

AC 1
MGH Telemedicine Center
Records, 1968-1996

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Agency History

The MGH Telemedicine Center, the first telemedicine program in the United States, was founded by Kenneth T. Bird and Thomas Fitzpatrick. [For general introductory insights and background to the collection see Krainin note 1 in the appendix to this finding aid, consisting of a detailed letter from Stanley Krainin describing the formation of the program and its accomplishments]. In 1967 the U.S. Public Health Service awarded the project a \$350,000 grant and in April, 1968, the first remote health station began operating and providing Primary Health Care at Logan International Airport in Boston. Technical assistance in design and installation was provided by Richard Oldham of public television station WGBH (Boston). In 1970 a telemedicine link was established between MGH and the Bedford, Massachusetts, Veterans Administration Hospital in order to enable psychiatric consultation between the two hospitals. Other telemedicine projects also included a system to counsel youth and speech therapy sessions.

The Telemedicine Center linked doctors with patients via interactive, two-way, closed-circuit television and this system enabled doctors to conduct examinations of patients located at a remote site. X-rays and electrocardiograms could also be transmitted, enabling a thorough examination of patients. The telemedicine project addressed the problem of physician shortages through eliminating the need for Logan International Airport to maintain a full-time physician at its health center.

The versatility and extension of telediagnosis was examined in study and demonstration projects. In 1969 Stanley Krainin of CBS Laboratories began assisting Dr. Kenneth Bird in areas of technology and systems engineering, work that resulted in the Mediscan System, which used telephone lines for the transmission of telemedicine. In 1974 the Veterans Administration Telemedicine Network Study showed the feasibility and cost benefits of connecting fifteen hospitals and clinics in various New England states.

Other projects included Medinav, funded by the U.S. Navy to show the feasibility of telemedicine links between ships at sea and/or hospitals ashore. [See Krainin note 2]. The Tri-Services Study attempted to obtain funding for the purpose of demonstrating the advantage of telemedicine links among military hospitals in the U.S.

Work included preparation of a new concept of medical records, which would provide ultra-high resolution storage and retrieval of all patient records, including handwritten notes. Far-range planning included gathering of information that would facilitate use of cable television systems for telemedicine transmission among healthcare institutions in Boston. The last and most ambitious project undertaken, Project Prime, proposed to connect the People's Republic of China with the U.S. in a teleconsultation link.

The telemedicine system that was in place in the 1960s and 1970s is no longer functioning. MGH and Partners reestablished the telemedicine center in the 1990s. It

focuses on providing remote links for access to medical information, diagnostic tools and consultative services.

Summary of Contents

The collection includes press clippings from 1968-1996, the bulk being from 1968-1975. The clippings contain information about the telemedicine center at Logan Airport (1968-1975), the youth counseling project (1970), the Bedford Veterans Administration Hospital (1970-1975), the proposed medical information exchange with the People's Republic of China (1980), and other matters. The clippings also include general information about the concept and use of telemedicine (1968-1996). The collection also includes proposals for the exchange of medical information with China (1976), the establishment of a Veterans Administration telemedicine system (1973-1974), and the creation of a telemedicine laboratory at MGH (1973). Also included are reports and analyses (written by Kenneth Bird and Stanley Krainin, the latter for technology and systems engineering) on the cost effectiveness of various aspects of telemedicine. These reports discuss using television for professional consultation (1970-1975), the Bedford Veterans Administration Hospital project (1970-1975), the use of television for diagnosis (1968-1975), the Logan Airport project (1968-1975), budgetary and cost containment issues (1974) and the use of telemedicine in nursing homes. The collection contains technical charts, reports, and test data to show teliagnosis capabilities under various combinations of image enhancement and transmission constraints (1968-1975) as well as the design of electronic stethoscopes used (1972-1975). The collection also includes photographs of Kenneth Bird, nurses and doctors conducting examinations, and installations and equipment.

The collection contains only a small amount of correspondence. It includes no documents relating to the end of the telemedicine project at MGH and no information about restarting telemedicine under the aegis of Partners Healthcare Systems, Inc., in the 1990s.

Photographs depicting Kenneth Bird and other people associated with MGH Telemedicine, as well as telemedicine equipment will be found in Series VII (Box 3).

Assistance in the description of this collection was provided by Stanley Krainin.

Related Collections Note

AC 8, Partners Telemedicine, consists of material donated by Eric Menn of Partners Telemedicine in 1999, relating primarily to telemedicine and the internet (unfunded proposals), 1996.

The following list of contents is best used in conjunction with explanatory notes provided by Stanley Krainin in 1999. Items for which an explanatory note has been written are followed by square brackets identifying the number of the note, which can be found in the appendix to this finding aid. These notes have also been inserted into appropriate folders in the collection.

Box 1.

Series I. Press Clippings, 1968-1996

Press clippings, n.d.
Press clippings, 1968
Press clippings, 1969
Press clippings, 1970
Press clippings, 1971
Press clippings, 1972
Press clippings, 1973
Press clippings, 1974
Press clippings, 1975
Press clippings, 1980
Press clippings, 1981
Press clippings, 1996

Series II. Project Prime, 1976

Friendship and understanding: the People's Republic of China and the United States of America: the role of medicine
Program for international medical exchange with the People's Republic of China and introduction to the PRIME systems concept (PSC) [see Krainin note 3]

Series III. Teleconsultation, 1970-1975

Automated analysis of data on telemedicine transactions, 1975
Correspondence, 1975
The Feasibility of a Veterans Administration telemedicine network, 1974 [see Krainin note 4]
Operational telemedicine: present capabilities and future needs, 1975

The Puerto Rico telemedicine system, 1972
Reprints, 1972-1974
Teleconsultation brochure, n.d.
Teleconsultation: a new health information exchange system, 1970
Teleconsultation: a new health information exchange system, 1971
Telemedicine: the Bedford Veterans Administration Hospital-Massachusetts General Hospital closed circuit television system for the exchange of medical information, 1970-1975, 1977
Telemedicine and patient care: the Veterans Administration Network, 1974

Box 2

Veterans Administration: telemedicine: a new health information exchange system, 1973
Veterans Administration: telemedicine: a new health information exchange system, 1974

Series IV. Telediagnosis, 1966-1991

Auditory discrimination of speech sounds in telemedicine, 1974
Bird, Kenneth: obituary, 1991
Blueprints, 1967
Brochure, n.d.
Correspondence, 1970
Electronic stethoscopes, 1972-1975 [see Krainin note 5]
Image enhancement of video signals, 1968 [see Krainin note 6]
Medical station "Wee Care" contents, 1974
NEREM notes, 1970-1971
Press release, 1968
Reprints, 1968-1975
Telediagnosis: a new community health resource, 1966
Telediagnosis: a new community resource, [1968]
Telediagnosis: a new link in medical care, 1968

Telediagnosis system video characteristics study at the Massachusetts General Hospital and Logan International Airport, 1970 [see Krainin note 7]
Telediagnosis system video response evaluation: Massachusetts General Hospital and Logan International Airport, 1969 [see Krainin note 8]
Telemedicine: a new health information exchange system, 1970
Teleoperators and human augmentation: tomorrow and the future, 1969
Tele-poem, 1970
Teleradiology: remote interpretation of roentgenograms, 1972

Box 3

Series V. Telemedicine, 1970-1982

CATV interconnect: expansion for Veterans Administration and Tricom systems, 1974
Conclusions from experiences with telemedicine, 1973
Correspondence, 1982
The cost of telemedicine, 1974 [see Krainin note 9]
Mediscan (telediagnosis II) feasibility demonstration, 1970
Mediscan (telediagnosis II): A joint M.G.H., C.B.S. study, 1970 [see Krainin note 10]
Proposal for the creation of the telemedicine laboratory of Massachusetts General Hospital, 1973
Reprints, 1969, 1972, 1975
Telecare: a nursing home resource, n.d.
Telemedicine block diagrams, n.d.
Telemedicine Center program, 1978
Telemedicine: the practice of medicine by two-way television, n.d.
Telemedicine system for health care: development and evaluation of three components: Don Orione Nursing Home, Bunker Hill Medical Center, East Boston Youth Center: a consolidated grant proposal, 1971
Telemedicine systems, n.d.
Tri-Services telemedicine serving regional and subregional military health care facilities: A pilot program, n.d.

Series VI. Other Related Projects, 1969-1983

Analysis of Boston proposals: part G: technical: preliminary, n.d. [see Krainin note 11]

Emergency medical systems, 1972-1976 [see Krainin note 12]

MGH storage and retrieval, 1969-1970 [see Krainin note 13]

Teleconferencing: Warner Amex, n.d., 1982-1983 [see Krainin note 14]

Series VII. Photographs, ca. 1967-1975

Bird, Kenneth, ca. 1967-1975

Equipment, ca. 1967-1975

Work and activities, ca. 1967-1975

Appendix

Stanley Krainin's explanatory note No. 1

July 10, 1997.

Dr. James J. Mongan, M.D.
President & Chief Operating Officer
Massachusetts General Hospital
Fruit Street
Boston, Ma. 02114

Dear Dr. Mongan:

The purpose of my writing to you is to bring to your attention the fact that MGH is a pioneer in Telemedicine and Dr. Kenneth T. Bird, M.D., deceased, was its leader while an Associate Physician at MGH. He interned at MGH in 1944 and retired due to illness in 1988. His early vision, determination and achievements in Telemedicine, I believe have earned him the title of "The Father of Telemedicine".

I met Dr. Bird in 1968 while he was on a visit to CBS Laboratories where I planned and developed R&D programs in video, audio, acoustics and optics. Dr. Bird's enthusiasm for and his dedications to developing Telemedicine as a compatible adjunct to traditional health care delivery and support, was quickly grasped.

It seemed that my own experience in the early 1950's, producing the first commercial closed circuit, high fidelity color television systems for CBS Laboratories, with ultimate use (through Smith, Kline and French) as a tool for teaching surgery, provided me an insight into what Dr. Bird might accomplish. In addition, Dr. Bird's relentless drive to achieve his goals was understood, as my early training with a former associate of Thomas A. Edison showed me, that invention was a product of 5% inspiration and 95% perspiration.

With Dr. Bird's support from Dr. Knowles then Director of MGH and mine from Dr. Peter Goldmark, President of the Laboratories as well as the encouragement from Dr. Denis Gabor, on the Staff of the Laboratories and a Nobel Laureate for his discovery of Holography, I provided consultation in technology and systems engineering of that period to help Dr. Bird develop his concepts of Telemedicine and perhaps enable him to go beyond his original Telediagnosis.

There were no formal agreements between Dr. Bird representing MGH and myself or the Laboratories. Realizing that perhaps 90% of Research and Development does not come to fruition, my hope was that perhaps government or other sponsorship might directly support some of our effort in his behalf. Specifically, my work at the Laboratories was to plan and manage Independent Research and Development (IR&D) government sponsored to freely create new ideas and technology outside of the limitations set by the requirements of our formal contractual efforts. So whenever prudent, I integrated Dr. Bird's needs into our regular IR&D activities through common objectives, a totally acceptable procedure; or I supported him on my own time.

I am presently retired and live in Spain (at the time of this original writing). My records as well as those of Dr. Bird are in the U.S. From memory, the following is a summary of Dr. Bird's Telemedicine activities in which I provided technical consultation and assistance in systems

engineering. It is my hope as well as that of Mrs. Jean Bird, Dr. Bird's widow, that you will recognize Dr. Bird's work and his leadership in Telemedicine.

1. Briefly, Dr. Bird's Telediagnosis facility was a two-way, "black and white", interactive television system providing standard NTSC pictures and high fidelity audio, essentially what is called today (30 years later) a teleconferencing system, which I believe, in many ways is generic from Dr. Bird's Telediagnosis facility. The initial installation was done by others working from concepts provided by Dr. Bird.

Dr. Bird demonstrated the viability of delivering healthcare at a distance using his Telediagnosis facility as a testbed. It connected the emergency ward at MGH with the Logan Airport Clinic where a nurse clinician assisted Dr. Bird, who was at the hospital. The nurse provided functions such as palpation, manipulation and color rendition, which the system could not transmit. The system had two-way camera control (attitude and focus), a high fidelity electronic stethoscope, and an electro-mechanical writer for delivering prescription orders, all extremely effective.

2. Dr. Bird conducted careful procedures with his system, and many reports and notes are still in the possession of Mrs. Jean Bird. One impressive experiment was Teleradiology. Taking X-Ray plates which Dr. Bird had diagnosed about 10 years prior to this test, he covered all written information on them; then using himself again as a control, rediagnosed at random the plates through the Telediagnosis system. While many commented that it could not be done with the standard NTSC system resolution, the advanced image enhancement equipment that I provided enabled Dr. Bird to produce about 95% congruity with his prior conclusions 10 years before.
3. The results of Telediagnosis were impressive and an article was published in Life Magazine describing his work. They were also convincing enough for the Veterans Administration to award Dr. Bird a separate grant to develop and evaluate a system similar to his Telediagnosis, but between MGH and the Bedford Veterans Hospital separated beyond line-of-sight and requiring microwave repeaters.

This new system was called Teleconsultation since its purpose was to provide consultive, MGH medical expertise to the personnel of that hospital through "face to face" discussion. In the course of its operation, it also provided Teleteaching and Teleseminars to Bedford VA personnel. Human factors evaluation showed that as long as recipients were open to innovation, the system met all expectations – an important observation.

4. The Veterans Administration then approved a comprehensive study to connect all its significant VA facilities in the New England States in a large, Teleconsultation, interactive network with MGH as the switching center. Dr. Bird assessed the medical specialties of each facility. Then in operational simulation using linear programming techniques, we examined how each hospital might share its consultative expertise in several independent interactive exchanges and/or simply in a broadcast mode.

This study covered microwave propagation on alternative routes, one being via Mt. Washington in New Hampshire. It also provided total cost estimates. It showed that such a system was feasible and limited medical expertise of hospitals might be enhanced by consultation and seminars from others in the system.

5. At the time I met Dr. Bird, he suggested that we investigate new interactive telemedicine systems. Later, it led to a system concept which we called Mediscan. This system generated single TV pictures at the remote clinic and transmitted them to the hospital by normal telephone lines where they would be stored for display. All other features were similar to those of the Telediagnosis system. The basic idea of Mediscan is seen today in Telemedicine systems using PC computers.

The key component was an electronic storage device. Solid state technology was not as yet cost-effective, so we looked toward the Laboratories' development of a storage tube which was called a Retentatron. It was about 1 inch in diameter and seven inches long. Tests were partially successful as they did not fully produce the standard 10 levels of gray scale which we needed. We put the Mediscan project on hold until we could solve the problem or find another solution. Meanwhile, using the Telediagnosis system as a test bed, we experimentally reduced its bandwidth and planned image enhancement devices to simulate possible use through normal telephone lines. Dr. Bird visualized the need for portable Telemedicine systems of the future, especially in remote areas where a single nurse clinician or a doctor's assistant might serve many hundreds of patients scattered over a wide area.

6. In order to get government funding to develop Mediscan, we turned to the U.S. Navy for support. We were invited to submit a proposal which resulted in a study to determine the probable benefits and the feasibility of using naval communication facilities for the network links between ships and ship to shore. Reliable naval communication was assured by the Pentagon, but two proud, but very biased, medical corpsmen present at our final meeting with the Navy vowed that Telemedicine would never be used. Again, Dr. Bird was ahead of his time as there is evidence today that the Navy is using Telemedicine – more than 20 years later.
7. Dr. Bird then questioned the economic feasibility of his Telediagnosis concept in the real world. This led to studies of various system configurations e.g. one physician serving one or more remote clinics. The results showed that with proper economic design based on his operational experience with the MGH to Logan Airport Clinic system, financially self-sustaining operation could be achieved.
8. Perhaps the most ambitious project conceived by Dr. Bird was Project Prime during 1976 and 1977. If successful, it would have served to demonstrate the great capabilities of Telemedicine beyond a medical tool.

Project Prime offered to connect the Peoples' Republic of China (PRC) in an interactive Teleconsultation system between the Peking General Hospital and MGH, separated by thousands of miles. It was an opportunity for the PRC to communicate with the outside world in an area that should have been above suspicion, and could have eroded the walls of misunderstanding between our countries.

A proposal was prepared for our State Department. Dr. Bird developed the medical justification and the needs to successfully carry out an exchange of ideas; I supported him in the systems and technical planning covering all satellite and ground cable routes as well as the necessary ground facilities both in the PRC as well as in our own country.

The proposal had many months of review through State Dept. and PRC channels. There was no formal rejection, but I felt that acceptance was blocked on political grounds – a

contradiction to PRC policies of self-reliance, and in their restriction of foreign influence. Dr. Bird again was way ahead of his time.

9. There were other projects, but I will list only two of them to indicate further diversity of Dr. Bird's concerns and thoughts related to Telemedicine:
 - a. A centralized, high resolution medical record storage and retrieval system to physically condense the voluminous paper medical records into microfiche. Remote stations could access the file and display them with resolution in excess of even today's HDTV standards.
 - b. A Teleconsultation network connecting significant health-care facilities in the Metropolitan Boston Area using the then proposed CATV facilities by Warner-Amex.

Dr. Bird was also concerned with privacy and liability issues in Telemedicine. Studies were discussed and these might be found in Dr. Bird's records and papers.

There were other projects and other people assisting Dr. Bird. My memory does not recall the detail necessary to include them. Evidence also might be found in Dr. Bird's papers.

There is little doubt that Telemedicine in various forms will play an important role, as a tool in the delivery and/or support of healthcare. The advent of the PC computer, high resolution displays, digital processing, compression techniques and connectivity via existing communication links, would have eased the many problems Dr. Bird faced in his development of Telemedicine. What is now needed is the vision, leadership and determination demonstrated by Dr. Bird.

What I and Mrs. Jean Bird now wish to suggest is that MGH set aside a small space in the MGH library under the name of Dr. Kenneth T. Bird, M.D. to contain his papers, proposals, reports and notes now in the possession of Mrs. Bird. I will contribute what I have. Thus, it will provide a reference source to those who now are engaged in further development of Telemedicine; and evidence that MGH was the Pioneer in Telemedicine and Dr. Bird was its leader.

I sincerely hope you will consider this proposal worthy of your action. Otherwise, all the aforementioned material may be lost. If you wish to communicate with either or both Mrs. Bird and myself, addresses and telephone numbers are as follows:

Mrs. Jean Bird, 8 Flintlock Road, Lexington, Ma. 02173

Telephone (617) 862-0817

Mr. Stanley Krainin, Calle Benavente 24, Apt. 6D 03560 Campello, (Alicante) Spain

Telephone 011-34-96 594-1660

Sincerely yours,

[signature]

Stanley Krainin, P.E., Retired

cc. Mrs. Jean Bird

Appendix
Stanley Krainin's explanatory note No. 2

MEDINAV

The U.S. Navy has medical and surgical responsibilities for its personnel worldwide. Facilities range from minimal in the field, on small vessels and in remote stations with only EMT or Medical Corpsmen in attendance, to well-equipped and staffed hospitals aboard capital ships and ashore.

To enhance these diverse facilities and to integrate the Navy's far-flung expertise, Telemedicine could provide the necessary tools for information exchange through utilization of Telediagnosis, Teleconsultation and/or Mediscan modes of operation through naval communication links.

A presentation was made to the Naval Headquarters in Washington, D.C. A funded study was awarded. Its purpose was to indicate feasibility of Telemedicine in diverse (war and peacetime) environments.

The Pentagon assisted by describing its classified worldwide communication facilities. The Chief Architect of Naval Communications assured us that reliable radio (and later satellite) links could be provided. Analog and digital modes of transmission were examined.

A classified report was prepared and a briefing was held at the Naval Headquarters where medical officers and corpsmen were present. The officers saw the need and advantages of Telemedicine; the Corpsmen were hesitant. The latter thought that on balance it would diminish their self-reliance and independence of action, especially in isolated and wartime conditions.

Dr. Bird was encouraged to continue his work. A demonstration project between a ship at sea and a shore-based hospital was proposed. However, funds were not available at that time and follow-on effort was assigned to the Naval Electronic Laboratories in San Diego, California.

Years later, inquiries with the 6th fleet indicated that Telemedicine in some form was then used in the Navy.

Appendix

Stanley Krainin's explanatory note No. 3

This was a proposal to use Telemedicine as a means to transcend political and ideological barriers by establishing a dialogue on health care problems.

Kenneth Bird had assistance of Robert Green, a businessman who had first-hand knowledge and experience with the Chinese establishment and people. He also had the help of Richard H. Solomon, a scholar on Far Eastern affairs and a member of the National Security Council under Secretary Kissinger. Kenneth Bird also made a trip to China for exploratory talks with health care officials.

Stanley Krainin had pertinent technical discussions with members of the ABC TV engineering team who provided coverage of President Nixon's trip to China. He also had meetings with personnel of the AT&T Long Lines Dept., the Bell Laboratories, and Intelsat to integrate the Prime systems requirements.

Appendix

Stanley Krainin's explanatory note No. 4

This was a task requirement of the Veterans Administration to look forward and examine the feasibility of connecting the Teleconsultation system to other VA facilities in the New England area. The proposed switching network interconnected MGH with 15 VA hospitals and clinics.

Two-way microwave links connected all sites in a “star” configuration with MGH as the control center. Microwave links were surveyed and calculations made to insure reliable operation. Touch-tone control was planned for switching segments of the network. Kenneth Bird delineated the health care capabilities of each VA facility, and with Stanley Krainin, performed simulation studies to test the versatility of the proposed network in Teleconsultation and Broadcast modes of operation between facilities. A cost budget was estimated and included in the report. The report showed that the VA Telemedicine Network was both technically and operationally feasible.

Appendix
Stanley Krainin’s explanatory note No. 5

Significant development of the electronic stethoscope was made by others and proved to be an important adjunct in the Telediagnosis system for reliable auscultation.

Appendix
Stanley Krainin's explanatory note No. 6

It was found that image enhancement was a required function to effectively provide an increase in apparent resolution for X-ray film analysis in Telediagnosis. This component was an off-the-shelf item as described and its use proved that NTSC video standards were adequate and cost-effective for Telemedicine. Experiments showed that approx. 90 and 95% correlation was achieved between reading the X-ray film directly and through the Telediagnosis system. Kenneth Bird, who 10 years earlier directly read the X-ray films, provided the control. Unfortunately, all experimental data was lost.

Appendix
Stanley Krainin's explanatory note No. 7

These were comprehensive engineering tests directed by Stanley Krainin, to gather reference data on the Telediagnosis facility. The system used black and white NTSC video with a nominal bandwidth of 4 MHz. No color video was used since observations showed that available NTSC color was directed toward entertainment rather than true color rendition. Kenneth Bird said that a poor color picture could lead to erroneous patient assessment and diagnosis. As a result, standard graduated color cards were used when necessary and comparisons were made and verbally transmitted.

Different conditions of transmission bandwidth – full, $\frac{1}{2}$ and $\frac{1}{4}$ bandwidth – were introduced by low pass filters. In addition, image enhancement was employed to make comparisons when used and the normal video observed. The results were recorded by a Polaroid camera and the photographs included in a report.

Although not part of this study but later made, audio response tests showed that the channel passed 30 Hz to about 15 KHz.

Appendix

Stanley Krainin's explanatory note No. 8

Tests and subsequent evaluation yielded the standards for Telediagnosis technical performance. Image enhancement was a necessary component when limited bandwidth transmission facilities were encountered and/or X-ray film analysed through the Telediagnosis system. The results also indicated the possible success of the Mediscan(Telediagnosis II) concept using telephone lines for transmission of patient transactions. Consideration was given to using only one-way video transmission (clinic to hospital) on the Telediagnosis system to partially simulate Mediscan.

A comprehensive cost study was made by Kenneth Bird and Stanley Krainin to answer questions concerning the economic viability of Telemedicine. The voluminous study report was lost. Fortunately, it was summarized in the paper "The Cost of Telemedicine" read in Miami, Florida in 1974 at the First Annual Conference on Progress in Health Care Distribution Systems. Copies are included

In this paper the cost-effectiveness of Telemedicine was briefly addressed. There are 36 major elements in the criteria of which 6 were cost considerations. These 6 were operations, administration, maintenance, amortization/depreciation, lease and interest costs. Telediagnosis, Mediscan and the VA Telemedicine network facilities were independently examined in simulated operation using real-world settings. The important conclusions drawn from this study were: 1) Like any profitable enterprise, the Telemedicine facility must be operationally utilized beyond the break-even for economic viability and 2) Telemedicine can contain and even reduce Primary Health Care costs.

Appendix
Stanley Krainin's explanatory note No. 10

In 1970, Kenneth Bird expressed the concern that Telediagnosis system capital costs might discourage its introduction into operational use. To be practical, health care costs must be contained and if possible, reduced.

It was believed that if the “full motion” Telediagnosis two-way video could be changed to only a single frame sequence in the direction of patient to physician, and two-way audio maintained by telephone lines, economic delivery of Primary Health Care could be achieved. This concept was called Mediscan and its key component was a video frame storage device.

If successfully developed, better primary health care could be delivered to remote country and isolated areas where only an EMT or Nurse Clinician might provide only minimal services. An Indian Reservation and a rural community were visited to assess preliminary requirements.

CBS Laboratories was developing a video storage device and called it a Retentatron. It was a read/write storage, vacuum tube about 1 inch in diameter by 6 inches long. No economical solid-state system with sufficient capacity for even a single video frame was available. The Mediscan would use the Retentatron if it could be developed to provide quality, frame storage.

Considerable effort was expended at the Laboratories to overcome the Retentatron's major deficiency – lack of adequate grey scale. It was concluded that this difficulty could not be overcome, so the Retentatron development was halted and further work on the Mediscan concept was suspended until a cost-effective video storage device could be found.

Kenneth Bird believed that emergency medical services would be an excellent application of Telemedicine. The preliminary sketch prepared by Stanley Krainin shows the principle technical elements. The Mediscan concept would be used to provide one-way video from the EMT vehicle to the emergency ward of a hospital. Two-way radio would provide voice communication. As part of this study, discussions were held concerning the work of the EMT, the many medical problems encountered, the typical equipment carried and the issue of liability.

Appendix
Stanley Krainin's explanatory note No. 11

In 1975 while supporting Kenneth Bird on Telemedicine, Stanley Krainin became the chief technical consultant to Warner-Amex (now Time-Warner). He was responsible for advanced design of large, urban cable TV systems, and participated in planning entire facilities in Pittsburgh, Milwaukee, Cincinnati, New York City and lastly, Boston.

Boston afforded an excellent opportunity for Kenneth Bird to demonstrate Teleconsultation. As a public service, Warner-Amex tentatively agreed to provide equipment and the use of its proposed cable system, should they win the franchise in competition with Cablevision.

Stanley Krainin prepared the analysis of the competing cable systems for Warner-Amex. With permission, a copy of the report was given to Kenneth Bird to familiarize him with the comprehensive nature of the future, city-wide cable system.

Kenneth Bird often stated that having a patient's medical record would greatly facilitate proper diagnosis and recommended treatment. Storage and retrieval of medical records (some of which may have many pages of hand-written notes, typed reports and charts) is a major problem which at that time was further compounded by the existence of a law in Boston requiring medical records to be kept 50 years. In future Telediagnosis systems, the physician would be at the control center where he would serve multiple outlying clinics. It would be advantageous to have quick access to any available medical records at the hospital center. Computer systems were not available at that time.

CBS Laboratories had developed component technology for scanning and display of visual material with a resolution in excess of 2500 TVL and a grey scale range of more than 100:1. In addition, large microfiche storage and retrieval systems were available and off-the-shelf.

At the request of the MGH administration a preliminary study was made and a block diagram prepared. Presentations were made, but it was later determined that adequate funds for further development were not available.

Appendix
Stanley Krainin's explanatory note No. 14

Kenneth Bird's Teledagnosis and Teleconsultation facilities demonstrated the concept of Teleconferencing and became the model for future systems. In 1982, Stanley Krainin was the principle consultant to Warner-Amex (now Time-Warner) cable TV systems. It was thought that a standard teleconferencing center design would be appropriate for use in the cable systems. To show usefulness, the problem of connecting the Warner-Amex executive offices in NYC with the engineering center in N.J., was examined. A survey of existing teleconferencing systems was made and it was found that Kenneth Bird's original design of the Teleconsultation Center was superior to all others.