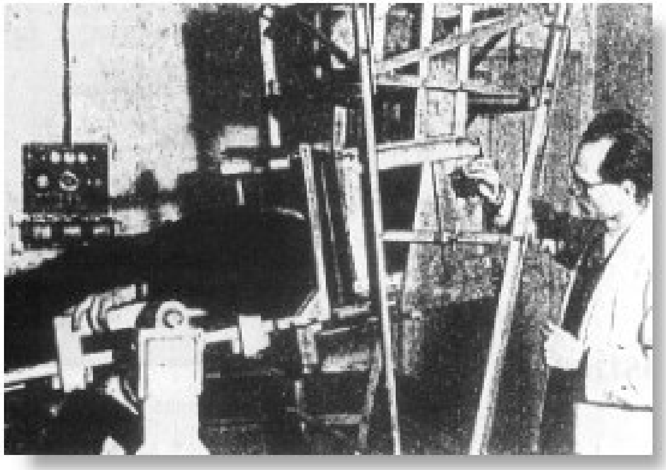
Aparatura Dussik'a



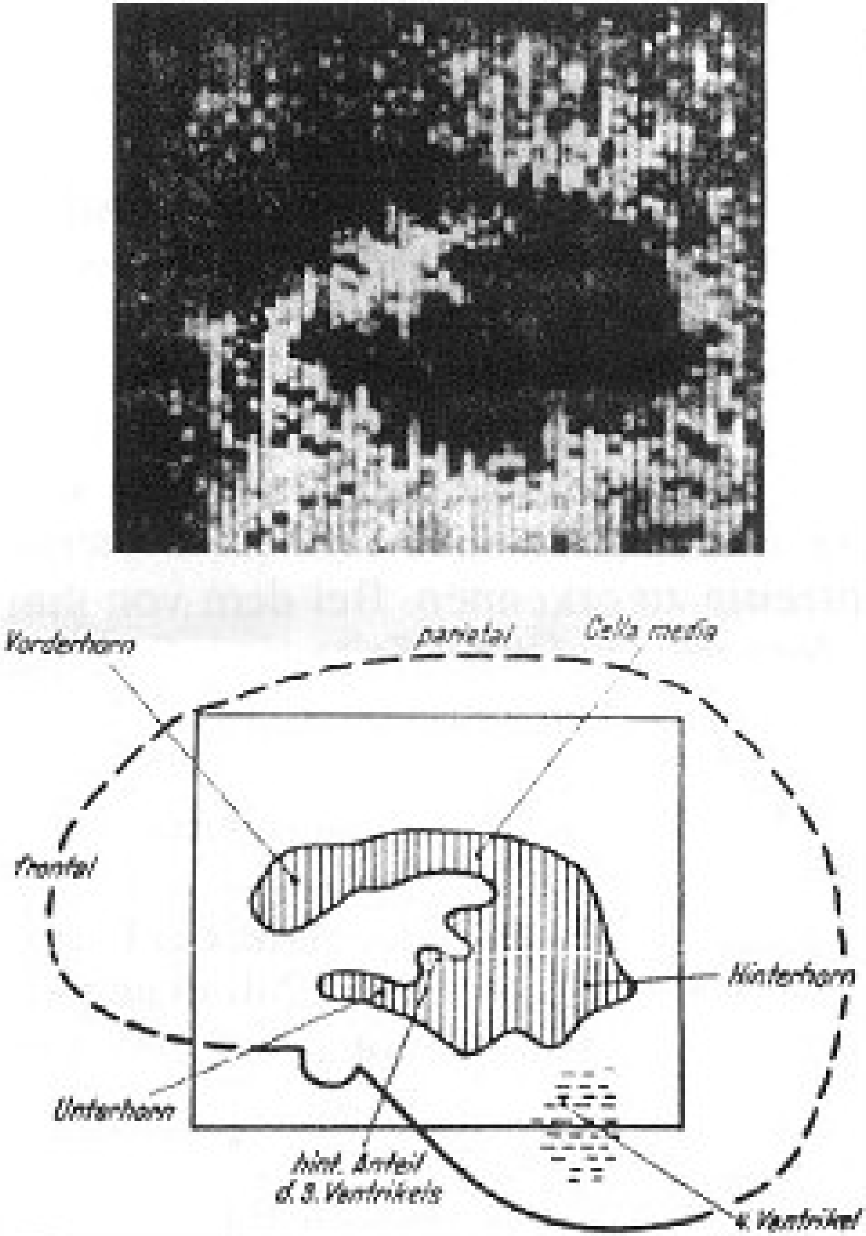
T1 -- ultrasonic generator, Q1-- transmitter, Q2 -- receiver, T2 -- converter amplifier, W -- waterbath, L -- light, P -- photographic paper



Dussik with his ultrasonic apparatus

apparatus was quite elaborate with the transducers mounted on poles and railings. The image produced was a 2-dimensional image consisting of rows of mosaic light intensity spots. They had also reasoned that if imaging the ventricles was possible, then the technique was also feasible for detecting brain tumors and low-intensity ultrasonic waves could be used to visualize the interior of the human body.

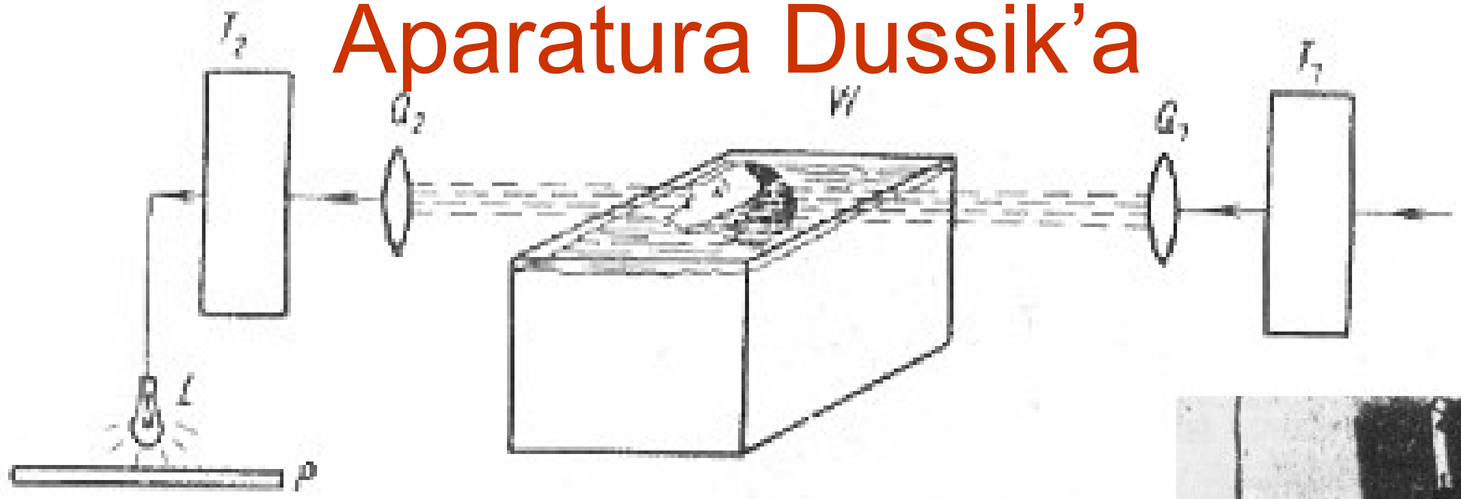
Wyniki badań Dussik'a ?



The hyperphonogram was thought to depict the ventricles

Bolt, Ballantyne (USA) and Hueter (Germany) obtained in 1950 financial support from the Public Health Service and set up a project to evaluate the value of ultrasound as a diagnostic tool in neurology. After some initial experiments which produced results similar to that of Dussik's, they put a skull in a water bath and showed that the ultrasonic patterns Dussik had been obtaining in vivo from the heads of selected subjects could be obtained from an empty skull. It soon became apparent that the reflections within the skull and attenuation patterns produced by the skull were contributing to the attenuation pattern which Dussik had originally thought represented changes in acoustic transmissions through the cerebral ventricles. Further research in this area was subsequently **terminated.** After the mid-1950s, due to its ineffectiveness, the transmission technique in ultrasonic diagnosis was abandoned from medical ultrasound research throughout the world except for some centers in Japan, being replaced by the reflective technique which had received much attention in a number of pioneering centers throughout Europe, Japan and the United States.

Aparatura Dussik'a



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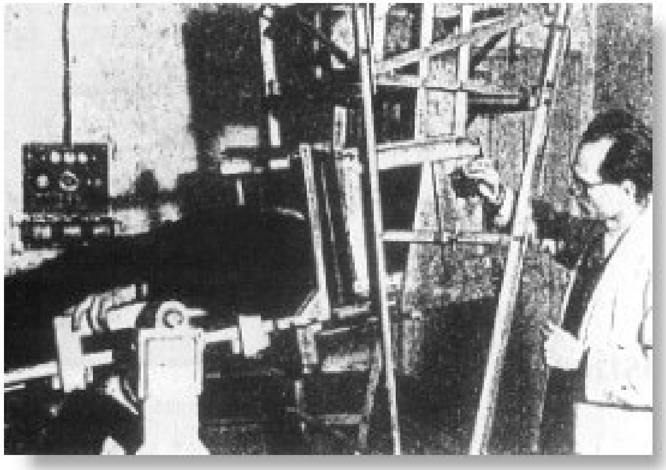

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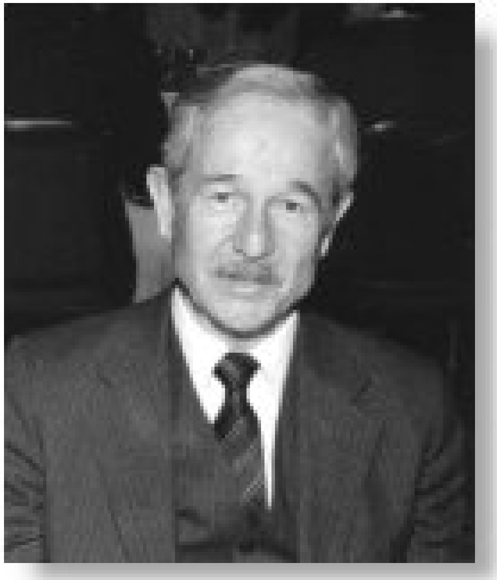

Theodore Hueter

1948 Zaprzeczenie wyników Dussik'a

In 1948, Hueter met Bolt and Ballantyne at an ultrasonic trade show in New York and agreed to join them for new research into the application of ultrasonics in human diagnosis. After a visit to Dussik's department in Austria with Bolt and Ballantyne, the group launched a formal project at M.I.T. to perform experiments in through transmission similar to that of Dussik's. After some initial experiments they arrived at differing conclusions. They noted that ultrasonic mapping of the brain tissues within the human skull was prone to great error due to the large bone mass encountered. Efforts were made to compensate for the bone effects by using different frequencies and circuitories, but were only marginally successful at that stage of computational technology.

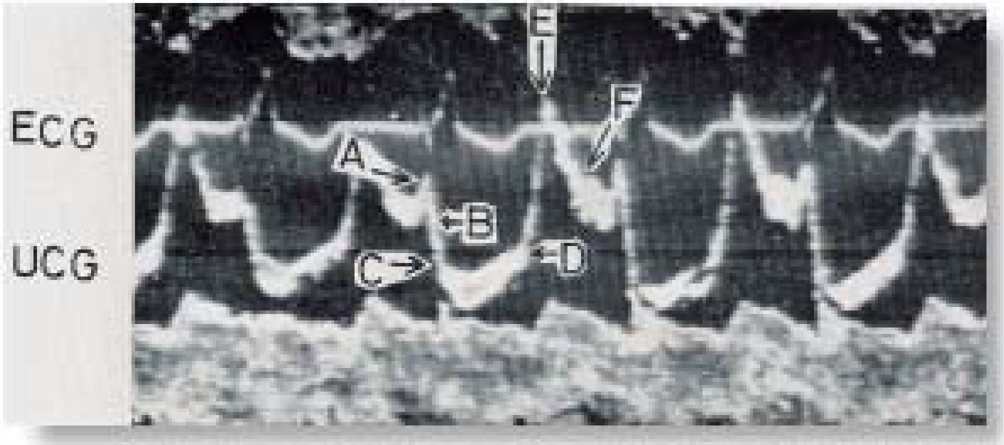
Lata –50-te

The group's research had nevertheless put together a good many basic data essential for tissue characterization and representation and had demonstrated very importantly that interpretable 2-dimensional images was not impossible to obtain. These efforts had paved the way for the subsequent development of **2-D ultrasonic image formation.**

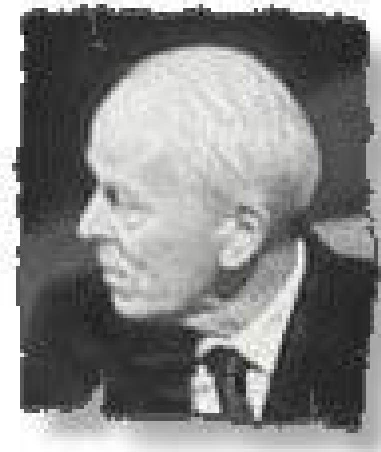
In 1956, D Goldman and Hueter pulled together all the then available data on ultrasonic propagation in mammalian tissues for publication in the Journal of the Acoustical Society of America.

The 'newer' uni-directional pulse-echo A-mode devices developed from the reflectoscope/ metal flaw detectors were soon employed in experiments on medical diagnosis by bold and visionary pioneers around the world.

1950 pulse-echo A-mode



Edler and Hertz's echocardiographic trace
of the anterior mitral valve leaflet in the late 1950s



Inge Edler

The 'newer' uni-directional pulse-echo A-mode devices developed from the reflectoscope/ metal flaw detectors were soon employed in experiments on medical diagnosis by bold and visionary pioneers around the world. Such were the cases with **Douglas Gordon**, **JC Turner** and Val Mayneord in London, Lars Leksell (in 1950), **Stigg Jeppson** and **Brita Lithander** in Sweden, **Marinus de Vlieger** in Rotterdam and **Kenji Tanaka** and Toshio Wagai in Japan for their pioneering work in the examination of brain lesions. These devices were also employed by Inge Edler and Carl Hellmuth Hertz in Lund in cardiac investigations in 1953, and followed on by **Sven Effert** in Germany in 1956

1953 B-mode

John Wild c. 1953

John M Reid c.1970s

Wild and **Reid** built a linear hand-held B-mode instrument, a formidable technical task In those days, and were able to visualise tumours by sweeping from side to side through breast lumps. The instrument operated at a frequency of 15 megahertz. Wild said in one of his papers, ' We have a tissue radar machine scaled to inches instead of miles by the use of ultrasound '.

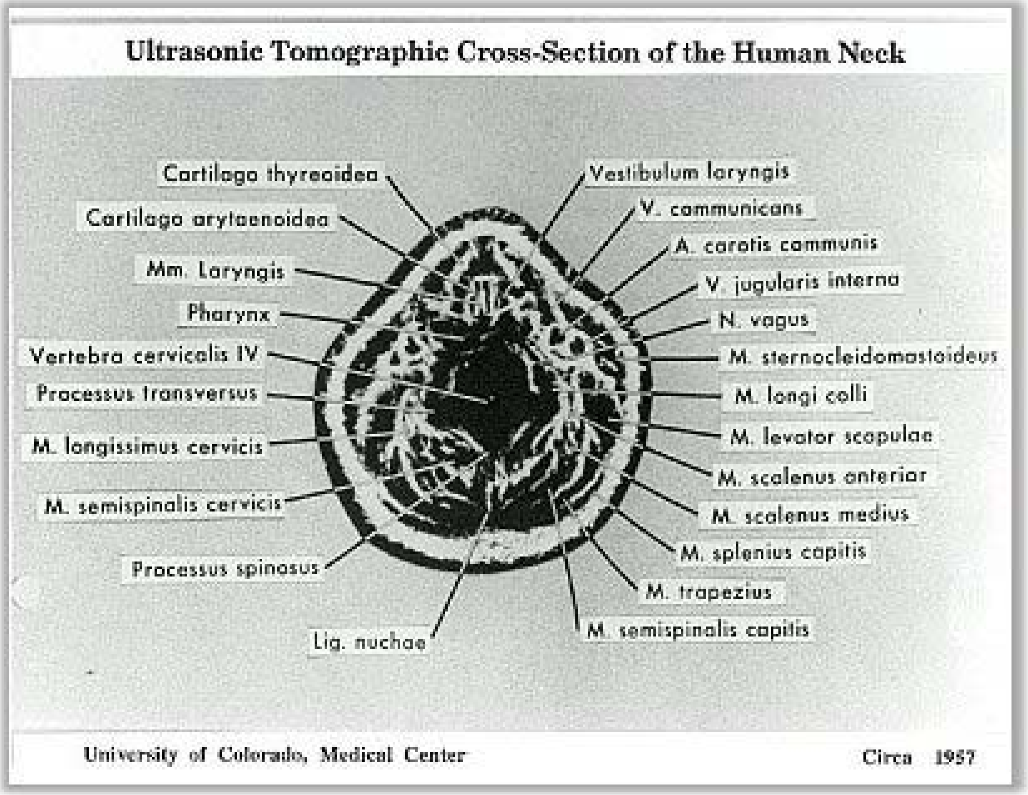
1954 B-mode (2)

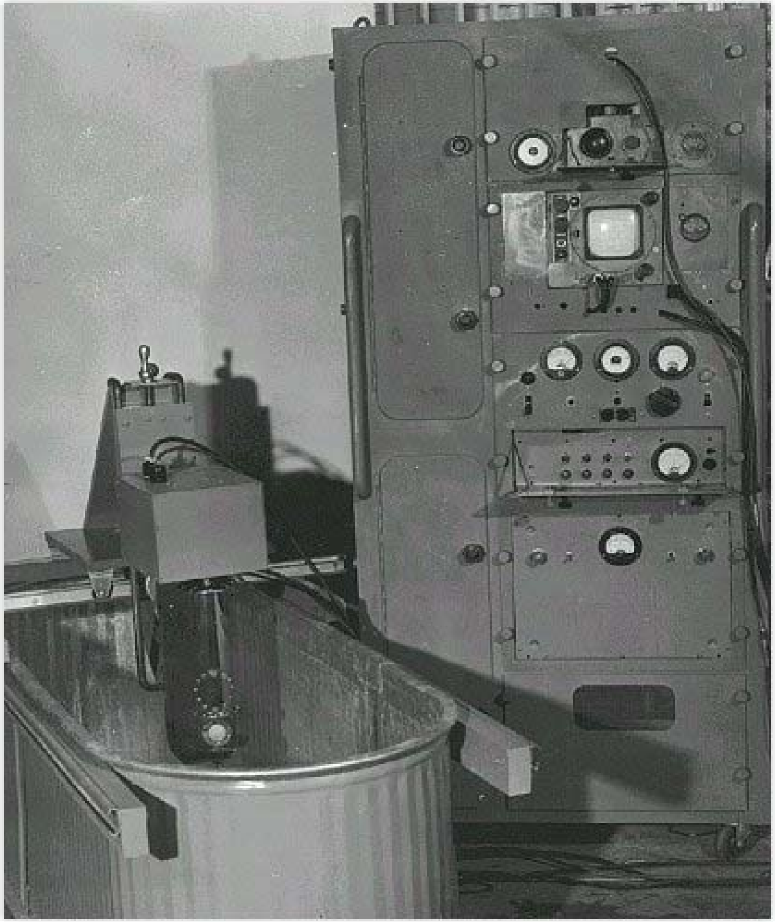
Douglass Howry, late 1960s

Howry's somascope reported in the LIFE magazine in 1954

Douglas Howry, a radiologist working at the Veteran's Administration Hospital and at the University of Colorado in Denver , had concentrated more of his work on the development of B-mode equipment, displaying body structures in a 2-dimensional and sectional manner "comparable to the actual gross sectioning of structures in the pathology laboratory". Published works from the M I T Radar school staff served as initial reference material on techniques in data presentation.

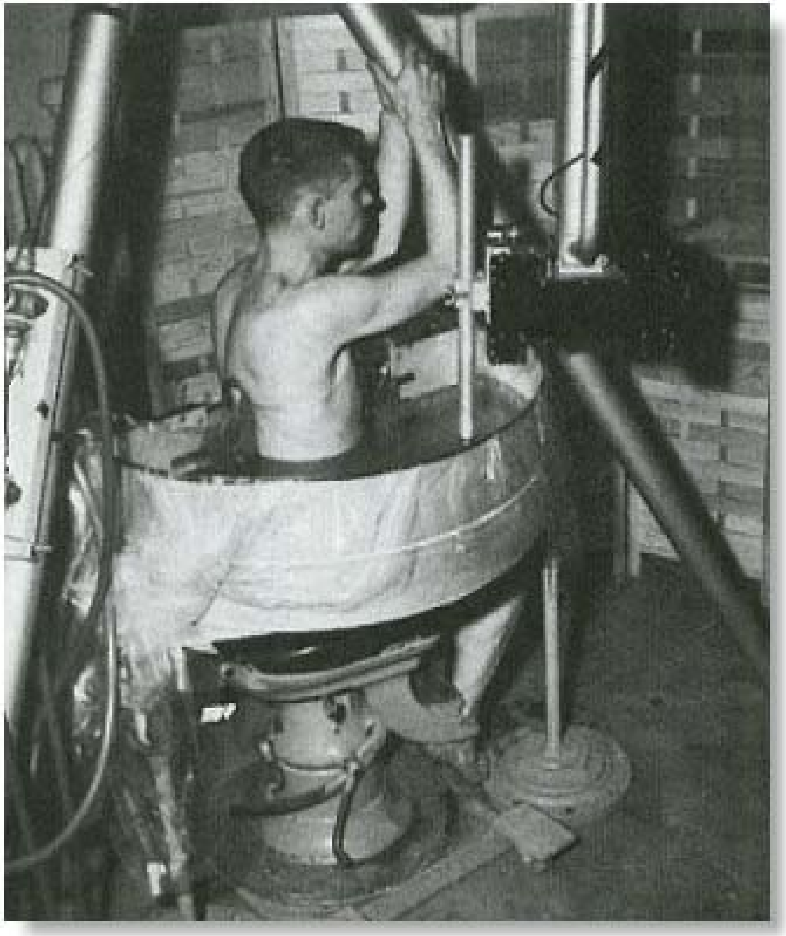
1957 Somagram





'Somagram' of the human neck obtained by **Douglass Howry** in 1957 using the waterbath scanner. The patient had to be sitting almost completely immersed in water up to the level of interogation and the scanning transducer moving circumferentially around the rim of the bath.

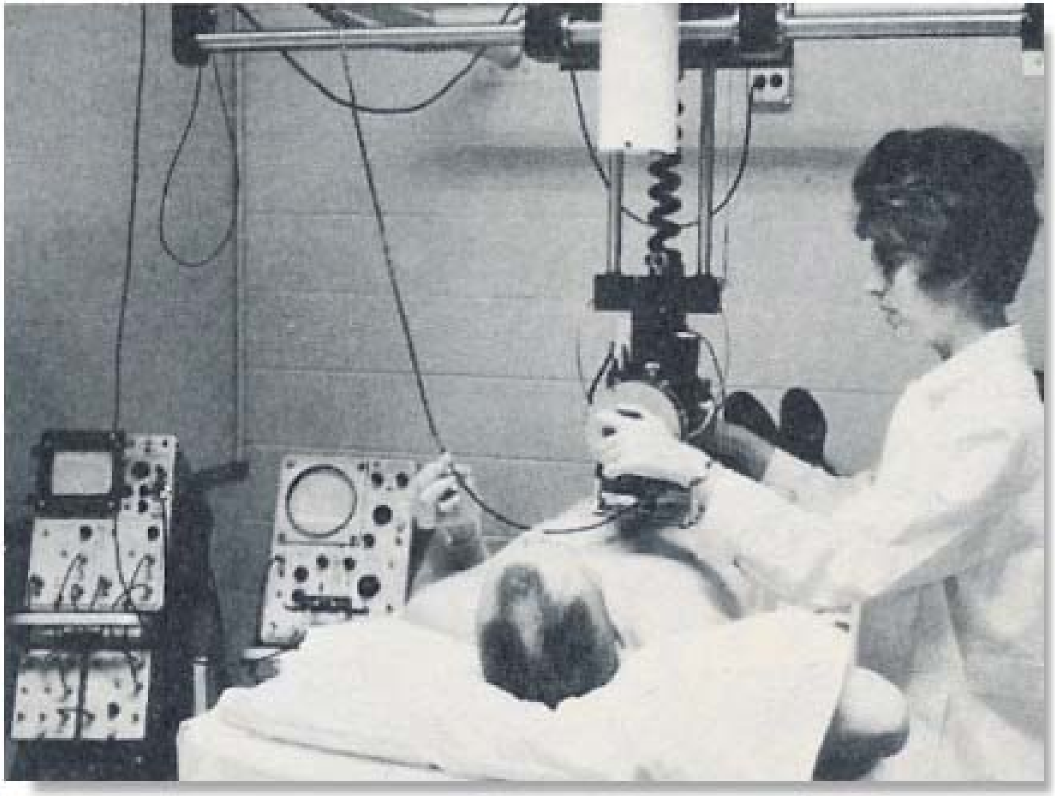
An accurate, 2D and reproducible image is produced

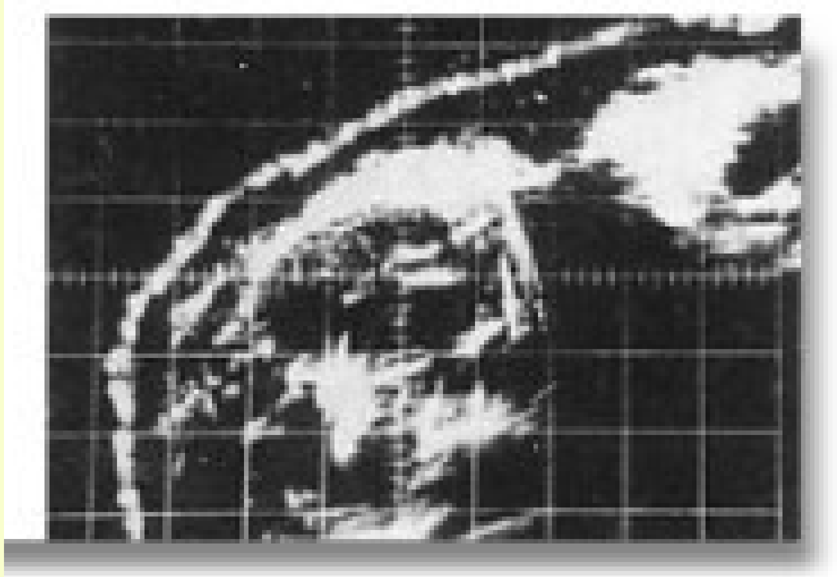


1957 Pan-scanner

Dr. Joseph H. Holmes

The 'Pan-scanner' *, where the transducer rotated in a semicircular arc around the patient, was developed in 1957. The patient sat on a modified dental chair strapped against a plastic window of a semicircular pan filled with saline solution, while the transducer rotated through the solution in a semicircular arc. All of these systems, although capable of producing 2-D, accurate, reproducible images of the body organs, required the patient to be totally or partially immersed in water, and remained motionless for a length of time.



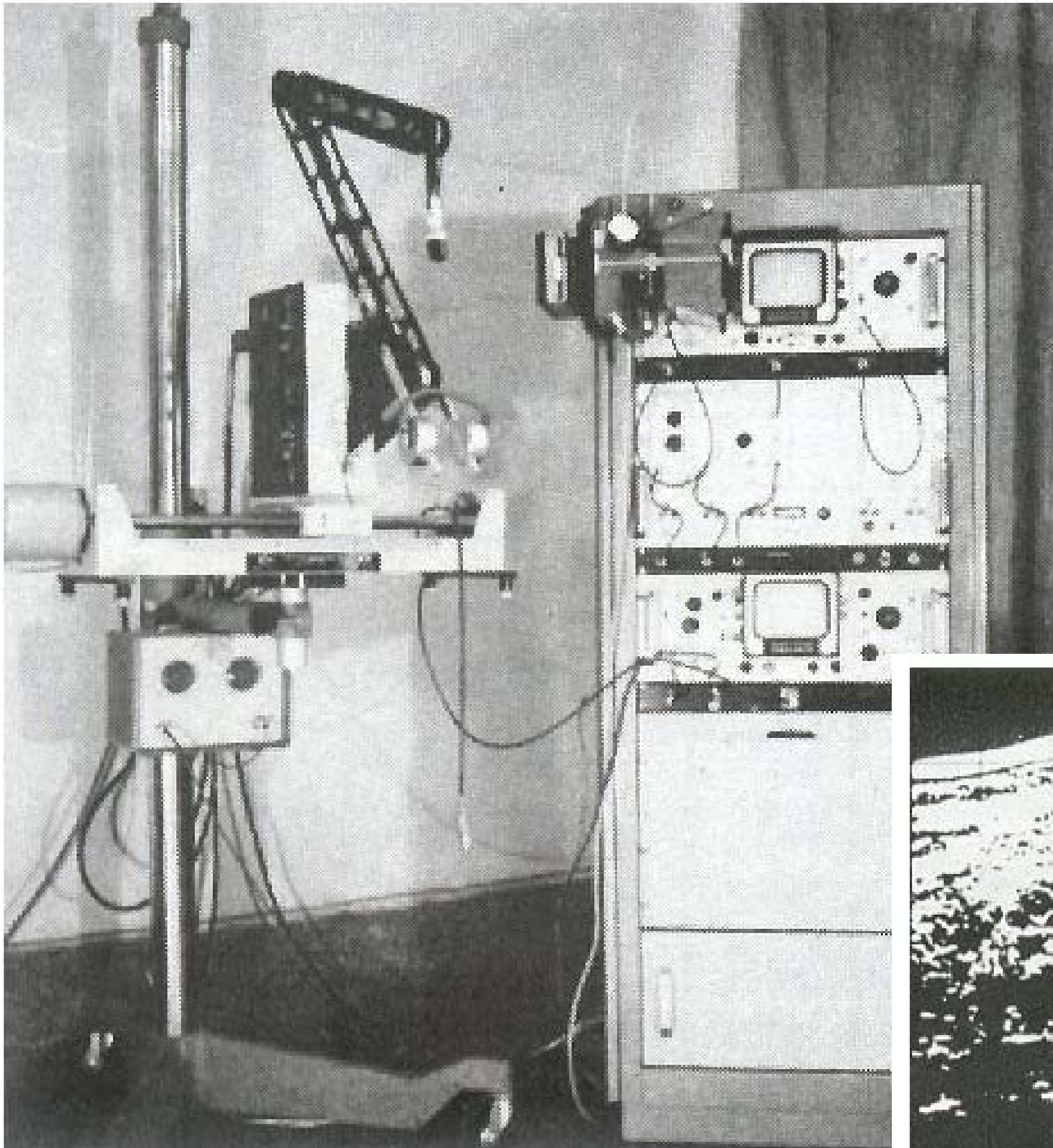


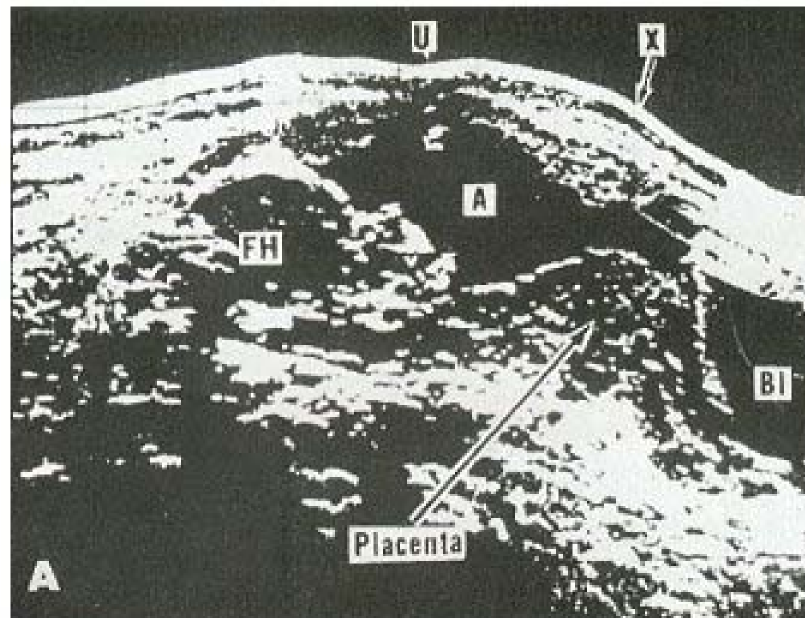
1962 compound contact scanner

Homles, together with consultant engineers William Wright and Ralph (Edward) Meyerdirk, and support from the U. S. Public Health Services and the University of Colorado, continued to fabricate a new prototype compound contact scanner, which had the transducer in direct contact with the patient's body and suspended on moving railings above the patient

compound contact scanner (2)

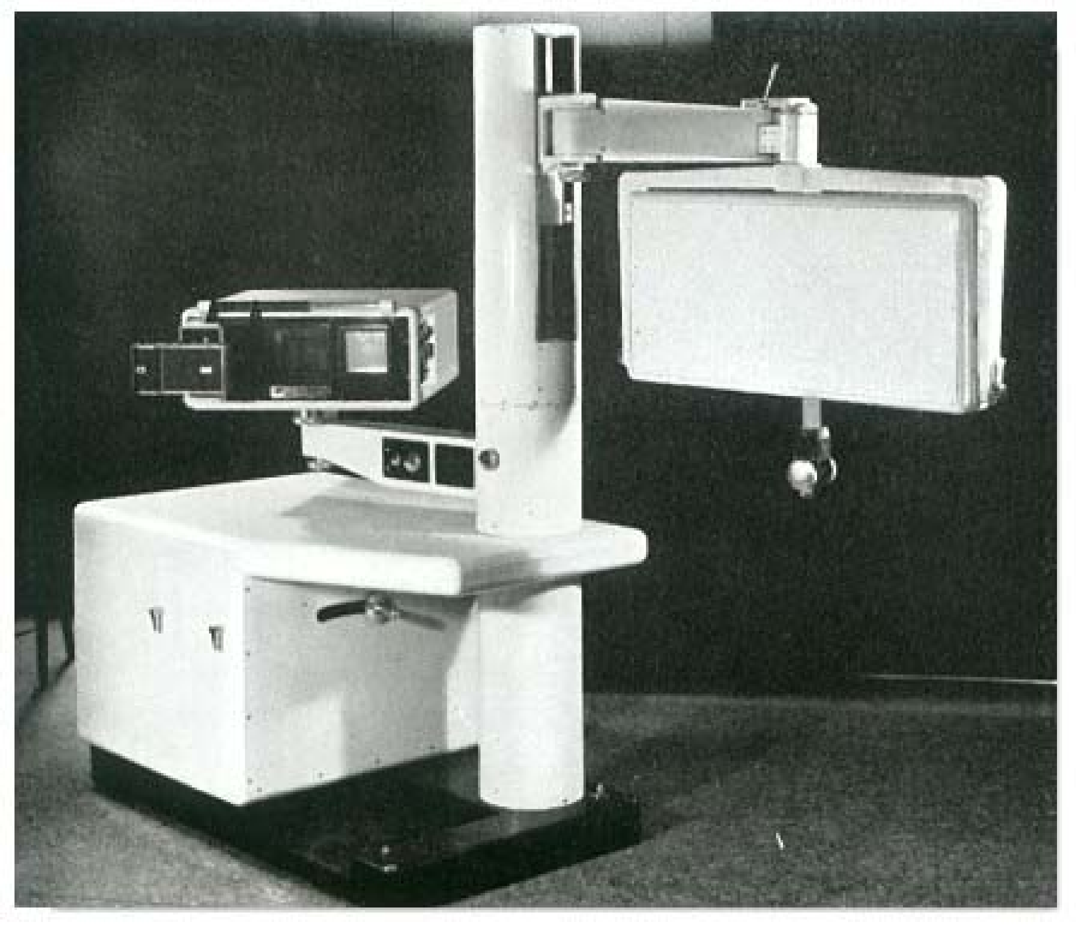
This was the start of the most popular design in the history of static ultrasound scanners, that of the articulated-arm scanning mechanism.



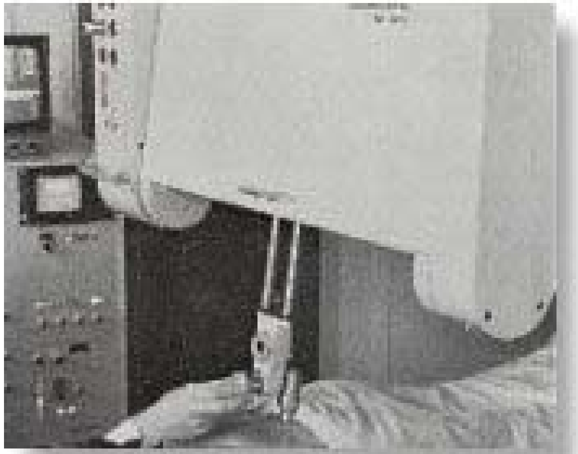


Placenta Previa imaged by the machine (without gray-scale) in 1970

1960 **Diasonograph**



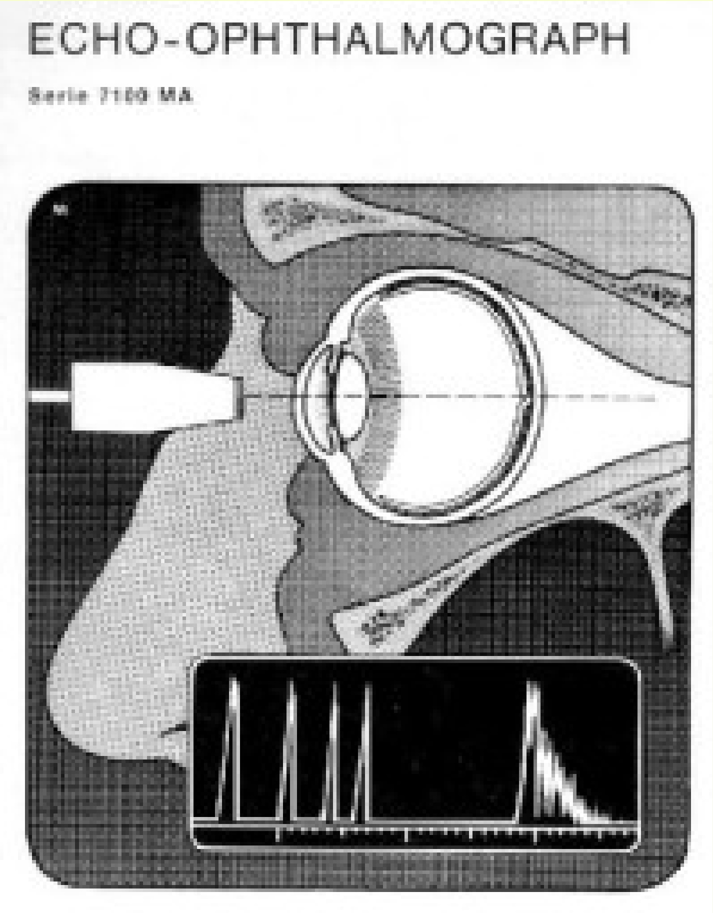
The "First" generation commercially available Diasonograph manufactured in 1960



NE 4102 scanning gantry

Kretztechnik AG, Austria

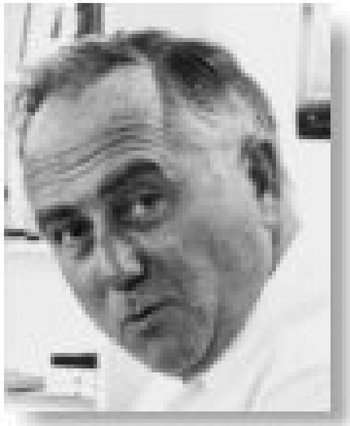
1972
Austria



B-scans became an integral part of standardized ophthalmologic echography again only after about 1972.

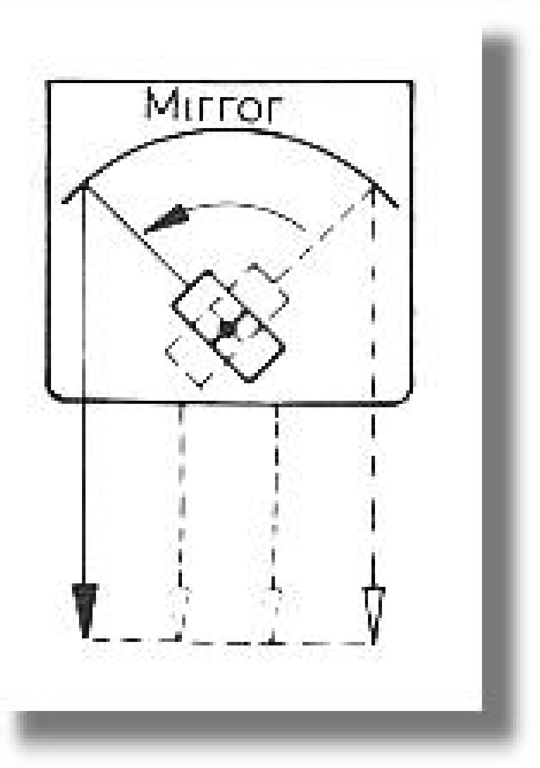
real time - początki

The innovation which had soon completely changed the practice of ultrasound scanning was the advent of the Real-time scanners. The first real-time scanner, better known as fast B-scanners at that time, was developed by Walter Krause and Richard Soldner (with J Paetzold and and Otto Kresse) and manufactured as the Vidoson®



Richard Soldner

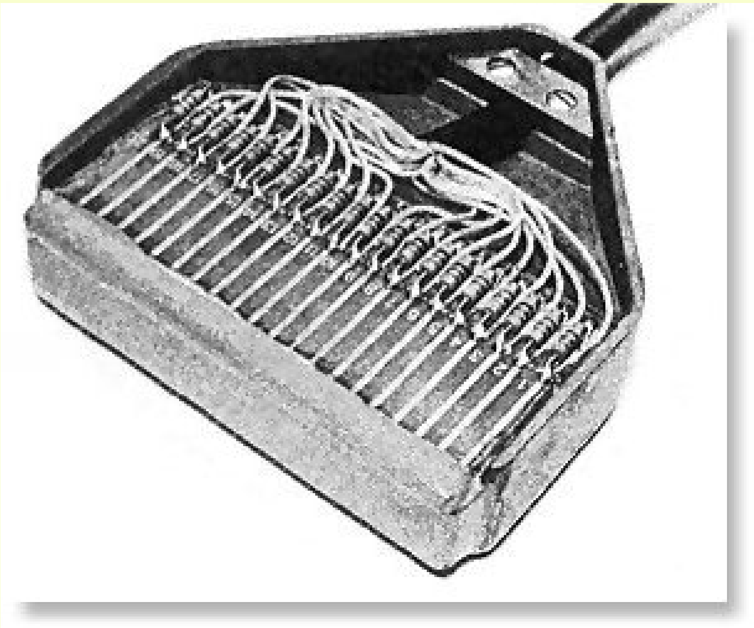
The Vidoson used 3 rotating transducers housed in front of a parabolic mirror in a water coupling system and produced 15 images per second. The image was made up of 120 lines and basic gray-scaling was present. The use of fixed focus large face transducers produced a narrow beam to ensure good resolutions and image. Fetal life and motions could clearly be demonstrated.



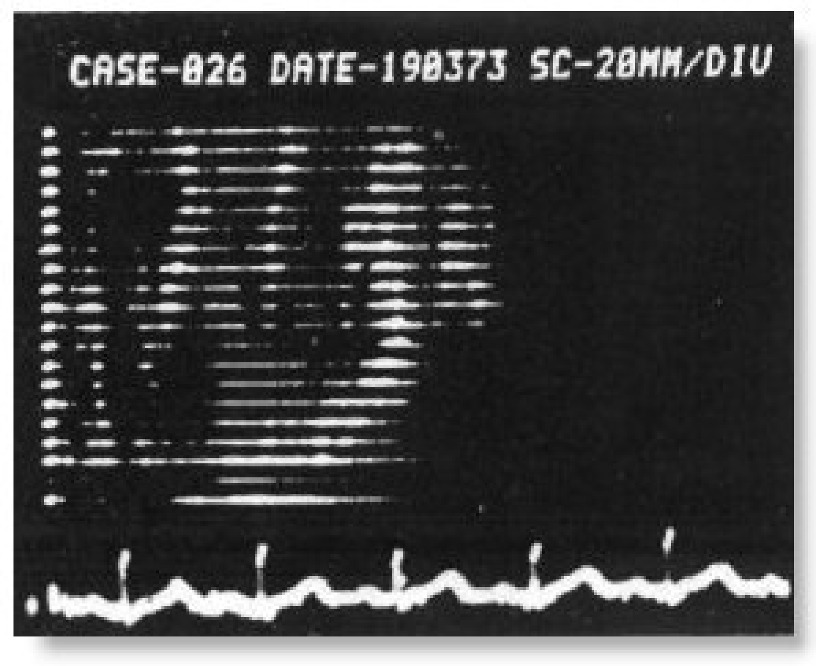
resultant image of a fetal face and hand.

multiscan - początki

In collaboration with cardiologist Paul Hugenholtz and local Dutch company Organon Teknika, they produced in 1972 the "Multiscan system", notably the earliest commercial linear array scanner in the world, mainly aimed at cardiac investigations.



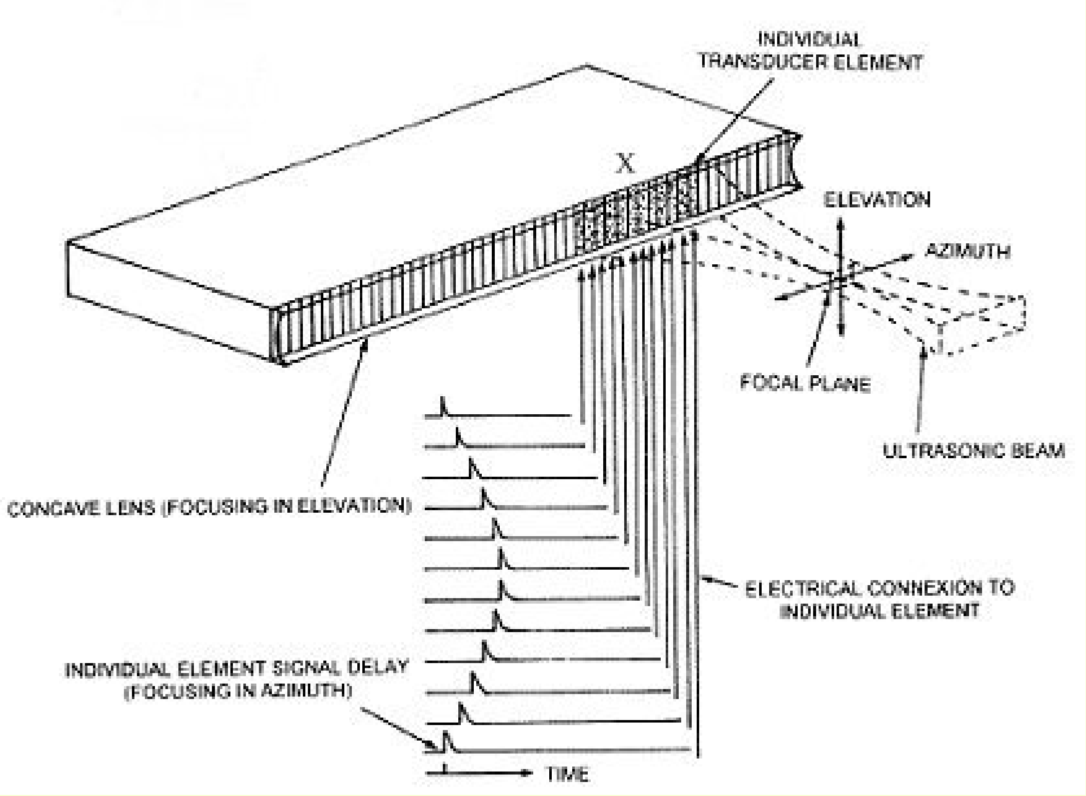
The inside of the transducer assembly of the Multiscan. This transducer measured 80x10 mm, has 20 crystals and operated at 2.25 and 4.5 MHz



Sonogram of a sagittal section of the heart. Note the relatively low lateral resolution. 20 scan lines from the 20 crystals. No focusing technique was incorporated

liniowe matryce

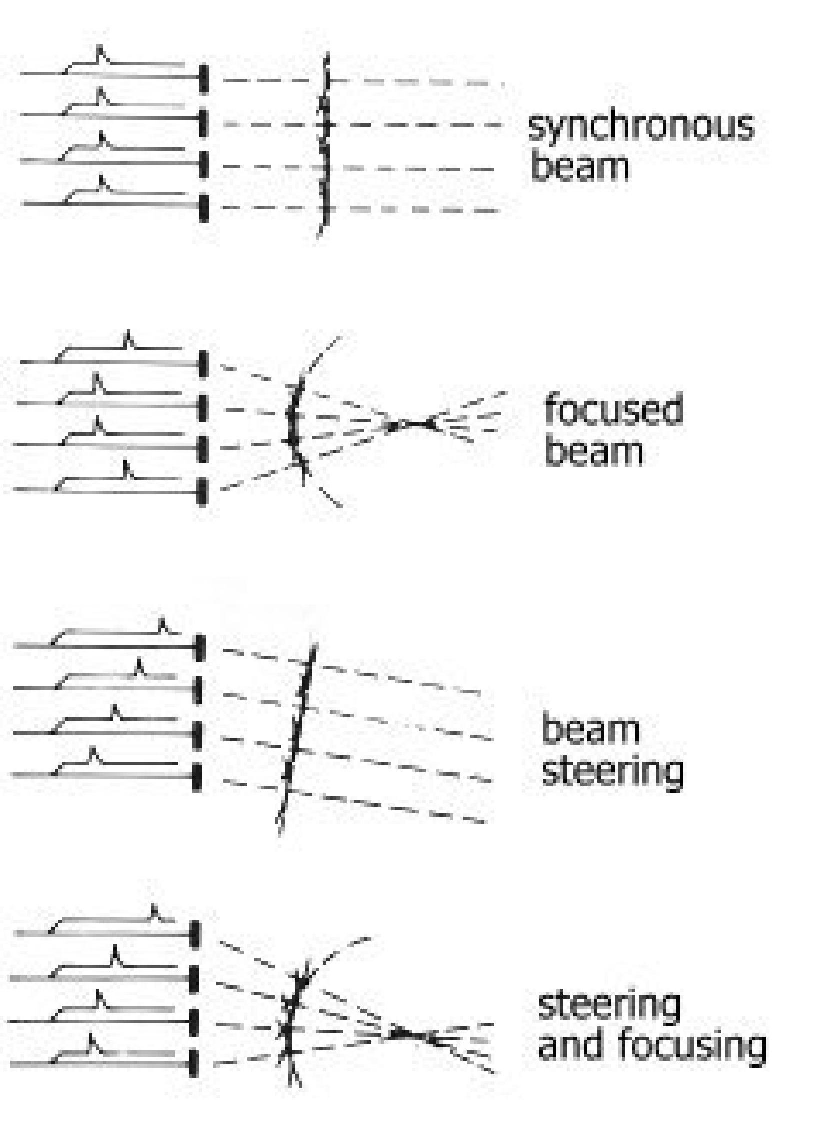
The **linear array transducer** can have up to 512 elements spaced over 75-120 mm



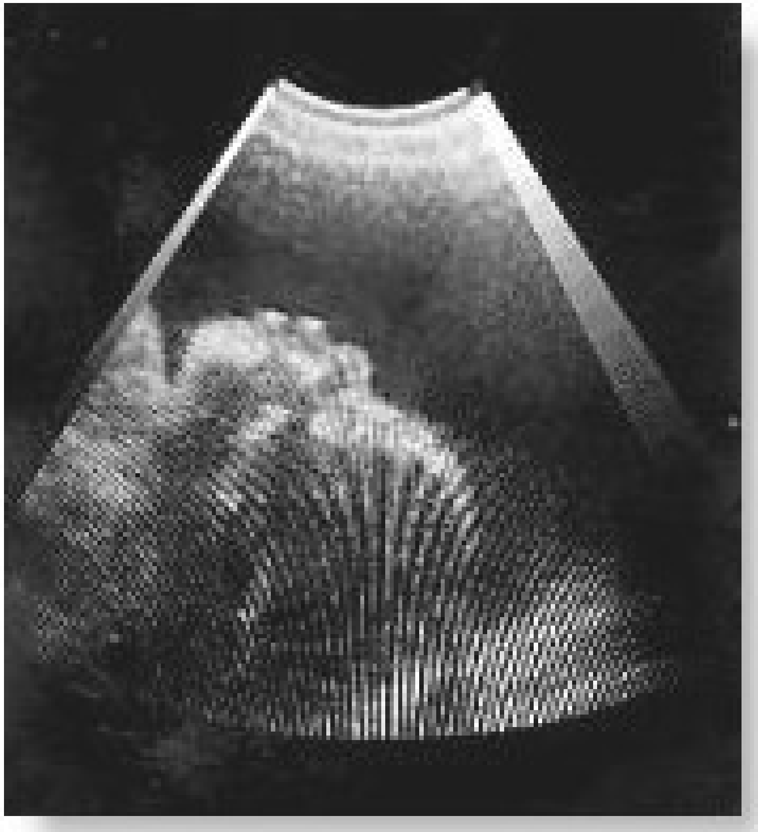
Adjacent elements typically 8 to 16 (more in wide-aperture designs), are pulsed simultaneously. In the subgroup of X elements, pulsing of the inner elements is delayed with respect to the outer elements. A focused beam results from the interference of the X small divergent wavelets. The time delays determines the depth of focus for the transmitted beam and can be changed during scanning. The same delay factors are also applied to the X elements during the receiving phase resulting in a dynamic focusing effect on return. In this manner, a single scan line in the real-time image is formed.

To generate the next adjacent scan line, another group of X elements is formed by shifting one element position along the transducer array from the previous group. The same pattern is then repeated for this set of X elements and all other sets along the array, in a sequential and repetitive manner.

liniowe matryce – przemiatanie i ogniskowanie



The "steered-beam, phased-array" system requires a unique total element pulse sequence for each scan line (typically 128) since each line has its own unique angle with respect to the transducer face in the sector format. The complexity of the newer designs requires sophisticated, high-speed, computer-controlled pulsing of the individual elements circuitry. Electronic focusing on both transmit and receive (similar to annular array designs) provides a longer focal zone with a narrower beam width than conventional single element designs. Similar to linear array designs, focusing in the direction at right angles to the scan plane determines the slice thickness and is accomplished by use of accoustic lens



1977 Austria real time

Carl Kretz (1977) starts the production of the Combison 100, a real-time mechanical sector scanner for the abdomen and other parts of the body. It had a unique and large probe housing 5 transducers rotating around the axis of the probe handle. The 'rotating' mechanism was initially chosen because the angular velocity was constant, without a peaking velocity in the center of the images as in oscillating designs. Though the probe was quite heavy to hold in the hand, the scanner was welcomed by the ultrasound community because of the very good image it produced and the wide near-field that was not found in other hand-held mechanical sector transducers.

1973 Gray scale

George Kossoff
c. 1975

The application of true gray scaling had evloved from the work of the Kossoff group at the Ultrasonic Institute in Sydney (formerly the National Acoustic Laboratories), Australia. In 1975 the Kossoff group constructed and demonstrated the **UI Octoson**®, a rapid water-bath scanner employing 8 annular dynamic phased-array transducers which achieved it's scans by a combination of mechanical rocking and sequential pulsed-echo operations. The machine produced very impressive images at that time compared with the European counterparts.

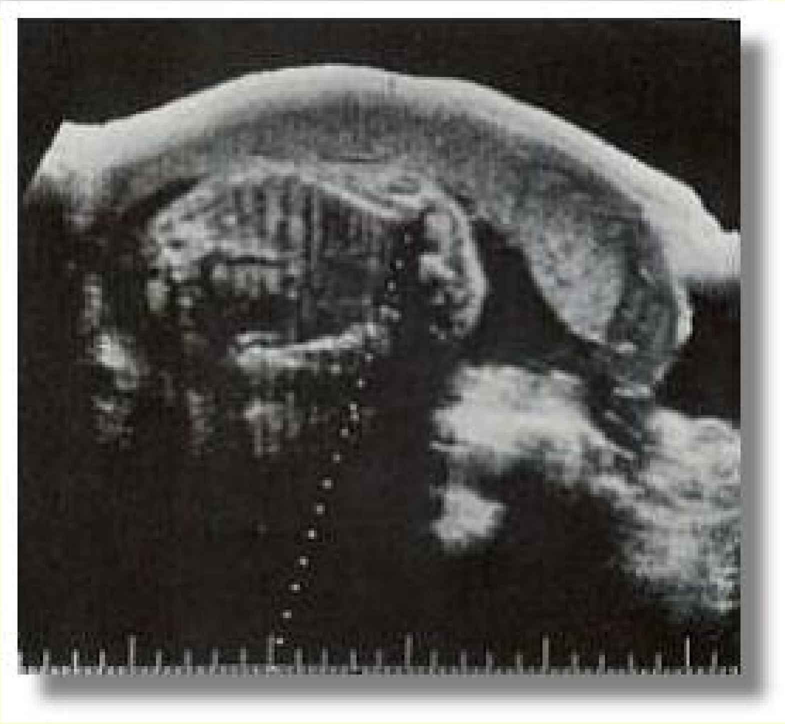
Gray scale – porównanie (60 , 70)

A bistable b-scan image of the maternal abdomen showing abdominal circumference and placenta using a compound contact scanner (Diasonograph®) *without* gray-scale in the **late 1960s**.

B-scan image with gray scale of a similar section of the maternal abdomen showing abdominal circumference and placenta using the Nuclear Enterprise® NE 4102 in the **late 1970s**

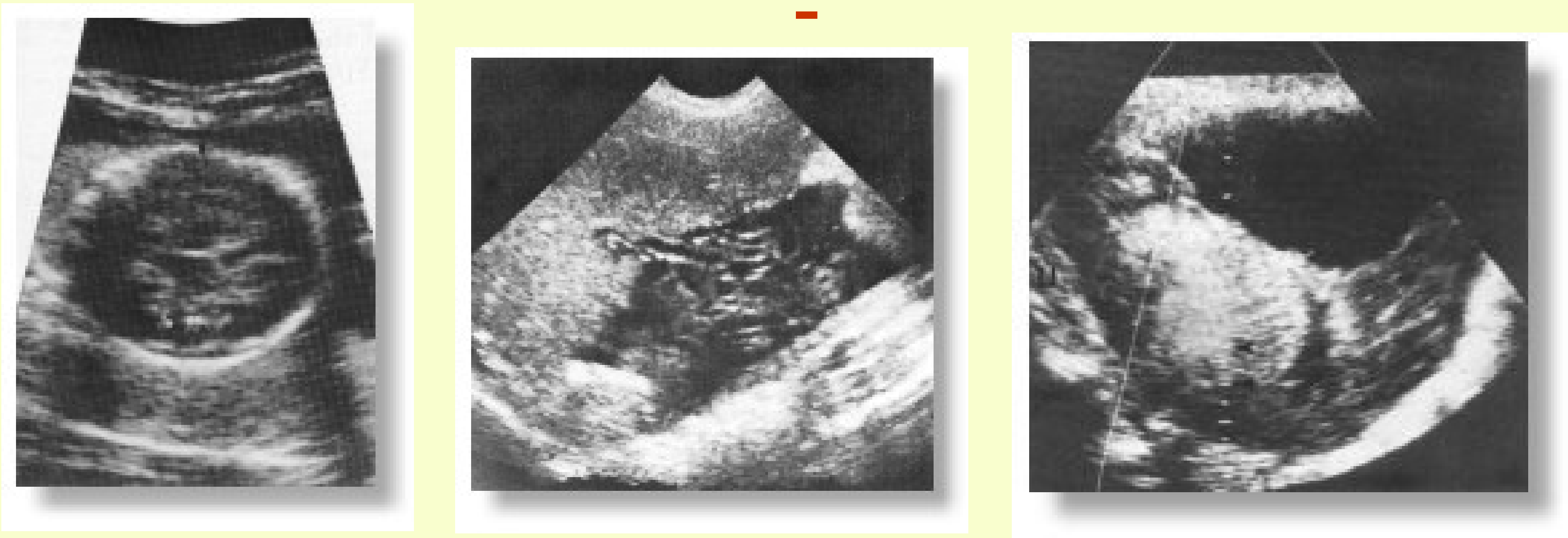
Gray scale – porównanie (70 , 80)

A **gray scale** Octoson® image of the abdominal circumference and placenta in the **late 1970s**. The Octoson® produced superior images as compared to articulated arm scanners but loosed out on mobility and flexibility.



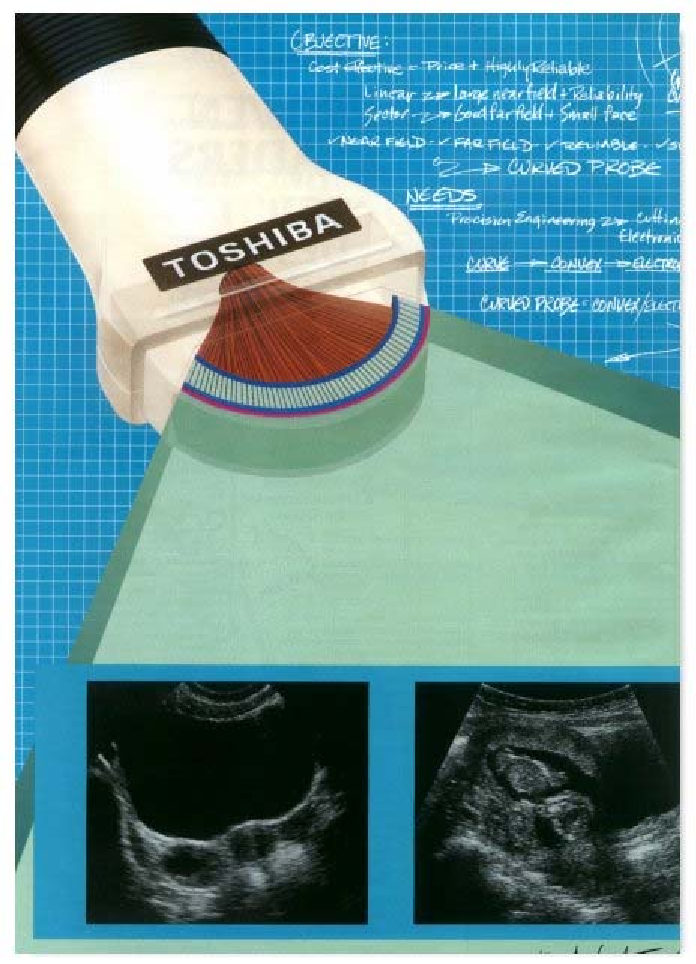
A gray scale longitudinal scan of a section of the fetal trunk and placenta made with the very popular Picker® 80L static scanner in the early 1980s. Despite the very good images that could be obtained with these machines, they were soon replaced by the new real-time scanners.

1980 zmierzch 'mechan icznych' skanerów -



In the early 1980s (around 1980-1985), many agreed that mechanical sector scanners (be it rotating, oscillating or wobbling designs) which employed relatively large area transducers produced better and less noisy images than electronic linear-array scanners. Shown here are very good images from **SKI®** (left), **Diasonics®** (middle) and **ATL®** (right) taken in 1981. The market in Obstetrics and Gynecology was divided between the mechanical sector scanners and the linear-arrays until the second half of the 1980s where both were replaced by **convex** sector-arrays.

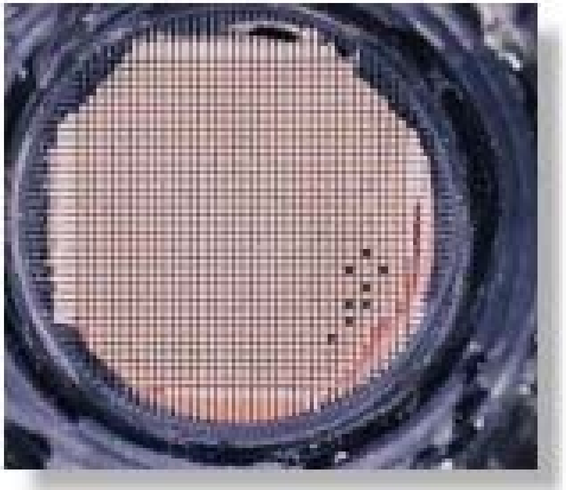
1983 Convex array



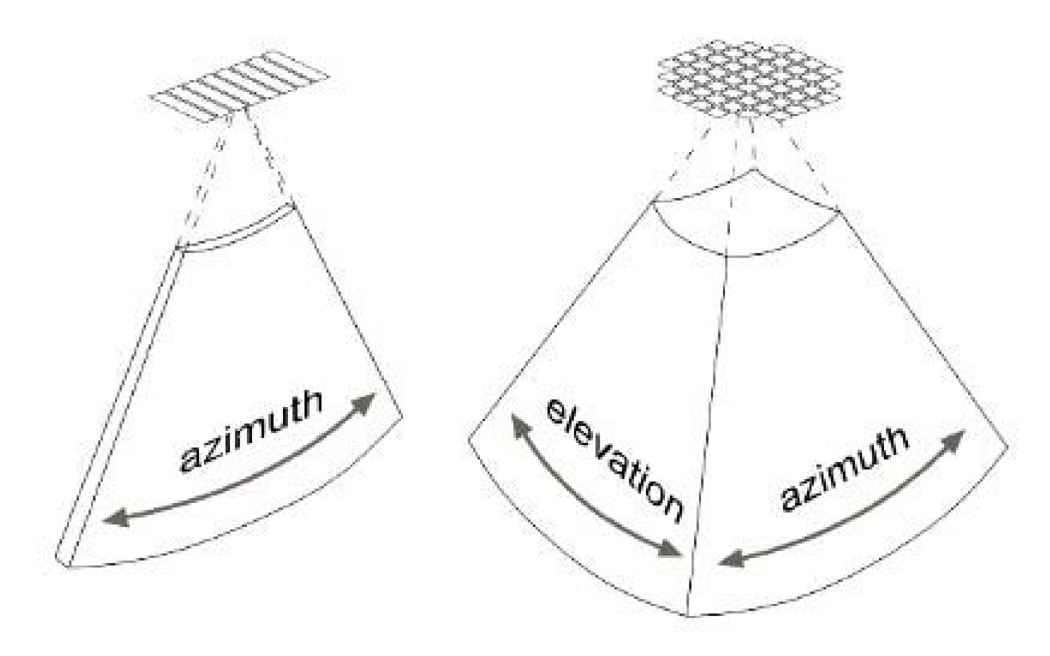
Because of its smaller convex contact surface, the curvilinear or convex sector-array fits much better on the abdomen and allows for a wider field of view than does the linear-array configuration. The first commercially available convex array transducer apparently only debuted in 1983 in a scanner from **Kontron Instruments®** in Europe, the Sigma 20, which was designed especially for use in Obstetrics and Gynecology

1987 Array matrix – 3D visualization

Duke University (Durham NC) started in **1987** a project to develop a real-time volumetric scanner for imaging the heart. In **1991** they produced a matrix array scanner that could image cardiac structures in real-time and 3-D. In **1994**, Olaf von Ramm, Stephen Smith and their team produced an improved scanner that could provide good resolution down to 20 centimeters. The team developed state-of-the-art "Medical Ultrasound imaging" integrated circuits (**MUsIC**) which were capable of processing signals from multiple real-time phased-array images



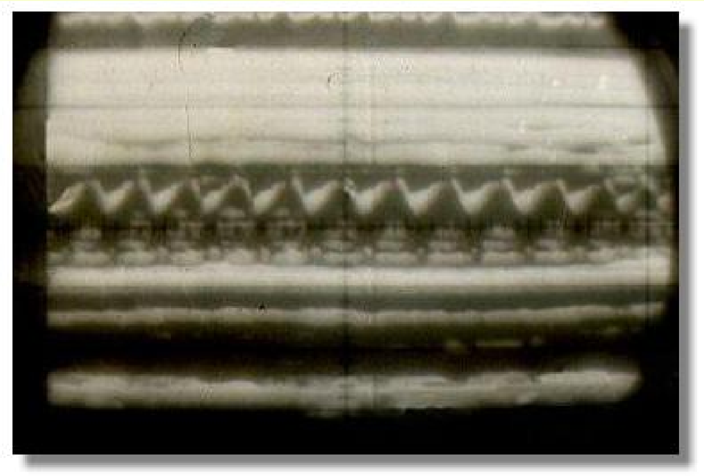
2-D matrix-array at Duke



M – Mode

M-Mode procedures record the amplitude and velocity (one-dimensional) of moving structures that produce echoes

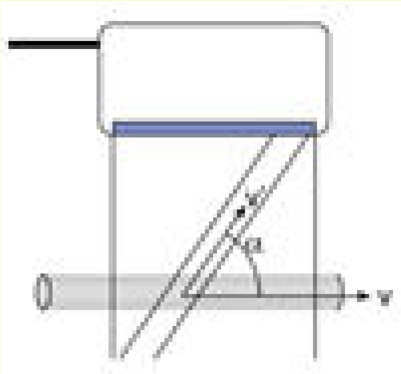
The **M-mode (time-motion) display** was first described by Inge Edler and Hellmuth Hertz in **Lund**, **Sweden** in 1954 using a modified metal-flaw detector from Siemens® of Germany. They demonstrated the feasibility of recording cardiac valvular motion ultrasonically. **Jens Bang** and Hans Henrik Holm demonstrated fetal cardiac motion using M-mode from 10 weeks onward in **1968**. In the same year Alfred Kratochwil described similar usefulness of detecting fetal cardiac motion by M-mode in patients with threatened abortion. These were nevetheless 'blind' procedures. Hugh Robinson in Glasgow described with great success in **1972** the detection of fetal cardiac motion at 7 weeks by A- and M-mode after locating the fetus with on B-mode ultrasound



M-mode tracings as reported in the study in 1964

Doppler effect – pomiar prędkości krwi

$$F = F_o \times (c + v \times \cos(q)) / (c - v \times \cos(q))$$



c is the acoustic velocity in blood, $1.54 \cdot 10^{5}$ cm/s;
F_o is the transmitted frequency;
q is the Doppler angle;
v is the velocity of the blood.

$$F \sim F_o + (2 \times F_o \times v \times \cos(q)) / c = F_o + f$$

where **f** is the **Doppler shift frequency**.

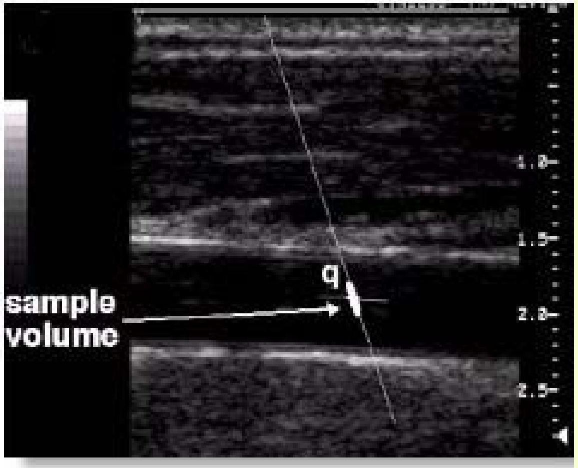


Figure 1

The Doppler shift of the moving blood is monitored continuously to form the Doppler signal. Because the transmit frequency is about 2 to 4 MHz, the Doppler shift of moving blood is in the audible range, e.g., ~2 kHz, and can thus be heard through a pair of stereo loudspeakers. The forward Doppler signal is made audible through one loudspeaker and the reverse Doppler signal is made audible through the other loud speaker. The resulting sound is distinct and provides feedback to the operator, allowing the appropriate placement of the Doppler sample volume.

Efekt Dopplera – 3 metody badania

There are three main techniques for making Doppler ultrasound velocity measurements of blood flow:

- continuous wave Doppler,
- pulsed Doppler
- color Doppler.

Pulsed Doppler can be referred to as pulsed Doppler, spectral Doppler, or duplex Doppler

The continuous wave Doppler method did not provide explicit information about the distance between the ultrasonic transducer and the moving target. Further development led to the introduction of **pulsed-doppler** system by Baker in **1970**, a concept based on the repetitive propagation of short ultrasound bursts and analysis of the signal received at a preselected time delay with respect to emission (the sample volume). Baker also outlined a technique for determining the volume blood flow from Doppler velocity measurements. The team also recruited John Reid from **Pennsylvania** who complemented the flow designs with 2D and M-mode technology. New instruments basing on the ultrasound doppler principles were developed. The first **duplex pulsed-doppler** scanner, a milestone development in ultrasound instrumentations was designed and developed by Frank Barber, **Baker**, **Reid** and other colleagues in **1974**. The duplex scanner finally enabled 2D gray scale imaging to be used to guide the placement of the ultrasonic beam for doppler signal acquisition.

Pulsed Doppler effect –

Shown in Figure 2 is the spectral Doppler measurement of blood flow in the common carotid artery. The location of the Doppler sample volume is illustrated by a cursor overlaid on the B-mode image shown above. To provide a localised velocity measurement, the instrument transmits a pulse that is 6 wavelengths to 40 wavelengths long - depending on the desired length of the sample volume.

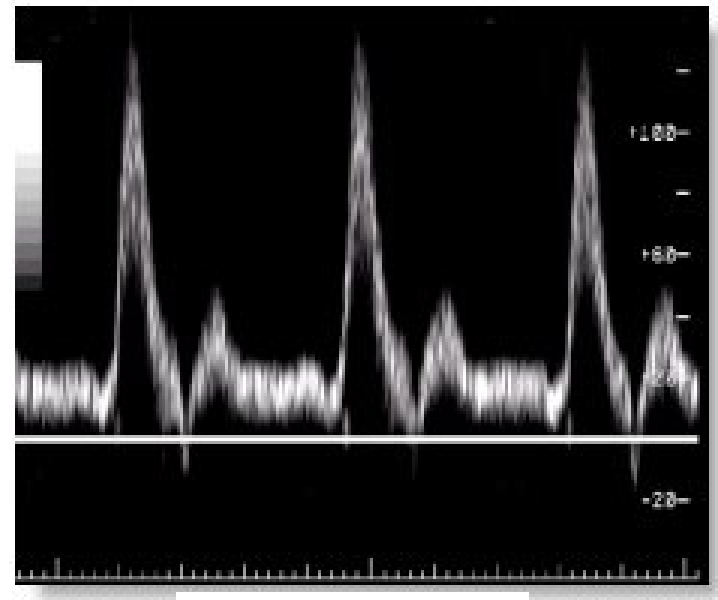


Figure 2

The received signal is gated so that the time elapsed between the transmission of the pulse and the opening of the gate determines the depth of the velocity measurement, i.e., the position of the sample volume. The Doppler signal is processed by a Fourier spectrum analyser, which performs a Fourier transform on the Doppler signal at intervals of approximately 10 ms. The amplitudes of the resulting spectra are encoded as brightnesses and these are plotted as a function of time (horizontal axis) and frequency shift (vertical axis) to provide a two-dimensional spectral display. With this technique, a range of blood velocities in the sample volume will produce a corresponding range of frequency shifts on the spectral display. The incorporation of pulsed Doppler and B-mode imaging into one instrument allows the position of the Doppler sample volume to be known and enables the measurement of the Doppler angle as is shown in Figure 1.

Spectral Doppler waveform measurements

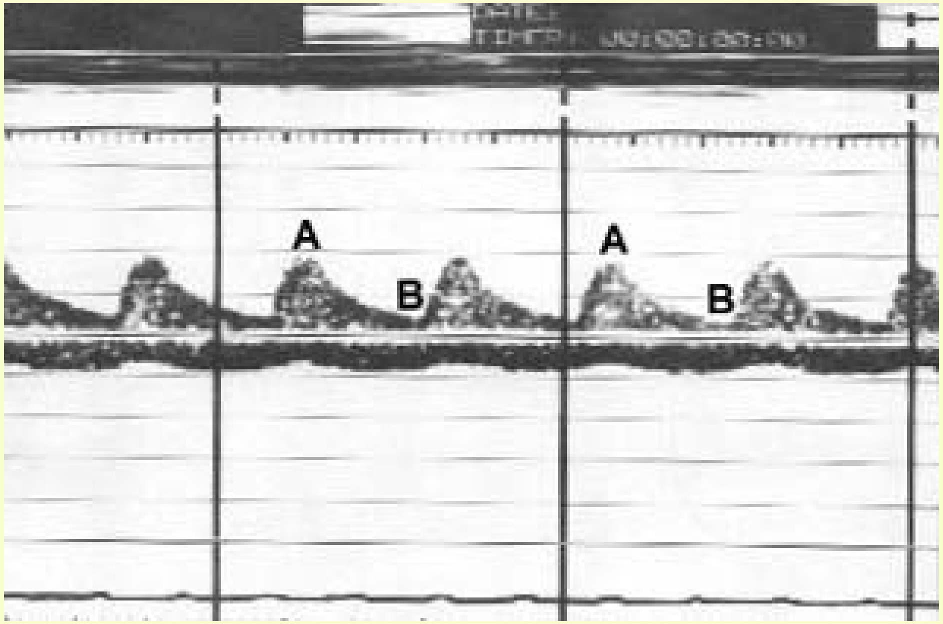
The complex shapes of Doppler waveforms can be described by relatively simple waveform indices, which have been used to evaluate foetal health and organ blood flow. The use of waveform indices to quantify a number of physiological quantities is frequently used. Common indices are the pulsatility index (PI), resistance index (RI), and systolic/ diastolic ratio (S/D, or A/B).

PI = f max - f min/ f

RI = 1- (f min/ f max)

S/ D or A/ B= f max/ f min = 1/ 1- RI

where: **fmax** is the maximum systolic frequency,
fmin is the minimum diastolic frequency, and
f is the time-average peak frequency.



The A/B ratio in a growth-retarded 24 weeks fetus (A/ B = 4.6

Color Doppler measurements

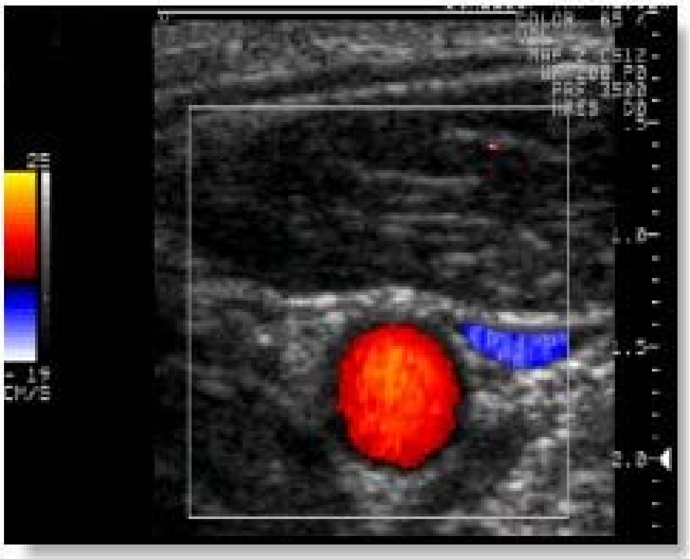
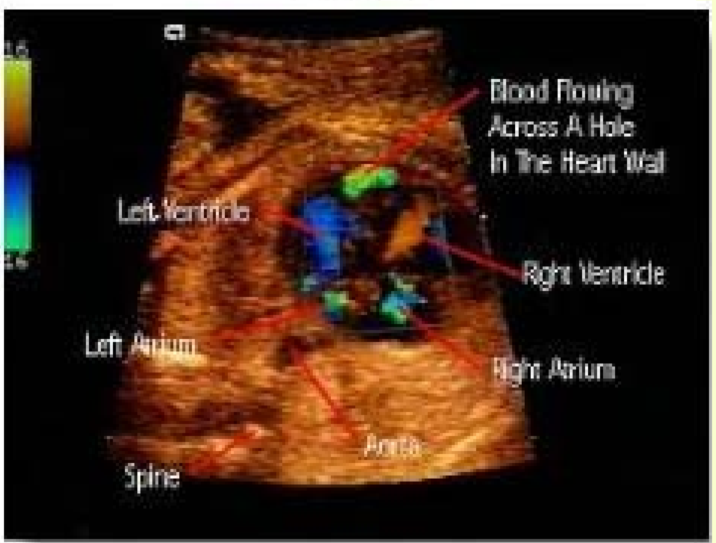


Figure 3

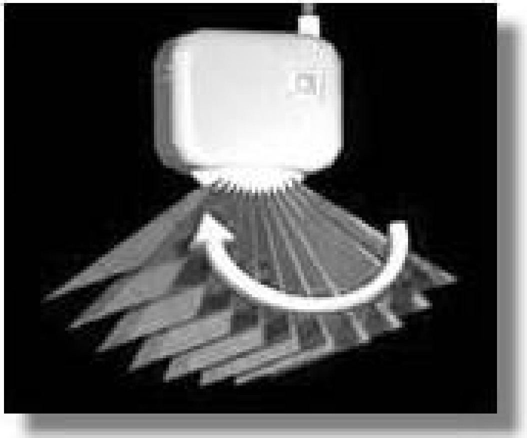


color doppler assessment of a VSD ***

Color Doppler ultrasound (also referred to as color flow ultrasound) is a technique for visualising the velocity of blood within an image plane. A color Doppler instrument measures the Doppler shifts in a few thousand sample volumes located in an image plane. For each sample volume, the average Doppler shift is encoded as a color and displayed on top of the B-mode image, such as shown in Figure 3. The way in which the frequency shifts are encoded is defined by the color bar located to the left of the image. Positive Doppler shifts, caused by blood moving towards the transducer, are encoded as red and negative shifts are encoded as blue. Color Doppler images are updated several times per second, thus allowing the flowing blood to be easily visualised.

The use of color doppler has become indispensible in the diagnosis of more complicated cardiac malformations. By the late 1990s, the diagnostic accuracy of the nature of complex cardiac malformations in utero can be as high as 95 percent.

1989 3D



Hand-held 3-D probe from Kretztechnik

In 1989 Kretztechnik introduced the world's first 3-dimensional ultrasound system,

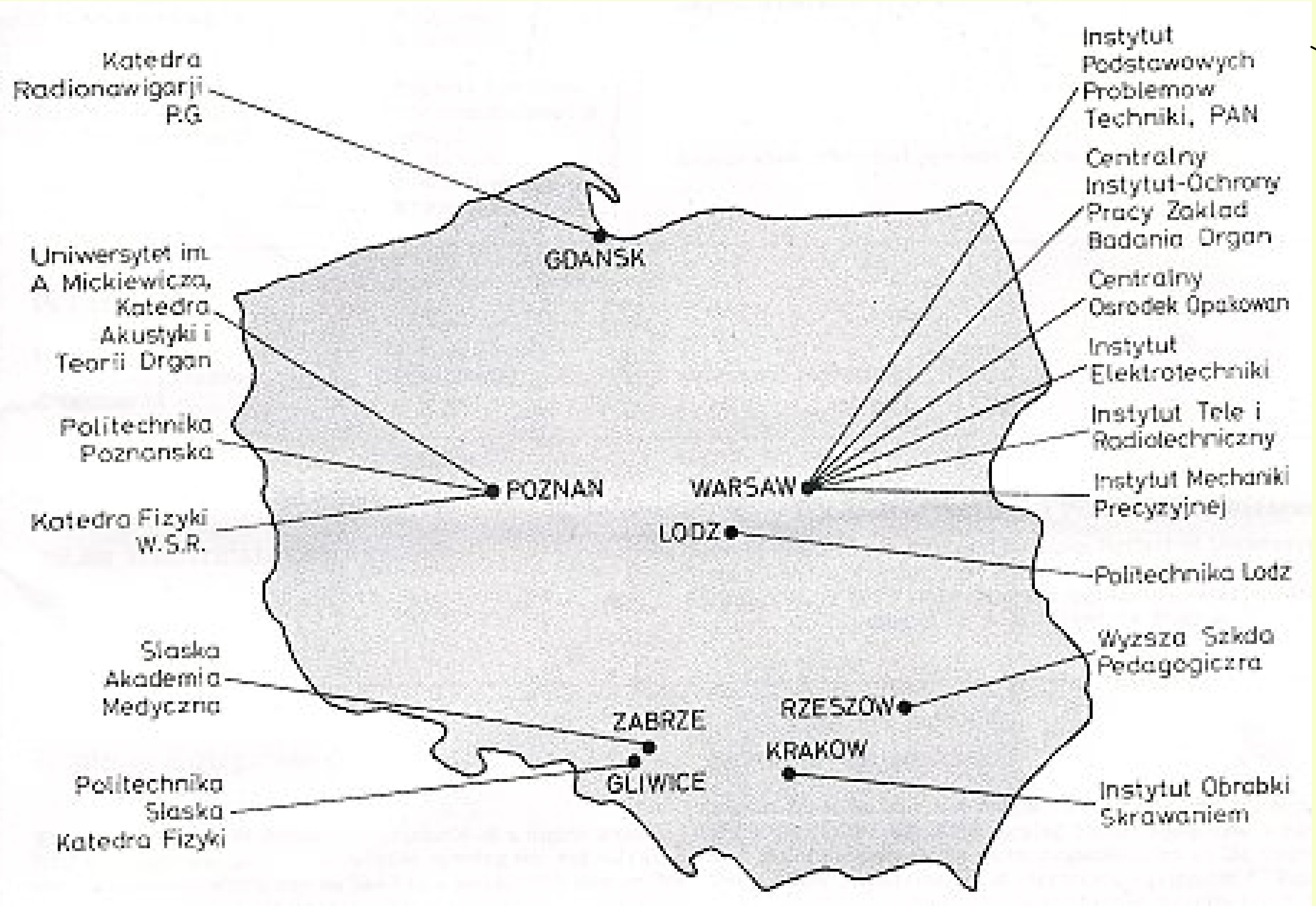
The most sucessfully deployed transducer design is the mechanically-driven arrays that is built-in into the probe housing. The second generation of 3D-ultrasound, the COMBISON 530 was launched in 1993, already delivering spatial reconstructions. The third generation 3D-ultrasound, VOLUSON 530D featured full-digital technology and interactive real-time 3D-rendering.

The abdominal **Voluson** sector transducer is a 90 mechanical annular array transducer with a relatively large coupling area. Its fast scan sector is swept automatically in a direction perpendicular to the fast scan plane

1998 3D live

In 1998 the break-through 3D technology, the "LIVE 3D" (4D) was invented. This was incoporated in the VOLUSON 730.

Historia nauki o US w Polsce 1



Since the 1960s, there were 8 regional centers in Poland engaging substantially in different areas of **ultrasonics research and development** (see map below). These included development in measuring techniques, medical applications and equipments, non-destructive testing, transducer designs, high power ultrasonics, chemical applications, magneto-constrictive devices, interferometry, liquid staes, agriculturral applications, industrial medicine, hazards, underwater research and ultrasonic machining.

Historia nauki o US w Polsce 2

Poland was one of the several countries where ultrasonic development had started with the initial use of metal flaw detecters

The IPPT-PAN was established in 1953 on the basis of a few divisions in Department IV (Technical Sciences) **of the Polish Academy of Sciences.**

Polish metal flaw-detector in the early 50's

During the consecutive stages of organization the basic core of the Institute was formed by divisions carrying on research in the following fields: mechanics of continuous media, mechanics of structures and materials, fluid mechanics, physical acoustics and ultrasonics, mechanical systems and electromagnetic waves. Throughout its history Institute has had an important influence on the development of research in basic technical disciplines in Poland.

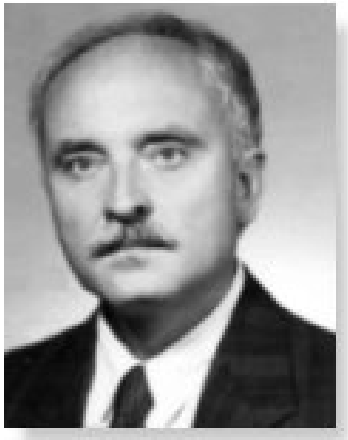
Historia nauki o US w Polsce 3

Leszek Filipczynski

Profesor Leszek Filipczynski was one of the earliest and most important pioneers in many areas of medical ultrasonic diagnosis including neurology , ophthalmology, surgery and gynecology.

Polish made A-scope in the 1960s

With experience in metal flaw detectors he had started looking at its application in medical diagnosis in 1964. The first dedicated medical scanner the UG-1 was constructed and was used to examine the abdomen. In the following year with the help of colleagues **I Roszkowskiego**, ultrasonic investigation was applied to the field of Obstetrics and Gynaecology. In 1966, the scanners EM-1 and UO-1 were produced for brain and ophthalmologic investigations. The UKG-1 was produced for the use in cardiology in 1968.


Andrzej Nowicki

Historia nauki o US w Polsce 4

Another well-known pioneer is Professor Andrzej Nowicki, currently Professor and head of the Department of Ultrasound at IPPT

Prof. A. Nowicki has been active in the field of medical ultrasound, research and development of the pulsed Doppler, cardiac imaging, transcranial and tissue flow Doppler and recently high frequency ultrasonic imaging. He has published over 100 scientific papers in renowned journals and conference proceedings in English and Polish and is the author of two books on basics of ultrasonic medical imaging and Doppler (in Polish).

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Polskie aparaty USG - TECHPAN

TECHPAN Research & Development Departament at the Institute of Fundamental Technological research (IPPT-PAN) started to design and manufacture Polish diagnostic ultrasound equipment in the late seventies. These included the early USG-10 for gynecology and obstetrics and the USO-10 for opthalmology. The UDT-10 was produced in 1978 for the detection of fetal pulsations.

The cardiac sectoral real-time scanner USK-40 was produced in 1984, and the computerised USG-P30 in the same year. The **USG-40,** a popular abdominal and Obstetric scan employing a mechanical rotary probe was manufactured in 1985. This was upgraded to the USG-50 in the following year.Transvaginal and electronic array probes were produced in the folllowing few years.

USG-40

Polskie aparaty USG: ECHO-SON

With the transformation of the economy commenced in the early nineties, the "Echo-Son®" S.A. ultrasound manufacturer in Poland was made in 1993. The company is the continuation of the TECHPAN. Echo-Son now produces state-of-the-art ultrasound scanners marketed outside of Poland.

http://www.echoson.com.pl/cowyr.html

CO NAS WYRÓŻNIA

Najwyższa jakość zobrazowania
Zastosowanie unikalnych cyfrowych technik obróbki obrazu
Najlepsze proporcje jakości do ceny
Największy zakres produkcji - ultrasonografy uniwersalne, okulistyczne, dopplerowskie, mikroskanery (2,5MHz ...40MHz)
Zainstalowano już 3000 aparatów.

ECHO-SON: ultrasonografy

http://www.echoson.com.pl/spinel.html

Ultrasonograf **SPINEL II** to urządzenie przeznaczone do rutynowej diagnostyki . Wielofunkcyjna rodzina głowic , możliwość podłączenia modułu Dopplera , bogate i wszechstronne oprogramowanie specjalistyczne czynią ten model idealnym urządzeniem do wielu zastosowań zarówno w środowisku szpitalnym jak i praktyce prywatnej.

http://www.echoson.com.pl/desmin_h.html

Mamy zaszczyt przedstawić Państwu jedno z naszych najnowszych opracowań - ultrasonograf przenośny **DESMIN H**. Został on zaprojektowany jako aparat mający obalić powszechne przekonanie, że ultrasonograf jest urządzeniem drogim i dostępnym jedynie dla wąskiego kręgu diagnostów. Tymczasem właśnie DESMIN H przeznaczony jest do gabinetów prywatnych, znakomicie może wpływać na efekty pracy lekarza rodzinnego, może pomóc lekarzom wielu specjalności, szczególnie zaś tym, którzy odwiedzają pacjentów w domach

ECHO-SON: DESMIN H

http://www.echoson.com.pl/desmin_h.html

DANE TECHNICZNE ULTRASONOGRAFU

1. OBRAZOWANIE

- B, B+B, 4B, B+M, M, ZOOM

2. TYP SKANOWANIA

- mechaniczna convex (sector)
- elektroniczny linia / convex

ultrasonograf przenośny ogólnego przeznaczenia

- interfejs głowic: 2x mechaniczne i 1x elektroniczne (opcja)
- pamięć obrazu: 512 x 512 x 8
- skala szarości: 256 poziomów
- pamięć cineloop (64 klatki)
- ogniskowanie:
  - wydłużona strefa ogniskowania
  - multi (4 strefy ogniskowania)
- głębokość skanowania: 3...25 cm
- prędkość skanowania: max. 25 frames/sec z automatyczną optymalizacją dla każdej głębokości skanowania
- 4 przełączalne prędkości przesuwu M-mode
- płynna regulacja mocy emitowanej