1928
K. N. Toosi University of Technology

An article on

“Picturephone”

Museum of Electrical Engineering

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A brief history

As far back as the 1930s, researchers at AT&T's Bell Labs built a device that sent a television signal over standard phone lines. However, it had a problem; it was not efficient and practical enough to be used by people around the world.

34 years later AT&T's Picturephone, introduced as a futuristic demonstration at the New York World's Fair. There were eight Picturephone booths at the fair and visitors could use them for making video telephone calls. It seemed to many at Bell Labs and at AT&T that universal video telephony was a worthwhile new mission. Thus in 1969 Annual Report, AT&T confidently predicted with perhaps one million sets in use, Picturephone service might be a billion dollar business by 1980. They were thinking that it can largely utilized by businesses-particularly by large corporations then it would spread gradually into the residential market.

On June 30, 1970, AT&T finally uncloaked a commercial Picturephone service in the city of Pittsburgh, Pennsylvania. Then after a couple of months they made three more available — one in New York, one in DC, and one in Chicago. The three machines could only communicate with one another and were extremely expensive, costing between $16 and $27 (that is $118 to $200 when adjusted for inflation) for just three minutes. The interesting statistics is that in the next 6 months Just 71 calls were made.

Despite these setbacks over the next few years, Bell Labs designed an improved Picturephone set. This set is known as the Picturephone MOD II, which had an innovative silicon photodiode array camera, a zoom lens, and some graphics capability.

Years later AT&T itself introduced a consumer-oriented color videophone in 1992, the AT&T Videophone 2500. Using data compression technologies, it offered a small full-color picture that could be transmitted over standard telephone lines. Even though it was marketed for uses such for grandparents to see their distant grandchildren, still it failed to attract a good market.

Picturephone booths at the 1964 New York World's Fair (courtesy AT&T Archives and History Center).

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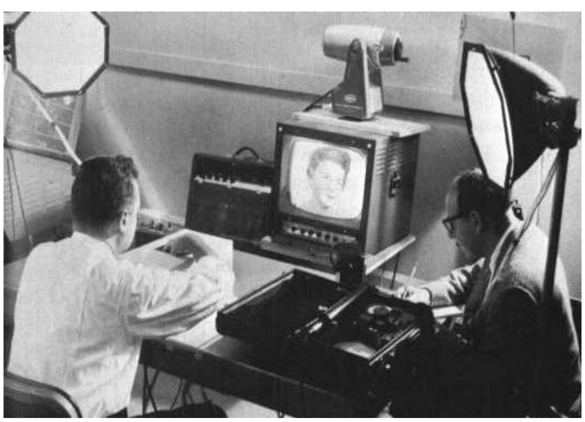


Year 1957, Studies and experiments continued at Bell Labs to develop an economically feasible videotelephone system.

Inaugural call, Picturephone booth service, 1964. Illinois Bell Telephone President John de Butts in Chicago talks to First Lady Lady Bird Johnson in Washington. (Courtesy AT&T Archives and History Center

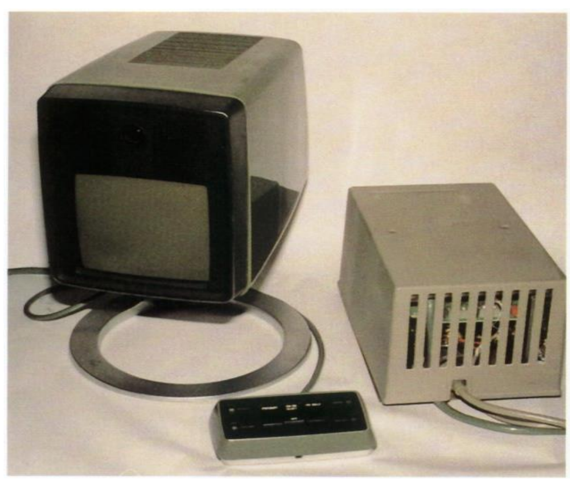
More details of Picturephone

Picturephone design team had another idea that this service is useful in other ways too. Graphic material, such as drawings, photographs, and physical objects, can be viewed with the Picturephone set. The customer could interact with computer via touch-tone dialing buttons, and the computer's responses are displayed on the picture tube.

The equipment at the Picturephone customer's location consists of four parts: a 12-button touch-tone telephone; a display unit, with picture tube, camera tube, and a built in loudspeaker; a control unit, which contains a microphone; and a service unit containing power supply, logic circuits, and transmission equalizing circuits.

The Picturephone customer initiates a video call by pressing the lower right-hand or 12th button, labeled #, and then, in most cases, dials the regular telephone number of the person he is calling. The "ON" button, of course, turns the set on. But, during a conversation, if the viewers desires to mute the microphone, they again could press and hold the "ON" button. This could allow them to talk to someone else in the room without being heard by the person at the other end of the line.

The customer service unit contains the low voltage power supply, the control circuits, and the station set equalizer. Usually, the unit is not in view at an office or home, and can be placed up to 85 feet away from the other units.

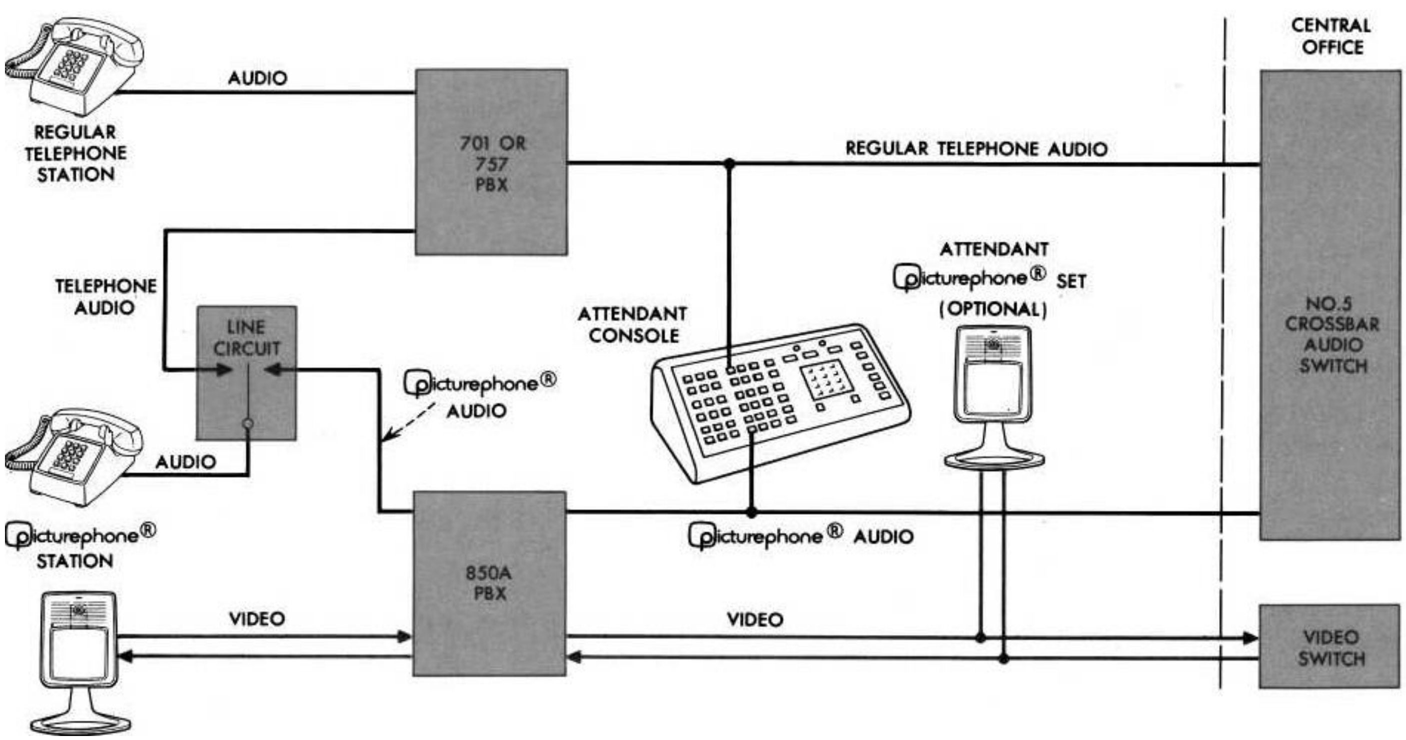


The original Picturephone, made by Western Electric in the early 1970s consisting of 1A display unit, the 72A control unit, and 1A service unit.

Communications and Network

The Picturephone system is designed to take maximum advantage of the existing telephone network and add as little new equipment as possible. Thus service requires no modifications to existing two-wire loops (the wires that connect a customer's telephone to the local switching office), voice calls and the voice portion of Picturephone calls use these wires. Two more pairs of wires in standard telephone cables are assigned for the picture signals, one pair for transmission in each direction. Equalizers are inserted at about one-mile intervals along the additional pairs. The ON-OFF switch-hook signals and Touch-Tone dialing signals, as well as the voice portion of Picturephone calls, are transmitted over the voice pair.

The picture signal is composed of about 250 active lines, displayed 30 times per second on a 5.5 -inch by 5-inch screen. Transmitting the picture signal requires a 1-MHz bandwidth.



As can be seen from the picture above, making such a network is sophisticated and requires high maintenance price

The Picturephone signals, both audio and video, arrive at the local central office in analog form over six-wire "loops"-two wires for audio and two wires for each direction of the video portion.

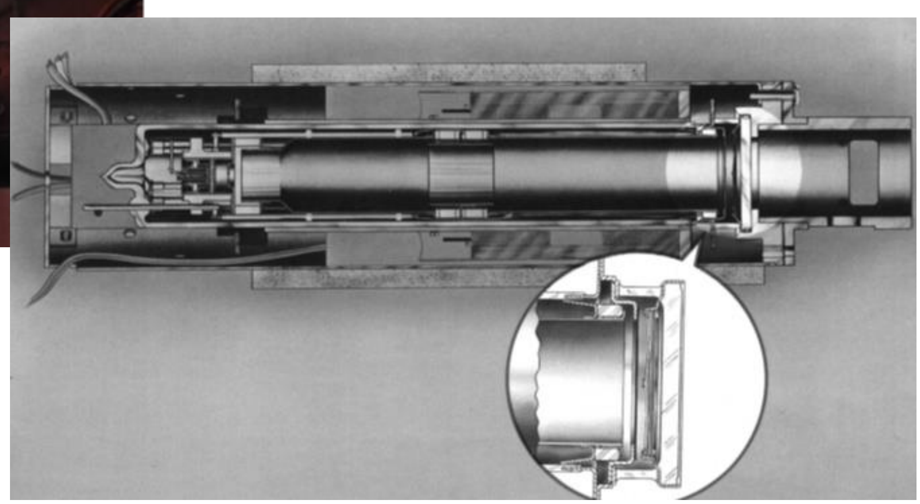
For longer exchange trunks and toll trunks, analog transmission could also be used, but it would not be a very practical solution, economically. It turned out to be more economical for most of the longer exchange trunks, and for toll trunks, to transform the analog signal to digital form, and convert it back to analog at the distant terminal And this is easy to do, since digital transmission in the Bell System was evolving rapidly. Information could be sent in a digital format over transmission systems that use frequency division carrier techniques for carrying several signals simultaneously

Inside device

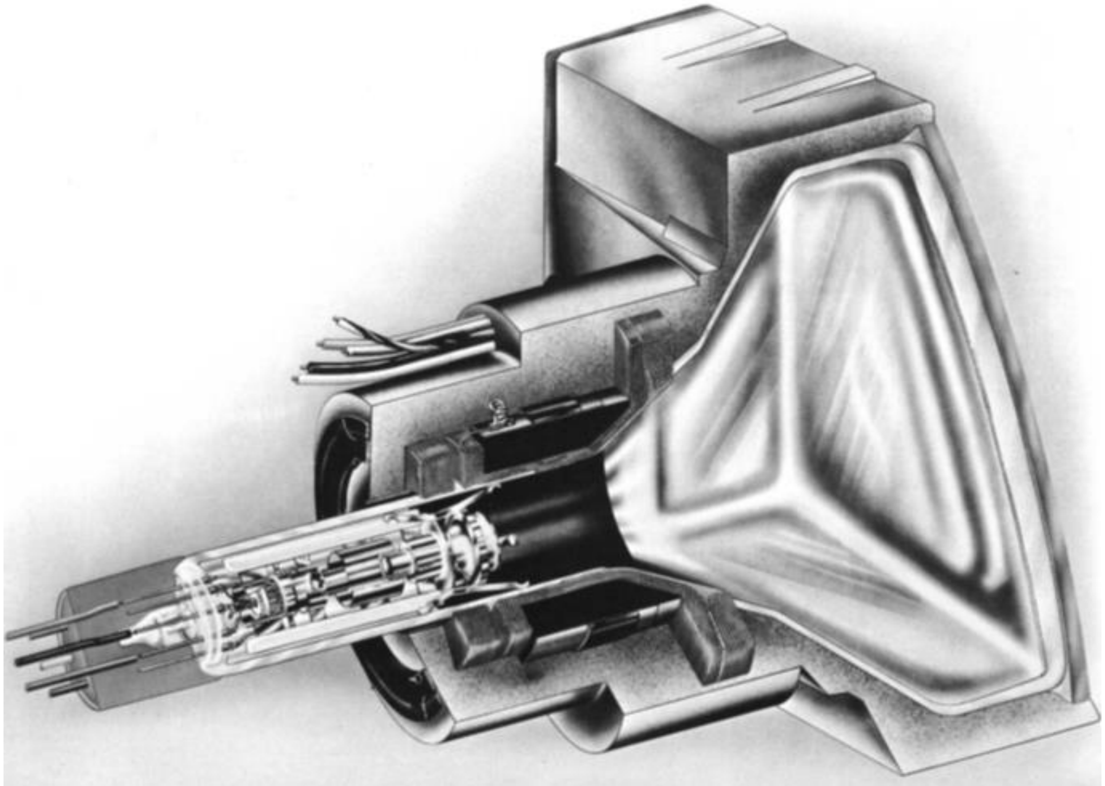
A list of electronic devices used in the Picturephone system will gain insight into the meaning of technological evolution. On this list are devices that would have been impossible to produce only a few years before 1970, for example devices that was based heavily on silicon and thin-film technology.

the picture tube, the camera tube, and six integrated circuit devices. All eight were expressly designed for the Picturephone display unit. picture tube is an electrostatically focused cathode-ray tube with magnetic deflection. Of the eight devices, it is the only one the customer will see and, this is like old home televisions. However, there are significant differences- most of which add up to greater safety, reliability, and economy of installation. In the drive circuit of an average cathode ray tube, the cutoff voltage would have to have an allowable range of 30 volts or more. In the Picturephone set, however, the cutoff voltage needs a range of only 15 volts, which permits more economical circuitry. What makes this reduced range possible is precise control of spacing and grid aperture sizes during manufacture.

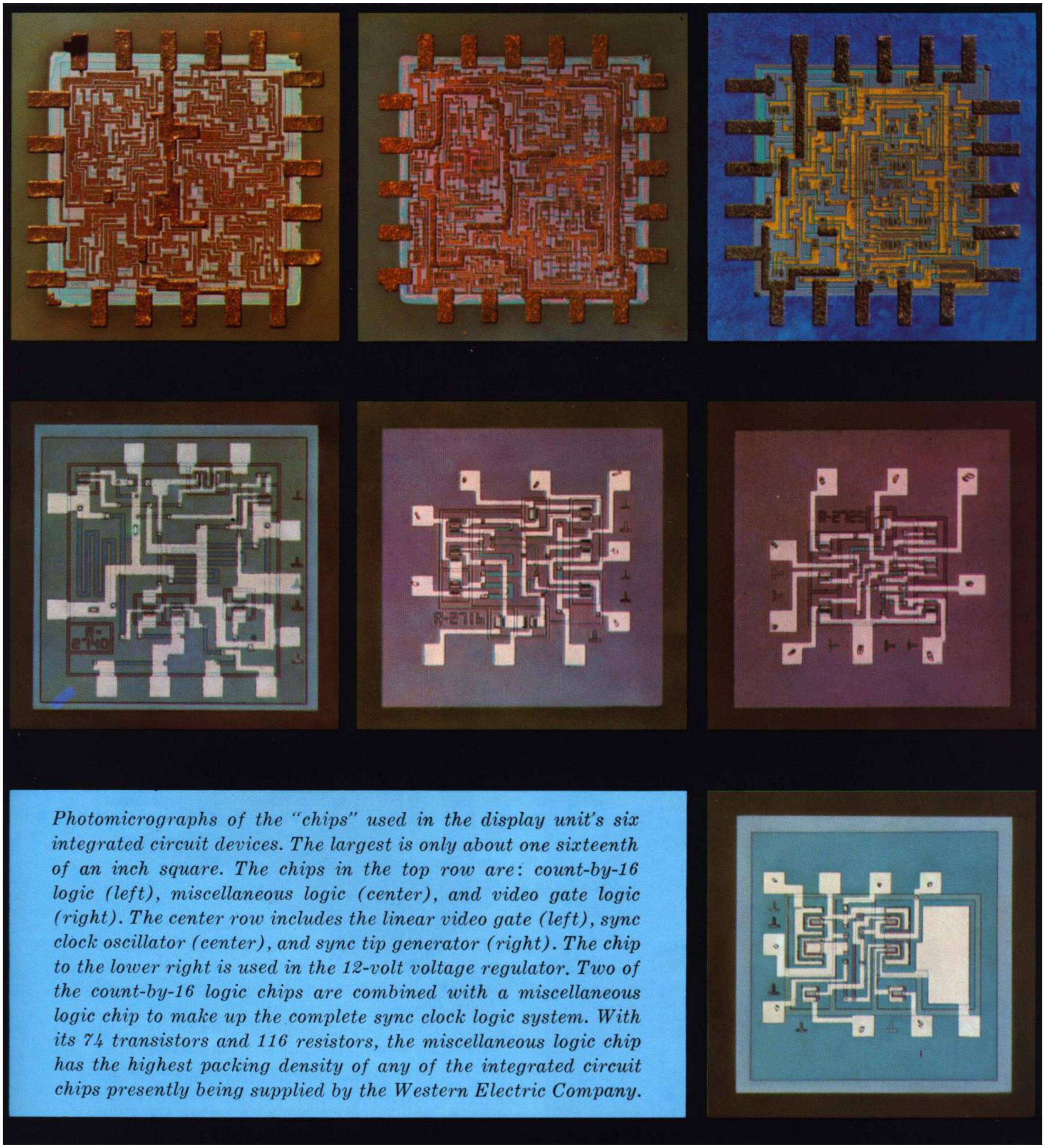
The camera tube is supplied ready for use and was comming with its magnetic deflection coils prepositioned. The electron beam is magnetically aligned within the gun during manufacture, and the tube is enclosed in a high-permeability magnetic shield.



Camera tube and picture tube



The six integrated circuit devices that control the camera tube are the products of the best technologies of that time. The devices are: a voltage regulator, a linear video gate, a video gate logic circuit, a synchronizing clock oscillator, a synchronizing tip generator, and a synchronizing clock logic system.



Photomicrographs of the "chips" used in the display unit's six integrated circuit devices. The largest is only about one sixteenth of an inch square. The chips in the top row are: count-by-16 logic (left), miscellaneous logic (center), and video gate logic (right). The center row includes the linear video gate (left), sync clock oscillator (center), and sync tip generator (right). The chip to the lower right is used in the 12-volt voltage regulator. Two of the count-by-16 logic chips are combined with a miscellaneous logic chip to make up the complete sync clock logic system. With its 74 transistors and 116 resistors, the miscellaneous logic chip has the highest packing density of any of the integrated circuit chips presently being supplied by the Western Electric Company.

The voltage regulator maintains a critical supply voltage for the sync clock oscillator and the horizontal and vertical sweep generators for the camera tube. The sync clock system supplies all of the timing signals for the Picturephone set's camera. The count-by-16 circuits are used to divide the sync clock oscillator's basic frequency of 16.26 kHz to get a vertical sweep frequency of 60 Hz and ensure precise field interlacing.

Why did it fail?

first researched model in the 1950s, failed mostly due to the poor picture quality and the lack of efficient video compression techniques. The greater 1 MHz bandwidth and 6 Mbit/s bit rate of the AT&T Picturephone in the 1970s also did not achieve commercial success, mostly due to its high cost. it proved more expensive than its value even to the targeted business markets. Most new technologies are expensive at first, then come down in price. AT&T was confident that costs would come down over time, in this case with the coming employment of digital technologies, but Picturephone did not last that long.

Another important reason is that a Picturephone is only useful if the person you want to contact has one. with only a few hundred Picturephones in the world, users had extremely few contacts they could dial. Also new technology needs some group of enthusiasts to sustain it over these early years; and the Picturephone did not find such a group.

Today

the concept of this technology was far ahead of its time and paved the way for modern-day services like Skype and FaceTime. In a way, the rise of the internet and the world wide web in the 21st century has delivered on the promises of the Picturephone. By the help of internet and our smartphones, nowadays we can have high quality free video calls with its lowest delay.

Resources:

- Bell laboratories RECORD magazine, May/June 1969
- http://ethw.org/Picturephone
- http://www.beatriceco.com/bti/porticus/bell/telephones-picturephone.html
- https://www.theverge.com/2012/6/29/3126529/picturephone-1970s-debut-at-t-archives