On November 1, 1969, Ampex will be 25 years old. With this issue, MONITOR begins a documentation of the events which have filled this quarter of a century. The first chapter in this serialized history of our company is devoted to the life of Alexander M. Poniatoff, Ampex founder, and the decisions which led to the formation of our company.

Alexander M. Poniatoff in 1924 before leaving China for the United States.

THE AMPEX STORY
Chapter One: "AMP"

By Edmond G. Addeo

The story of Ampex Corporation can begin no other way than with the story of the spirit behind the company itself. And that spirit, which still pervades Ampex, belongs to the Russian immigrant who conceived and founded it 25 years ago, the man whose courage, confidence and dedication did more to create today's tape recording industry than any other single person: Alexander M. Poniatoff.

(It is sometimes thought the "AMP" in AMPEX stands for the unit of electrical current named for André Marie Ampere, the French physicist. "AMP" is in fact Poniatoff's initials; the "EX" stands for excellence.)

Alexander Mathew Poniatoff was born in the Kazan District of Russia, about 400 miles east of Moscow, on March 25, 1892. His middle name is the first Christian name of his father, such designations being a Russian family tradition. Mathew Poniatoff was a successful businessman with a couple of dozen employees engaged in cutting timberland and producing firewood and parts for carriages and sleighs.

Throughout Poniatoff's life, coincidence and fate, if you will, play an important role. (Poniatoff points out that the "goodness of people" plays an equally important role.) But the distinguishing feature throughout his life is his pioneering spirit—the blending of tenacity and conviction remind you of Alexander Graham Bell. This is the spirit which inevitably separates the man of accomplishment from the ordinary man, the adventurer from the meek, the discoverer from the straggler.

Scientific Interest

The young Poniatoff displayed this spirit early in life and showed a scientific bent even at the age of seven. At that age, he saw a locomotive for the first time, was enchanted by it, and decided immediately that he would design and build machinery when he grew up. This fascination led to studies in mechanical engineering at the University of Kazan, the Imperial College of Moscow, and an M.E. degree at Technical College in Karlsruhe, Germany.

While he was still in Germany at the age of 22, Russia declared war on that country, and Poniatoff found himself trapped. Warned that he would be thrown into a prison camp before long, he headed west for Belgium. On the train, he met two American women whose suitcases carried travel stickers from such places as Vienna, Rome and Paris. When the border guards threatened to prevent Poniatoff's passing (he spoke no English, only German, French and Russian), one of the women thrust her bags into the young engineer's hand, and told the guards that he was an American, a member of her group, and was bound for America.

He got through and headed for Great Britain. There he registered with the Russian Embassy and undertook a crash, five-week course in English from neighbors in his boarding house to prepare to volunteer for the British Expeditionary Forces. But he soon received word that all Russian youths of draft age were to report to Newcastle, to be transported by ship to Norway, where they could easily get transportation to their homeland.

Back in Russia, he served briefly in an artillery unit and finally became a pilot in the Imperial Russian Navy, assigned to huge flying boats made of plywood and used as bombers. He was then called on to design armament for the lumbering craft, and after testing 37 millimeter guns on piles of coal, he successfully installed them on the flying boats.

Couldn't Be Idle

While he never saw combat action, several episodes in the war point out a personality trait which would display itself in various forms throughout his life: Poniatoff was never content to sit idle while waiting for things to happen. Once, while his flying boat floated in the Baltic Sea waiting out a storm, he decided to take off before the storm had subsided.

"I was a typical impatient young man in those days," he calls now. "The waves were so high that when we were rolling along trying to build up air speed, we hit the top of a wave and the plane broke completely in half. It was quite a sensation." But the speed he had attained was sufficient to carry the pilot's half of the plane to a nearby beach. When he reported to headquarters after this incident, he was told that a shipment of French fighter planes had arrived, and he was in the group selected for training as a combat pilot.

He was excited at the prospect of flying the new fighter plane. While in training, he received instructions to take the craft into a spin after climbing 1,500 meters. Poniatoff climbed to a safer 3,000 meters to attempt the maneuver. Despite instructions to keep the controls in neutral to get out of the spin, he attempted to control the craft to pull out of the spin faster. The aircraft did not level off, instead it went into a reverse spin compounding Poniatoff's problems and panic. He said: "I remember seeing nothing but sky spinning around me. Finally, I threw the controls in neutral and pulled out of the earthward spiral just a few feet from the rooftops of a village." The 1,500 meter edge he had allowed himself in the maneuver saved him from disaster.

Poniatoff never had the opportunity to fly the new plane in combat. Before he could be sent to the front, the Russian Revolution started, and the peace treaty was signed between Germany and the new government of Russia.

At the end of the war Poniatoff looked forward to resuming pursuit of his mechanical interests, but the Bolshevik Revolution was spreading. While at his home he was contacted by an underground group of officers and asked to join the White Forces which were being organized to overthrow the Communist government. He was told to stay at home and wait for instructions. He didn't receive any word for some time. One day he heard heavy artillery fire near his home. He knew that the Civil War had started, and he must attempt to reach the White forces without falling into the hands of the Communists.

He decided to hire, for a price, the Red Commissar of his village to drive him to the combat area. If they were captured by Red forces, the Commissar would show his credentials. On the other hand, if they they were captured by the White Forces, Poniatoff would show his officer's credentials.

Here once more, the fates intervened for the young engineer. He and his driver were stopped, and they suddenly realized their plan had one flaw. They did not know which credentials to show because they didn't know which side the guard was on. Producing the wrong credential would be disastrous to both of them. However, Poniatoff noted the guard's polished boots, his reasonably clean and tailored uniform, and decided to gamble on his White papers, reasoning that the insurgent Reds were less likely to be neatly uniformed. He presented his officer's paper and found himself in the area of the White forces. The Red Commissar was sent on his way unharmed.

Poniatoff vividly rememoers flying over his parent's home and waving proudly to his mother and father, but being unable to land because the Kazan District was occupied by Red forces. It was the last time he would see his parents.

During the two years of Civil War, the White Army retreated through Siberia. Finally, the group of White forces to which Poniatoff was attached, learned that Admiral Kolchak, Chief Commanding Officer of the White forces in Siberia, and his military staff, had been routed and killed by the Red forces. The bitter struggle was over.

One member of Poniatoff's group was Captain Eugene Kostritsky, who had visited the United States years before. He kept his men entertained with stories of the American city, San Francisco. So fascinating was the man's tale of life in America, that Poniatoff decided then and there that if he made it through the revolution alive, he would go to San Francisco. Knowing he would never see his family or his home again, the 28-year-old pilot set out to make a new life for himself.

From Siberia he escaped into China in 1920 with high hopes of going on to the United States. In Shanghai, though, new difficulties arose. Poniatoff's English was barely intelligible, but his German managed to get him around. He looked for mechanical engineering work, but there was none—all the machinery in Shanghai was imported. Finally, his German landed him a job with the Shanghai Power Co., doing something completely new: electrical design work.

A Seven-Year Wait

Poniatoff then found that getting out of Shanghai was almost as difficult as his escape from Russia. He had no passport, no birth certificate—nothing but his Army papers. The League of Nations eventually began issuing passports to Russian refugees. It took Poniatoff seven years to get this essential document.

At 35 years of age, he finally sailed for San Francisco. He had a $2,000 bonus given him by the Shanghai Power Co. for his five years of service, and a glowing letter of introduction to an influential person at the General Electric Company in New York. But he wasn't sure he wanted to pursue a technical career any longer. When he landed in San Francisco, he decided to give rural life a try—he would become a farmer in this great modernized land of America.

But a shock greeted him. He found very quickly that America in 1927 was not "the land of push-buttons and mechanized farming that I thought it was." A Russian church in San Francisco provided directions to the nearest Russian community of farmers. Poniatoff was "very disappointed." The farming community was poor. The grape growers and chicken farmers in and around the Petaluma area north of San Francisco worked very hard to make their living without the help of advanced or modern equipment.

So, with typical optimism, he used a portion of his $2,000 to travel around the country, seeing the sights and cities of America. He visited Los Angeles, Chicago, Washington, New York and he marveiled at how prosperous most of the nation seemed to be. His tour completed, he decided to use his letter of introduction to General Electric in Schenectady, New York.

"The letter was a little too praiseworthy," Poniatoff says in typically modest fashion. "It said I was qualified for jobs I considered way beyond my abilities.

G. E. didn't agree. He was hired as an engineer and immediately assigned to a circuit breaker design group. Another event happened at this stage of his life which aptly characterizes the man destined to launch an important new industry.

At his first meeting with General Electric engineers, Poniatoff was befuddled by the technical terms these fast-speaking Americans thrust at him. So he merely took notes at the meeting, saying nothing. The first thing he did at the end of the day was to go to the library to decipher the complicated terms he had written down at the meeting. To his delight, the librarian was a Russian. The man took Poniatoff under his wing, guided his studies, and it was almost a month before Poniatoff said anything at the meetings with the engineers. But when he did, he knew what he was talking about.

A Challenging Assignment

A year later, with two patents issued in his name, he was called into the office of the head of the department. He was told that he would be a project engineer on a new vacuum type of circuit breaker. Poniatoff said that this was the only time in his life he was hesitant since the project looked too difficult for him. He asked Mr. Rankin, the department head, why he was selected for this project instead of one of the more experienced engineers. Mr. Rankin replied with a smile: "These engineers, because of their great experience, already know that it cannot be done. You are not smart enough yet to know it is impossible, and that's the reason I selected you."

Poniatoff successfully completed the vacuum circuit assignment and with heightened self-confidence decided at last to go to San Francisco. This was in 1930. His goal was to work in the development of new products. Because of the depression, he was unable to find any research and develop-

ment work. Few companies were risking investment capital on the future. He accepted the one job that was available to him as an engineer with the Pacific Gas & Electric Company. He never lost sight of his research goals, however, and continued to seek such work. During his search he was told that to spend money in such times on development of a new product, one has to be crazy. Eventually, in 1940, Poniatoff found such a man in Irving Moseley, who operated a small company called Dalmo Victor, which was developing small electrical appliances. In his eagerness for this type of work, Poniatoff offered his first three months' services without pay.

Dalmo Victor was at the time manufacturing permanent wave machines and had problems. The temperature controls of the machine created radio interference, for one thing, and the waves produced were not as permanent as desired. Poniatoff developed a new system that solved these problems. Moseley patented the new controls in Poniatoff's name. The patent was sold and Poniatoff received a portion of the income from the patent.

Meanwhile, Dalmo Victor had been developing an electric razor which when put on the market brought a patent infringement suit from a major manufacturer of electric shavers. Dalmo Victor lost the suit and was forced to reduce expenditures in development work. Poniatoff went back to P. G. & E. At this time he met Helen Hess of San Jose. They were married soon after and settled in Mill Valley near San Francisco.

Still eager for product development work, Poniatoff went to work for Westinghouse in Sunnyvale, and grew fond of the life on the Peninsula.

In 1942, as World War II raged, Poniatoff got a call from his old friend Moseley asking him to come back to Dalmo Victor. Moseley had received a contract to develop Navy Airborne radar scanners. According to the contract, the development of a prototype of the scanner had to be completed in 100 days. Poniatoff quickly accepted.

"The project group went without shaving for days at a time," he recalls. "The working hours were from seven in the morning until 11 at night."

His Own Company

Two of the components in the Dalmo Victor system, sophisticated motors and generators, were virtually impossible to obtain from existing sources. Seeing this as the opportunity for his friend to establish his own company, Moseley suggested that Poniatoff start manufacturing the two needed components. Poniatoff took his own resources, rounded up a handful of men, outfitted the abandoned furniture loft above the Dalmo Victor plant, in San Carlos, California, and formed the Ampex Electric and Manufacturing Company. The Dalmo-Victor building, in which Poniatoff began his company, has since been replaced by a supermarket.

It was November 1, 1944. At 52 years of age, when most men are beginning to plan for retirement, Alexander M. Poniatoff founced his company. The young pilot of World War I, ousted from his homeland by the Communists, was on the threshold of one of the most significant developments in electronics of the century.

Today, as he approaches this month's 77th birthday, Mr. Poniatoff is active as always with various projects. As Chairman of the Board of Ampex, he leaves active management of the corporation to younger men. He heads the company's Alexander M. Poniatoff Laboratory, which is devoted to investigation of advanced and experimental techniques in magnetic recording. He keeps regular hours in his Ampex office and pays fastidious attention to his health. In his office he has an ultraviolet light system and equipment to ionize the air.

He devotes a great deal of his time to the important field of preventive medicine. In his opinion, scientific and technological advances, although benefiting man in many ways, have brought with them a complexity of life which is often detrimental to human health. Medicine and surgery have made great progress, but tensions of big city life, polluted environment, and insufficient contact of man with nature have created many new diseases. Knowledge and understanding of environmental factors including nutrition, he contends, will prevent diseases or reduce their incidence, and as a result will extend man's useful life.

And the passion that radiates from his clear blue eyes makes every visitor share his excitement. He pursues his philosophy through various channels. He takes active part in several foundations which are devoted to medical research and to educational and charitable work. He sponsored and organized the Foundation for Nutrition and Stress Research of which he is the Managing Director.

He says: "A man's life is not complete unless he has made a contribution to humanity." And he thinks the opportunities for making such contributions are numerous: "The United States still has the greatest potential of any nation in the world. The destiny of man is to be involved in creative work and to acquire new knowledge, and to make new discoveries which are of value and importance to human life and progress."

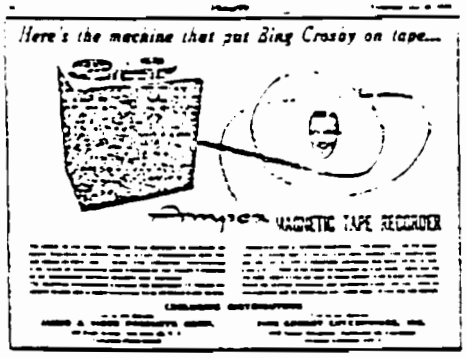
Mr. and Mrs. Poniatoff live in the spacious home he designed (the late architectural genius Frank Lloyd Wright, who was consulted on plans for the house, sanctioned the entire Poniatoff design except for a fireplace position). While at home, the Poniatoffs spend much of their time gardening. They grow many varieties of fruits and vegetables and experiment with soil conditioning and the addition of chelated minerals and trace elements to improve flavor and nutritional value of garden products.

As a young boy, he was impressed with the Tartar violin music of his neighbors. On his sound system, Poniatoff nostalgically enjoys violin music of Ippolitov-Ivanov, which reflects the Tartar influence.

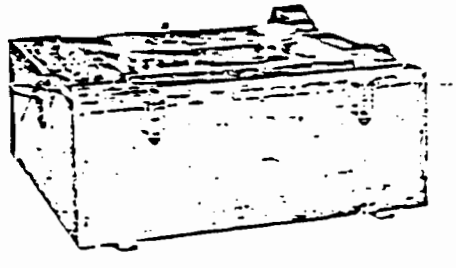
What kind of equipment does this pioneer of tape recording own?

"Ampex. It's the best equipment I could find," he says with a chuckle.

Below, one of the first advertisements for the Model 200. It appeared in VARIETY on July 28, 1948.



Alexander M. Poniatoff (far left) and Harold Lindsay (second from left) with one of the first Model 200 tape recorders.



Above, the German Magnetophon which stimulated Ampex to manufacture magnetic tape recorders.

The Ampex Story

Chapter Two:

The Deciding Years

by Edmund G. Addeo

In the waning days of World War II, before the awesome appearance of the atomic bomb, a highly decorated Navy pilot paid a visit to tiny Ampex Electric and Manufacturing Company in San Carlos, California.

His visit was one of several of its kind arranged by the Navy to urge maximum efforts by key suppliers. Ampex, not yet a year old, was producing critical components for airborne radar systems used in Navy aircraft.

Ampex employees listened as the pilot described his experiences flying night reconnaissance missions.

"Suddenly," he said, "all forward guns on my plane opened fire. A few seconds later, I saw a Japanese plane, engulfed in flame, falling toward the sea."

The guns were activated by the plane's radar system. Components in the system were supplied by Ampex.

This was one of a number of occasions when Alexander M. Poniatoff's characteristic concern with product excellence was recognized and acclaimed.

In his own words, "no effort was too great to develop and build products of highest performance and reliability." Such a philosophy, matched in performance, is the foundation on which Ampex is built.

"In designing the highly critical motors and generators for the radar systems," Poniatoff recalls, "we used newly developed alnico magnets to produce magnetic fields. This increased the efficiency and eliminated one set of electrical windings. For high reliability, the second set of windings was vacuum impregnated using a special synthetic resin."

Not long after deliveries of the radar components started, Ampex found itself a single supplier in spite of military rules that there must be a minimum of two manufacturers for all critical items. Radar components of the second supplier were failing in service in spite of efforts to improve the quality. Pilots were reluctant to fly planes if the radar components were not made by Ampex. As a result, the Navy made the unprecedented move of appointing Ampex as a single supplier. According to Navy records, not a single Ampex unit failed in service.

A great deal of credit should be given to Walter

Cabral who was in charge of Production and Quality Control at Ampex during this period. Later, with the encouragement of Ampex management, he started his own company in Los Gatos manufacturing airborne radar motors and generators which Ampex decided to discontinue.

When the war ended, Ampex took a day off to celebrate the end of war and victory. Days later, the Navy cancelled all Ampex contracts.

Friends of Poniatoff, experienced businessmen, advised him to dissolve his company. In their opinion Ampex had no chance to survive. With insufficient capital, no marketable peacetime product and very little business experience, he would not be able to compete with old, established companies.

In spite of the fact that Poniatoff could not dispute the logic of his business advisors, after a couple of sleepless nights he decided to develop a peacetime product without any change in the personnel or organization of Ampex. He gives two reasons for his decision. First, dissolving Ampex meant surrender without putting up a fight. Second, he could not see himself saying good-bye to the Ampex people who had worked with him so successfully. Everyone in the organization was waiting for Poniatoff's decision and ready to work on any project.

Poniatoff faced the serious problem of maintaining his staff intact at a time when there was no work for production people. "As fortune would have it," he remembers, "a business representative of a furnace company visited Ampex shortly after the Navy cancelled our contracts. The man asked that Ampex bid on the construction of motors to be used in his company's furnaces."

Mr. Poniatoff stated that the quality of motors Ampex was equipped to manufacture would be too expensive for this customer's application. In spite of Poniatoff's admonitions, the businessman insisted that Ampex bid on the contract.

The price Ampex quoted was more than four times the cost of these motors prior to the war. Disregarding the high cost, Ampex received an order for 10,000 units. Repeat orders for an additional 40,000 motors kept the production group at Ampex busy until they could begin work on the new Ampex product.

"In the early days of our company, whenever a serious problem arose," states Poniatoff, "some unexpected event appeared on the horizon providing the opportunity to solve the problem."

RECORDED SOUND

The possibilities of improving the quality of recorded music always intrigued Poniatoff because of his love for classical music. As a result, he made the decision to develop and manufacture high fidelity amplifiers and speakers for a new sound system.

During this period, two Santa Clara University graduates, totally unknown to each other, were following paths that would ultimately lead them to Poniatoff. The meeting was to create a tape recording industry with economic ramifications that would have boggled the mind of the most optimistic pioneer.

About the time Alexander Poniatoff was starting a new life in America, a young electrical engineer from California was taking his first job with the Shell Development Co. That was 1928, and Harold Lindsay continued with Shell until 1941. At that time, Lindsay went to work for the Lawrence Radiation Labs in Berkeley, on the highly-classified Manhattan Project. At night, he worked on high-altitude flying safety techniques at nearby Donner Laboratories. In the summer of 1945, these projects were completed and, looking for another job, Lindsay called some friends on the San Francisco Peninsula and found a position in a high-vacuum equipment plant.

The plant soon burned down, and, in what would soon turn into beautiful irony, Lindsay went to work for the fledgling Dalmo-Victor Co., which by now had a few hundred employees as a result of its successful radar equipment business during the war years. He eventually met a man named G. Forrest Smith, who worked for a young firm in a loft above Dalmo called Ampex. The men frequently discussed their mutual interests in classical music and engineering design. Lindsay became interested in some intimations by Smith that his firm was developing new products and would welcome any of Lindsay's ideas in the high fidelity area.

Now the other Santa Clara graduate comes into the picture. Major Jack Mullin, a Signal Corps officer stationed in England during the war, was also a classical music enthusiast. While monitoring German radio broadcasts from his post in England, he heard broadcasts of symphony concerts, oddly enough in the early hours of the morning. These could not be "live" broadcasts at such hours, yet the programs certainly did not originate on typical electrical transcriptions. It didn't take an astute electrical engineer—which Mullin was and is—to discern a transcription from the real thing, since transcription sound was pinched. There was other evidence that the Germans had some new high quality recording techniques. Broadcasts of speeches by Hitler and other Nazi officials were heard in one town and city after another, to camouflage their whereabouts, but it was obvious to the Signal Corps engineers that they couldn't possibly be moving around so fast. The "live-sounding" broadcasts had to involve some improved recording method.

Mullin, who had performed some recording work for a San Francisco industrial filmmaker, Palmer Films, Inc., went to France with the Signal Corps after V-E Day, and obtained permission to go to Germany to investivate the Germans' recording techniques. At about the time Harold Lindsay was joining Dalmo-Victor and Alexander Poniatoff was receiving cancellation of his military contract for radar generators, Mullin discovered a black trunk, about the size of a foot locker, designed for the Germans by Telefunken and called a Magnetophon. Mullin knew this bizarre box was the source of the live-sounding broadcasts he had heard in London, and after examining the instrument, saw it would be a valuable recording device for his film-making work in the States.

HISTORIC SOUVENIR

After filing his reports with the Signal Corps, Mullin soon found there was quite an amount of left-over machinery from the confiscated war items, and that this machinery had been qualified as war souvenirs. Mullin took two of the Magnetophons carefully disassembled them, and along with 25 rolls of magnetic tape, sent them home to San Francisco in ordinary mail bags. They arrived without damage and awaited him upon his discharge in early 1946.

Meanwhile, Lindsay and G. Forrest Smith met frequently to discuss high fidelity sound equipment plans for Ampex. Lindsay wasn't certain it was the best direction in postwar years, but Ampex seemed to be leaning that way.

In July of 1946, Harold Lindsay attended a meeting of the Institute of Radio Engineers in San Francisco. At the meeting, Jack Mullin gave a demonstration of the unique sound recording machine he had brought from Germany. The demo consisted of an "A-B switching" technique, whereby a signal was brought from a "live" sound source into the recording machine, where it was recorded. By playing it back immediately, the demonstrator could throw one switch, "A", to hear the recorded signal, or another switch, "B", to hear the signal before it was recorded. With the Magnetophon, Lindsay couldn't tell the difference.

He was astounded. He saw immediately the impact such a machine could have on high fidelity recording, and on the music-loving community in general.

After the IRE meeting, Lindsay collared Mullin and talked at length with him. Lindsay pointed out the tremendous potential Mullin had in his hands, and Mullin agreed. Mullin, however, rightly knowing that exploitation of this unique machine should be a cautious matter if it were to become profitable, guardedly avoided letting anyone—including Lindsay—know anything of the Magnetophon's recording heads and electronics—the most important parts of the machine. He did, however, tell Lindsay to give him a call if he needed any help.

Lindsay nodded, still dreaming of the future of tape recording. "Someday," he told Mullin, "I'd like to work on that."

Lindsay's "someday" wasn't far off. In October, when he finally met Alexander Poniatoff, whom Smith had mentioned many times by now, Lindsay spiritedly told Poniatoff of his experience at the July IRE meeting, and Poniatoff was intrigued. They decided to give Mullin a call, but Mullin's office told them he was en route to Los Angeles to demonstrate the Magnetophon to the October IRE meeting in that city.

FINALLY, A PEACETIME PRODUCT FOR AMPEX

Hurriedly, Poniatoff left for L. A. When he returned, he called Lindsay at Salmo-Victor. The two men excitedly discussed the idea of the Magnetophon and indicated to Mullin that they'd like to investigate the possibility of manufacturing such a tape recorder in the United States.

Mullin told Poniatoff that he had accepted a position as a consulting engineer with a company owned by Colonel Richard Ranger. Colonel Ranger, a Signal Corps officer himself, had also brought a Magnetophon from Germany and was working on a project to develop and manufacture a professional type magnetic tape recorder. He engaged Mullin as a Consultant and as a result, Mullin was not available to Ampex.

At this time, Poniatoff made a firm decision to develop a high fidelity magnetic recorder. He went to Salmo Victor management, telling them that he would like to employ Harold Lindsay at Ampex. They had no objections. On December 10, 1946, Lindsay accepted a position with Poniatoff. His first task was to design a Magnetic head for the proposed Ampex tape recorder.

After testing various laminations and hydrogen annealing of high permeability alloys, Lindsay came up with a head that he and Poniatoff took to San Francisco to test on Mullin's Magnetophon.

"The most exciting moment of my life was just before I pushed the button," Lindsay says today. "It seemed as though everything rested on whether it worked—our personal futures and the future of Ampex."

The new head worked perfectly and Poniatoff had full confidence that Ampex could make a tape recorder of its own.

Lindsay was put in charge of the design of the first recorder which was given the designation Model 200. The objective was to design equipment for top performance with the highest reliability. No consideration was given what the cost of the unit would be. The total expenditure in building the first working prototype was $76,000—a heavy financial burden to Ampex during this period.

The year between December 1946 and 1947 was an exciting one for Ampex, but a year not without its anxious moments.

To begin with, Poniatoff's "silent partner" was skeptical of Poniatoff's plans. He consulted a group of "experts" whose considered opinion was that magnetic tape was not practical. The threading of tape was too cumbersome. Furthermore, if this thin, fragile tape were to break, it would completely ruin the recording.* *(see footnote)*

Poniatoff was undaunted by these negative opinions, and proceeded to build the new recorder. As a result, his "silent partner" asked Poniatoff to find a party to buy him out.

Financial problems soon mounted. Poniatoff recalls at least two weeks when no one received a paycheck, but enthusiasm and confidence were high, and no one was disturbed.

Loans from First National Bank of Redwood City (which was later to become Wells Fargo Bank) kept the company going.

AMPEX MEETS CROSBY

In 1947, a public relieved of war was listening to radio entertainment in record numbers, and such great shows as the United States Steel Hour and the Standard Hour were at the peak of their popularity. Bing Crosby's radio show had been one of the most popular for several years, but in 1947

something happened. Bing's Hooper rating began to drop in spite of the fact that his material was as sprightly as ever. A quick analysis uncovered the problem. Crosby typically recorded about an hour long show in the studio. Engineers then cut down to a half hour. The trouble was the disc-to-disc dubbing and editing. It was of poor quality and got worse with each transcription in spite of the fact that the American Broadcasting Company was using the finest disc recording equipment.

According to the contract between Bing Crosby and Philco (the sponsor) if his Hooper rating dropped to 60, Bing Crosby had to go on the air live. Crosby told his associates that he would rather cancel the contract than to do a live program.

A group of people connected with the Crosby Show had attended the same IRE meeting in L.A. at which Poniatoff had first viewed the Magnetophon. These people, quite naturally, got to know Jack Mullin and expressed interest in his recording machine. As ratings dropped, they invited him to Los Angeles to record a Crosby show on tape. ABC engineers were naturally skeptical of magnetic tape and made Mullin dub his final edited tape onto one or more "sturdy and dependable" discs. Broadcast quality was noticeably better and audience response was good. Crosby immediately asked Mullin where he could obtain magnetic recording equipment. Since Colonel Ranger's development project was far behind Ampex progress, Mullin told him about the small firm on the San Francisco Peninsula which was developing recording equipment. Following this, Crosby invited Ampex to demonstrate the recorder in Los Angeles. So great was the spontaneous reaction and interest in the new recorder on the part of the Crosby engineers and entertainers, that the demonstration lasted a full day.

Immediately after this, Basil Grillo, manager of Crosby Enterprises, arrived in San Carlos. He told Poniatoff that Bing Crosby had called from Paramount Studios where he was making a movie, and asked him to go to Ampex and order recording machines.

McSharry, financial and production manager of Ampex, worked out a proposal. Basil Grillo was told that to make the cost of machines reasonable, the minimum order should be 20 units, and in this case the price would be $4,000 per unit. Since the machines were custom-built, Crosby Enterprises was required to make a deposit of $80,000. Basil Grillo accepted the terms and made the deposit. Crosby then resold the equipment to the American Broadcasting Company.

Since magnetic tape was not available in the United States, Ampex decided to import tape from Germany. It wasn't long before word began to get around about the new Ampex development. A representative of Audio Devices Company brought Ampex a sample of magnetic tape his company was developing and asked to test it on the new machine. A representative of Minnesota Mining and Manufacturing Co. came soon after. Ultimately, 3M developed and introduced a satisfactory tape in time for use with Ampex machines.

In April of 1948, the first seven machines without life test (time did not permit) were delivered to ABC and placed in service for time delay network shows across the country. After the Model 200s had been in operation for seven months, Poniatoff received the following letter:

"Commencing April 25, 1948, and continuing through September 25, 1948, (a total of twenty-two weeks), the American Broadcasting Company in Chicago recorded on the Ampex, approximately seventeen hours per day. For these 2618 hours of playback time, the air time lost was less than three minutes: a truly remarkable record. We believe that a large share of the successful operation was due to the use of the Ampex tape recorder manufactured by your company. We wish to thank you for your splendid cooperation in supplying us with this fine piece of equipment capable of withstanding the severe condition imposed during our delayed daylight savings time program."

Very truly yours,
Frank Marx, V.P. in Charge of Engineering
American Broadcasting Company

NEW PARTNERSHIP SPURS PROGRESS

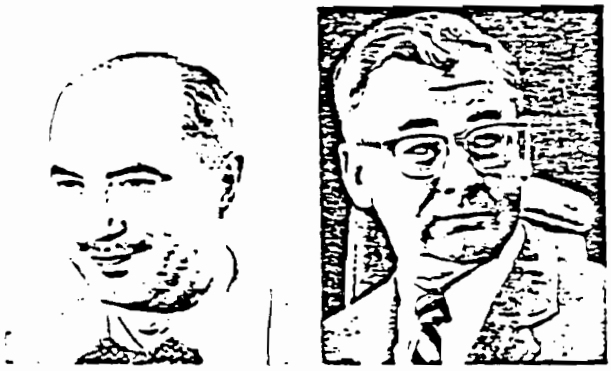
As orders began to rise, Poniatoff was visited by two brothers—Joseph and Henry McMicking. Joseph McMicking had a business in the Philippines and was contemplating investment in the United States. Wells Fargo Bank told him that Ampex was a company with a potential future. After a few visits and discussions, McMicking and Poniatoff came to an agreement. Mr. McMicking bought out Poniatoff's "silent partner", provided financing and helped in the organization of management of Ampex for expansion. His great interest in technology, his ideas for new applications of magnetic recording and his enthusiasm in connection with the future possibilities of Ampex were inspiring to every member of the company.

Eventually 112 of the original units were built and sold at the price of $4,000 each. The next order after Crosby and ABC was from Decca Records for mastering phonograph records. Other networks and recording companies quickly followed suit. The high fidelity era was born.

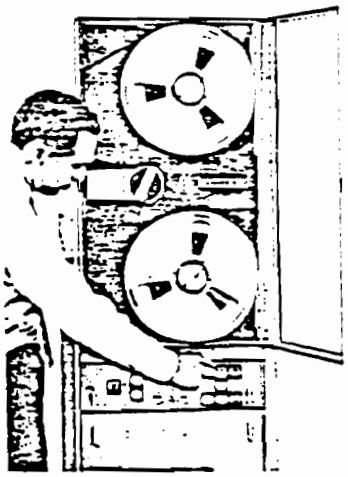
The historic Model 200 was manufactured throughout 1948. During this period considerable experience in the techniques of magnetic recording was acquired. The knowledge was used in the development of a new recorder with lower tape speed and lower production cost while retaining the same high quality performance. Lindsay again was named project engineer. This new unit was designated the Model 300.

Design patents of the Model 300 set down various configurations which became the National Association of Broadcasters (NAB) Standards. It was received with great enthusiasm by Ampex customers in July of 1949. Ampex was on its way.

Many years later, Poniatoff found out from Dr. Heyne, President of Telefunken, that Dr. Heyne had proposed the manufacture of a tape recorder to General Electric. The product planning group at G.E. also decided that magnetic recording was not a practical principle for product development.

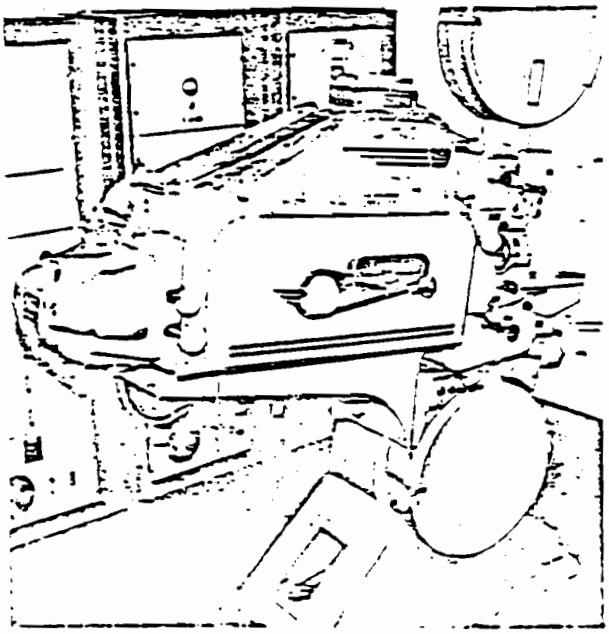


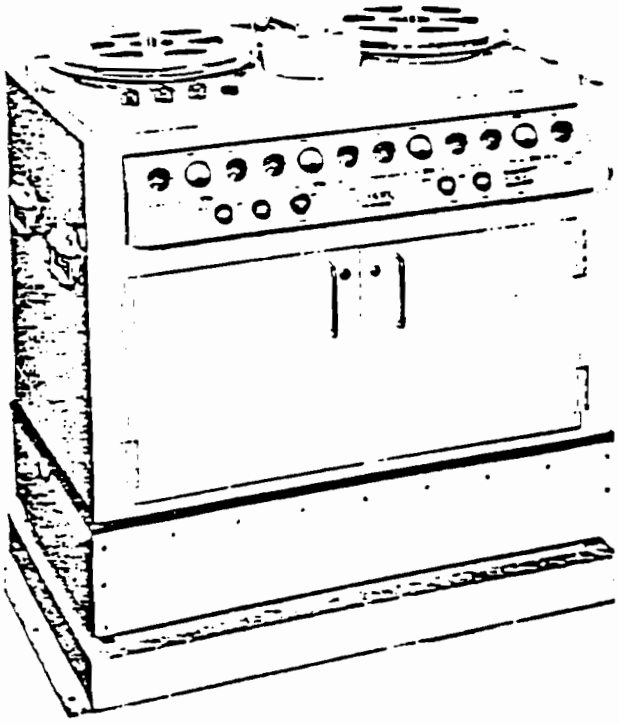
Two men who were influential in breaking the sound barrier in magnetic tape recording—Joseph McMicking (right, photograph taken shortly after Mr. McMicking suggested that Ampex take on the development of the instrumentation recorder) and Tom Davis, now Ampex Group Vice President (photo taken in 1967).



The Instrumentation Division's newest recorder, the FR-1900.

Below, installation of the Todd-AO motion picture and sound system in the Egyptian Theater in Hollywood. The development of this system put Ampex in the theater sound business.





The Model 500, the first militarized instrumentation recorder. Tom Davis sold the first 50 models of this recorder singlehandedly.

The Ampex Story

CHAPTER THREE

Magnetic Recording Breaks Sound Barrier

by Edmund Addeo

When a symphony is recorded on magnetic tape, the sound waves of the instruments are converted into electrical signals by the microphone. Capturing and reproducing those signals with unerring fidelity was the prime objective of the young Ampex Electric and Manufacturing Company in 1948 through 1950.

Not immediately obvious to anyone at that time was that any physical phenomena which could be converted into electrical signals could be recorded on magnetic tape. This discovery was to open up new markets which held greater potential than the application for audio recording.

A Project from Washington

By 1950, Ampex was firmly established as a producer of professional magnetic recorders for radio networks and the recording industry. By this time, Alexander M. Poniatoff had added two more engineers to his staff to work on further development of units which were in production and to plan for the next generation of recorders.

At this time, Joseph A. McMicking, the man who brought financial support and his personal enthusiasm about the future of tape recording to Ampex in its early days, returned from one of his trips to Washington with a challenging question. He asked Poniatoff if the frequency response of the Model 300 could be extended from 22 to 100 kilocycles to allow the equipment to be used for a new application—recording phenomena other than sound.

The question provided the opportunity to test the talent and ability of the newly expanded engineering group at Ampex. Poniatoff's concern for excellence which displayed itself in the precision design of the Model 300 was the factor that allowed the unit to be adapted to this new requirement without great difficulty. The specifications were met. Instrumentation tape recording became a reality.

McMicking, who served on MacArthur's staff during World War II, and at one time was Eisenhower's flight instructor, maintained his contact with top military personnel in Washington. He discussed Ampex magnetic recorders with members of the military technical group and learned from them their special requirements.

Later, after another of his trips to Washington, McMicking asked if Ampex could develop a unit which would record all low frequencies down to zero. This would create a new field of application for magnetic recording, he stated.

The first reaction for an engineer familiar with the principles of magnetic recording was that this could not be done. The difficult task was accomplished, however, with the development and introduction of the FM (frequency modulation) principle.

Ampex was now in the instrumentation recording business but the practical aspects such as the small number of readily available customers for these products did not indicate the potential of the field. The big problem yet remained to be solved—Who were the prospective customers for these new recording units and how could Ampex reach them?

New Markets for Instrumentation

At the time Ampex was conducting its first instrumentation development work for the government, Tom Davis, Engineering Sales Manager for Bing Crosby Enterprises, was independently seeking new applications for Ampex products. Bing Crosby Enterprises had distribution rights for all Ampex products and Davis was responsible for marketing these products in the 11 Western states.

Thomas E. Davis had earned a B.S.E.E. at the University of California at Los Angeles, and did post-graduate work at Columbia University. At the end of World War II, he became affiliated with Bing Crosby Enterprises and was immediately introduced to the new Ampex recorders.

"From the first time I laid eyes on the Ampex recorder, I was fascinated by its possible applications," Davis states. "I could see the potential of the new recording technology. After studying the Ampex recorders, and consulting closely with the Ampex engineers, I was highly interested in the idea of instrumentation applications. I realized that any signal recorded on magnetic tape could be reproduced later as many times as required. Engineers and scientific personnel could repeat the original experiment playing a magnetic recording over and over, instead of relying on the traditional single observation.

"So with a heavy Model 300 in the back of my station wagon, I took to the road and besides looking for sound recording customers I sought new applications for this amazing unit.

"I never really sold an instrumentation recorder. My efforts were to find a person with a potential company—an engineer who could understand the possible uses of magnetic recording. I did everything possible to interest him in trying the recorder in his work. My philosophy is that if the equipment is entirely new, you would have to let your customer himself experiment with the unit. I found this policy will bring orders in a fairly short time."

At Point Mugu, the Raytheon Company, under contract to Hughes Aircraft, was involved in the testing of missiles called "Loons." The Loon studies required the analysis of signals from the missile to determine the effects environmental influences had on flight behavior. After Davis' presentation about the capabilities of the new instrumentation recorder and seeing the product in use, Raytheon ordered 25 Model 301s (modified Model 300s) at the approximate price of $4,600 a unit.

Davis went back to Crosby Enterprises an excited young man. He saw enormous potential for magnetic recording in instrumentation and he wasted no time exploiting it.

Following this, Davis sold two 300s to a professor at Cal Tech who was stucying earthquakes, and he sold one to the California Research Corp. (a Standard Oil subsidiary near Los Angeles) for oil seismic research. Then he received a contract for

two 301s from the University of Washington's neurological department in Seattle for the study of brain waves of monkeys. He even took a 300, one bizarre afternoon, piece by piece, up to the belfry of the Pasadena Presbyterian Church and demonstrated how a recorder could preserve the tolling of bells, sermons and other ecclesiastical acoustics.

By this time, Ampex began to be known as a producer of instrumentation recorders. Next, it was learned that the U. S. Navy required a recorder which would withstand severe environmental conditions. This initiated the development of the first militarized unit, the Model 500.

Davis, as a representative of Crosby Enterprises, had so much confidence in this recorder that he placed an order with Ampex for 50 recorders at $17,250 a unit. Today, Davis admits that he had sold all of these recorders even before Ampex had produced them.

In 1955, Ampex developed the first recorder which industry and science could use for a variety of applications. It did not have to be adapted or modified for different customers.

Tom Davis' selling talents and ability to discover new applications for magnetic recording assisted Ampex in establishing itself in the forefront of the instrumentation business at this early stage in the development of the magnetic recording industry.

In 1956, when the company terminated its agreement with Bing Crosby Enterprises, Davis joined Ampex. At this time Ampex opened a sales office in Los Angeles appointing Davis as manager. In three months he became Western Regional Manager. In three more months he became National Sales Manager for Instrumentation Products as Ampex divisionalized its audio and instrumentation product activities.

Davis is presently a Group Vice President with responsibility for guiding the Professional Audio, Professional Video, and Special Products Divisions, Marketing Services and the Colorado Springs Operations.

In the years since Tom Davis pounded the pavement uncovering new applications for instrumentation recorders, the market for these products has grown broad and highly sophisticated. Today, Ampex instrumentation recorders can be found in aircraft, submarines, satellites, missile and satellite tracking stations, manufacturing plants, hospitals, oceanological laboratories and communications systems.

The Vietnam war curbed non-military government programs with the result that the instrumentation recording industry leveled off. Though Ampex has not been as seriously affected by the reduction in government spending as its competitors, it has felt the impact of the diversion of government funds away from research to armament.

In spite of the damper the Vietnam war places on the industry, Ampex continues to seek markets and engage in development of new technology for the day when the end of the war will bring about new demands for instrumentation equipment.

THEATER SOUND

In 1952, Alexander M. Poniatoff received a call from a New York banker who said that a very important person was going to visit Ampex. The banker could not disclose the identity of the mysterious visitor or the purpose of his visit, but indicated it could mean important new business for Ampex. He suggested to Mr. Poniatoff that he extend all appropriate courtesies.

On the appointed day, a chauffeur-driven limousine pulled up at 934 Charter Street, Redwood City, and a man emerged who introduced himself to Ampex personnel as "Mr. Edwards." Poniatoff and the others were puzzled by the fact that his large, gold cuff links and tie pin bore the initials "MT."

"Mr. Edwards" asked the Ampex group who met him if they had seen Cinerama (the original production was released shortly before "Mr. Edwards' " visit). When the Ampex executives indicated they had, he asked what they thought of the new film technique. After a general discussion of the many merits of this pioneer movie achievement, the visitor asked if Ampex could record sound on photographic film with a magnetic coating. As it happened, Ampex was working on a guided missile instrumentation project at the time which used 35 mm. film coated with magnetic material. Film with sprocket holes was used to accomplish long-term stability in the motion of the coated film. As a result, the answer to "Mr. Edwards' " question was "yes."

He next asked if Ampex had done any work in stereophonic recording of sound. At this time, Ampex maintained a stereophonic demonstration room in the same building. After listening to the system, the visitor became highly impressed with what he had heard. Upon returning to the office to continue the conference, the visitor revealed that he was, in reality, not "Mr. Edwards," but Mike Todd.

Mr. Todd then announced that as a result of what he had been shown, he was selecting Ampex to produce the sound system for the forthcoming Todd-AO motion picture system (a technique even more advanced than the new Cinerama process). In 1955, the first Todd-AO film—*Oklahoma*—was released featuring the new six-track sound system developed by Ampex. This was the first Ampex entry into the theater sound business.

In December, 1960, the Ampex theater sound system was presented to the Academy of Motion Picture Arts and Sciences. On the basis of its performance, and the accolades of sound engineers at several major studios, the Academy voted to award Ampex an *Oscar* for technical achievement.

When *The Robe* was released, amid publicity which heralded cinemascope as the screen technique of the future, it featured, unknown to the average moviegoer, a new Ampex stereo system.

Ampex surrounded movie audiences with sound in 1967 when it introduced a system known as Dimension 150. The solid-state, eight-track system features five speakers behind the movie screen and a group of speakers throughout the theater for off-screen sound effects.

Ampex sound systems are presently in use in theaters throughout the world.

The Ampex Story

CHAPTER FOUR

The Data Processing Boom

by Edmund Addeo

If there is one single factor that prompted Ampex growth, it is surely man's insatiable desire to preserve and manipulate information.

Bing Crosby sought a device that would preserve his voice with fidelity when replayed to radio audiences in different time zones and stimulated demand for audio recorders.

Scientists and engineers sought a device which would allow them to preserve transient phenomena for later repetitive analysis and brought about continuing demands for instrumentation recorders.

At the time the first audio recorder was introduced by Ampex, researchers were working with electronic devices, called computers, which were capable of solving complex problems rapidly. These machines were the progeny of mechanical computers used since the turn of the century. When computers entered the electronic world, they were generally assigned a natural arithmetic language which had always existed—one compatible with the positive and negative states in electricity. In this language, called binary code, all numbers, letters and other characters are translated into various combinations of 1s and 0s.

In their first applications, computers were used almost exclusively by scientists to solve problems which to this time, had been beyond the capability and patience of the human mind. Complex equations describing the movement of heavenly bodies and the structure of the atom were put to the new electronic marvel. Solutions resulted which would have required a lifetime of calculation by trained scientists.

Computers Come Of Age

From their lofty start, computers soon found their way into business to handle some of man's more prosaic tasks. Manufacturers are able to keep inventories to a minimum, freeing capital investment for other uses through inventory control records memory in 16 millionths of a second. (Today, inprocessed daily or weekly on a computer. The world of finance was quick to recognize the value of the computer to banking. Virtually all business and personal checking accounts and other bank transactions are processed by electronic computers. Soon even address labels were being processed by computers.

As computers moved into areas outside science they were handed an overwhelming workload. To keep business and industrial records in order, faster and more sophisticated data processing equipment was introduced. Computer operations became more and more expensive as the equipment grew more complex. Computers are worked around the clock to earn their price tag.

Terms such as "fast access time" and "storage capacity" became by-words of data processors as they sought more rapid means of feeding information-hungry computers.

In 1954, computer engineers began to look beyond the magnetic drums, acoustic delay lines and, particularly, punched cards which they were then using to store computer data. They reached out to others areas in electronics in their search for greater capacity and flexibility in memories (the central storage of the computer where information is held until called for) and off-line storage (methods of storing information outside of the central computer).

A New Direction for Ampex

Ampex engineers, returning from the Eastern Computer Conference in December, 1954, thought that magnetic tape recording would be a logical answer to computer storage problems because tape offered a faster access time and greater flexibility than the punched cards then used in most computer systems. Data which took a full day to handle with punched cards could be handled in less than one hour using magnetic tape. By April, 1955, engineers who were anxious to examine this new application for magnetic tape, had received approval to develop an Ampex digital tape transport which would be used as an off-line storage device for digital data processing systems.

The major engineering problem in translating knowledge of audio and instrumentation recording to the computer field was the rapid start, stop time which would be required to search reels of tape for digital information. A crew of engineers and consultants which included Harold Lindsay, designer of the first Ampex recorder, brought an Ampex tape transport to reality within eight months. The first prototypes of the FR-200 were shown at the Eastern Computer Conference in Boston in late 1955 and again at the Western Joint Computer Conference in San Francisco in February, 1956. The first production run was sold out within a month of its introduction. Some of the customers for the new digital tape transport included leaders in the computer field such as International Business Machines, which purchased several of the prototype models, Remington Rand Corporation, the Massachusetts Institute of Technology, Philco, National Cash Register and the National Advisory Committee for Aeronautics.

The enthusiasm for the new tape transport resulted from its ability to start and stop within less than .005 seconds, a simplified servo system which controls the feed of tape, and the ease of threading which permits fast reel change—all time-savers to the data processor.

Ampex found the burgeoning electronic data processing markets to be appreciative of the company's prowess in magnetic recording technology. Many major computer manufacturers beat a path to Ampex to test the FR-200 with their equipment. Enthusiasm over the performance of the FR-200, which was designed for off-line storage of computer information, prompted Ampex to to continue development of tape products for the computer market expanding into on-line (or central computer) applications. The next Ampex offering to computer users and manufacturers was the FR-300, a tape transport designed to act as a memory store in the central computer because of its fast access time. Then came the FR-400, an improvement of the FR-200 design; and the TM-2, an advancement of the FR-300.

A Merger for Growth

Later, most of the major computer manufacturers, seeing digital tape handlers as a necessary adjunct to computers, began manufacturing their own tape transports. But in the late 1950s, the promising activity which surrounded the Ampex tape products for the computer field, encouraged the company to begin searching for ways it could expand its interests in this industry.

Dismissing merger possibilities with smaller computer firms, Ampex was finally introduced to Telemeter Magnetics, Inc. (TMI) a pioneer in the core memory field. (Three types of memories are used with computers: tape which offers large quantity storage but relatively slow access to the information; magnetic discs or drums, which are typically faster than tape but provide only medium capacity; and cores, which offer instant access to information but contain only a limited quantity of data.)

Running down a customer list, it turned out that Ampex and TMI were supplying the same customers and their products were not competitive. Data processors looked to core memories for rapid access and to tape for its volume storage capabilities.

TMI, located in Culver City, California, near Los Angeles, had a firm hold on the core memory field. In 1954, TMI had introduced one of the world's first commercially available core memories. Cores, the storage cells in the memory are tiny "donuts" of ferrite material which are strung together by hair-thin wires to form flat planes called arrays. One array might contain up to 5,000,000 individual cores.

Information is stored in each core by magnetizing it with electrical current in either a clockwise or counterclockwise direction. The directions represent 1 and 0 in the binary coding system. The first core memory developed by TMI in 1954 permitted extraction of a bit of information from the memory in 16 millionths of a second. (Today, information is drawn from the cores in billionths of a second.)

Core Industry Leader

TMI had chalked up an impressive list of accomplishments before it was introduced to Ampex. It developed an all-magnetic core pulse source in 1955; a solid state core memory and a core buffer in 1956; a line of six microsecond memories and a core memory for small computers in 1958; and in 1960, a line of word-select core memories.

The decision to merge with TMI created a marriage between a leader in the core memory field and the leading manufacturer of precision magnetic tape memory units.

Immediately following the wrap-up of the merger, the Ampex digital tape engineering section was transferred to the TMI facilities in Culver City. The two activities were rechristened the Computer Products Company (now known as the Computer Products Division).

Hindsight indicates that the merger of the two computer-oriented groups could have been handled more gradually. In the burst of enthusiasm to get the computer activity centralized, Ampex lost many of its digital tape engineers who would not make the move to Southern California. At the same time, TMI personnel who had basked in the success of their core memory development and manufacturing viewed their parent company—this "giant" from the north—with skepticism. The reorganization and settling of the two activities under the same roofs resulted in the loss of some TMI personnel, also.

Fortunately, the initial merger problems were ironed out rapidly, and by 1961, the Computer Products Company was back on the track as a leading contributor to tape and core technology. In October of that year, Computer Products introduced the LQ, the first commercially available large capacity ferrite core memory with a rapid cycle time of 1.5 microseconds. Not even giants in the computer field such as IBM had been successful in developing such a product.

Major customers for this fast core memory were RCA, Philco-Ford, the Aberdeen Proving Ground, the National Bureau of Standards and the Air Force.

A request from Philco for even faster access to information spawned the development of the LZ, a one microsecond memory.

Meanwhile, core memories were beginning to relive the history of the digital tape transport. Major manufacturers, once acquainted with core technology decided to manufacture their own cores, arrays and stacks. Computer Products Division soon found itself with limited customers coming to Ampex for specialized core products.

In 1965, the Division did introduce a one-microsecond core memory, similar to the unit developed for Philco, but aimed at general market use. Soon after, however, in 1966, a major order was received for a more specialized large capacity core memory. This represented a multi-million dollar contract and a two-year engineering effort ensued which

overshadowed all other developmental efforts at the division. Once the project was complete, attention was again turned to expanding the standard product line. In the meanwhile, however, the division had lost some of its footing by devoting its attention to development of the mass core memory, the RM, and virtually ignoring the expansion of its line to serve the general market for core memories.

But a major step in revitalizing its line of core memories was taken when Computer Products Division introduced the RG memory at the Fall Joint Computer Conference in 1967. The RG was the answer to a data processor's dream. It not only matched or bettered other medium capacity memories with an access time of only 350 nanoseconds (less than half of one millionth of a second), but could be expanded from medium to very large capacities (up to 5,000,000 bits) simply by adding memory modules, somewhat like adding drawers to a bureau.

The pattern was set by the time Ampex entered the computer market. Give the customer greater speed in obtaining information, greater storage capacity and, increased reliability. The appetite for improvements on these fronts never wanes. Add to these lower cost and you'll touch the heart of every cost conscious computer user.

This was the path Ampex continued to follow in its efforts in the core memory field. Meanwhile it was reaching out to a broader customer base through increased speed and sophistication, smaller size, lower cost and higher reliability. A series of memories which were introduced in 1968 and 1969 feature faster cycle times and lower costs with extended capacities. Ampex can now answer a query from any potential customer with quotations on products standard in its line at competitive prices.

Tape Transports Improve

Meanwhile, digital tape handlers had not been forgotten in the pursuit of a greater share of the market for computer peripheral equipment. In November, 1963, a new tape transport was introduced which featured a single capstan tape drive design pioneered and patented by Ampex. It was the TM-7, first of a series of transports to use the new drive. The design used 80 percent fewer parts than previous tape drives and completely eliminated the traditional pinch rollers, brake cylinders and follower arms which handled tape roughly and caused frequent mechanical failures. As a result, the TM-7 was easy to operate, required little maintenance, was lower in cost and was more reliable.

Most recently, the TMZ low cost digital tape memory system, combining the economy, compactness and reliability required for use with small computers and remote computer terminals, gathered sales of $2.5 million in its first six months, and is now being delivered at a cost of only $3,500 each, a price achieved by large volume marketing, integrated circuit design and improved production techniques.

Many areas being investigated today at Ampex are the result of the Computer Products Division's exhaustive efforts to improve the techniques of core memory and tape transport development. In 1962, Ampex developed specialized test equipment for the government's investigation of electron beam recording techniques, an advanced concept for recording information. Today, continuing investigation is being carried out by Ampex, based on standards developed through the use of Ampex's first test equipment.

A major new direction in information storage for computers is the result of developmental efforts carried on in the corporation's Research Department. Applying the principles of videotape recording to the problem of large capacity storage of digital information, has resulted in a product called the Terabit memory, which uses video tape and contains the same information in a 36-transport system which is now stored in 20,000 conventional digital tape transports.

Ampex entered into a joint venture with Toshiba Electric Co, in Tokyo in 1964, in a move to strengthen overseas markets in a field that becomes more competitive every year. The joint venture manufacturing company is called Toamco (for Toshiba-Ampex) and makes and markets video, computer tape memory and instrumentation products in Japan. (More on this activity in the chapter devoted to the International Division.)

What started as a quest for new efficiency in preserving and processing information moved Ampex into an entirely new product field, one which has shown recent gains and a promising future.

New-found profitability which occured in 1969 is largely the result of a dedicated team of engineers, production men and marketing staff. Eugene E. Prince, vice president and general manager of the division, who was named to head the operation in 1966, is a man thoroughly dedicated to his operational plan. He has managed, in his tenure with the Computer Products Division, to increase manufacturing efficiency one-third while cutting overhead by a third.

"That's because of the people I have," Prince says. "We're all dedicated to keeping this division one of the company's most profitable, and we're always looking for cost reductions and higher efficiency."

Prince's optimism will probably prove correct. While computer users in the last decade (the sixties) have been primarily scientists and mathematicians, those in the years to come will be school teachers, nurses, production managers and others. Prince recently went on record stating that the equipment for this new generation of computer users cannot be the large, complex systems that fill entire rooms, but must be small data terminals with simple keyboards that will communicate with a massive computer which might be miles away from the kitchen, the hospital bed and the shop. And he cites the TMZ as typical of this next flood of hardware aimed at non-technical users.

"In fact, I wouldn't even call it a flood," he says confidently. "It will be more like a wave, and Ampex will be riding the crest."

The Ampex Story

CHAPTER FIVE

Pioneering Video Recording

In late 1951, an electrical engineer with 10 years of radio broadcasting experience in the San Francisco area was looking for a new career and a new home. Visits to Marin County, north of San Francisco, had sold him on the area, and he began looking for a suitable house for his family, which included five children. Some weeks previously, at the urging of friends, he had applied for a job with a small electronics company called Ampex, but there was nothing available. So he went ahead and bought a house in Novato, about an hour and a half north of the Ampex plant in Redwood City. One week after he moved in, Ampex founder and President Alexander M. Poniatoff called to offer him a job. Soon the house in Novato was on the market.

The man's name was Charles Ginsburg. Just a few years later he would accept an "Emmy" for Ampex from the Academy of Television Arts and Sciences and a list of other prestigious professional awards, including the David Sarnoff Gold Medal of the Society of Motion Picture and Television Engineers; the Vladimir K. Zworykin Television Prize of the Institute of Radio Engineers; and the Valdemar Poulsen Gold Medal awarded by the Danish Academy of Technical Sciences.

For Ginsburg is the man who led a team of dedicated engineers that literally gave video recording to the world. Now, asked about his first impressions of those days nearly two decades ago, Ginsburg says, "Well, golf in Marin County wasn't too good in those days anyway. I am glad Ampex called."

The story actually starts in January of 1952. Ginsburg was invited to conduct a highly secret Ampex engineering program. The sum of $14,500 had been alloted by the company to investigate the possibility of developing a rotary recording head for a tape recorder that would achieve the high relative head-to-tape speeds necessary for recording television images.

The idea fascinated Ginsburg immediately. Buoyed by what he knew of Ampex's achievements in audio recording, he enthusiastically set to work. It couldn't be described as a plush assignment. His first week on the job he had no bench and worked on the floor in a small building at 2385 Bay Road. Eventually, though, he had his first Ampex laboratory—a converted ladies' room at the same address.

Ginsburg worked alone until August of that year, at which time he acquired a new assistant. Poniatoff had met an extraordinarily astute Sequoia high school graduate by the name of Ray Dolby, and had asked the young man to come to work for Ampex. Ginsburg worked with young Dolby on a temporary project and was so impressed with his ability, he asked to have him made a full-time employee and assigned to him. Dolby accepted and continued his college studies at night.

"We can't give Dolby enough credit," Ginsburg says now. "He was as sharp a young man as I've run across, and he made important contributions to the project. He succeeded in finishing school and getting his degree even while we were putting extreme demands on his time."

(Ray Dolby has had an illustrious career since his Ampex days. After Army duty, he was graduated with distinction from Stanford and went to Cambridge on a Marshall Scholarship. There he earned a Ph.D. in electron microscopy. After establishing a research institute in India, he moved to England, where he today has an important research laboratory. He has recently received popular attention for the noise reduction method for audio recording that has made his name a by-word among high fidelity fans.)

Now a team of two, Ginsburg and his assistant, Dolby, began to attack the problem with vigor. In the early fifties there was great interest in the television industry in developing a magnetic recording device for television images. Three approaches to this seemingly overwhelming problem were being pursued by major technical organizations. The first was the so-called brute force method: actually pulling tape across recording heads at enormous speeds. This meant the tape would have to pass the heads roughly 300 times faster than in audio recording. The problems are obvious: at such speeds motional stability becomes almost impossible to achieve, friction problems multiply, and the size of the reels required to hold such an enormous amount of tape would prohibit any realistic-sized machine.

The second approach was to go to a "semi-high" speed of about 100 ips and break up the video signal into separate channels using time division multiplexing. This, too, is a complicated and awkward technique.

The third approach was to use rotary heads. Instead of the signal being recorded laterally along the length of the tape, it would be recorded almost vertically by means of a rotating head.

Rotary Head Developed

Ginsburg's crew took a 2-inch-wide tape, instead of the normal audio ¼-inch size, and placed four recording heads on a drum. This rotated each head *across* the tape, instead of *along* it. The tape moved at 30 ips: relative tape-to-head speed was approximately 500 ips.

The team worked hard and long on the project, getting a little money from the budget, here, a little there, and doing as much as they could on their own time so as not to exhaust the "official" funds too quickly. Ampex was still a tiny company in 1953, with annual sales totaling only $3.5 million. Midway through that year, management reviewed its requirements for engineering dollars and concluded it could no longer pursue the speculative video program.

Ginsburg and his assistant had anticipated this development, but refused to give up the project. They asked for an unused area in one of the buildings and requested permission to continue on their own time, working evenings and weekends.

In 1953, Ray Dolby was drafted into the Army, and Ginsburg lost an important helper. He continued his "moonlight" engineering, attacking the motional instability problem with occasional help from other interested engineers until Charles "Chuck" Anderson came to the company in the summer of 1954. Anderson, an experienced engineer, immediately took to the project, and he and Ginsburg doubled the efforts to get their video program off the corporate shelf and back into a funded research niche.

Finally, in the summer of 1954, the project had matured to the point that they were willing to gamble on an "audition" for the benefit of Ampex management. Key company executives were gathered together to show the first television images recorded on magnetic tape using a rotary head device. The picture was crude and unstable, but it succeeded in rekindling the enthusiasm of Ampex managers.

As a direct result of the showing, the project was revived. New funds were allotted, and project members were given their own work area behind locked doors. As quickly as funds were received, they were used up by the eager crew. A team of six engineers worked feverishly, determined to prove to management that a priority should be assigned their video recording project. They were: Ginsburg, Anderson, Fred Pfost, Shelby Henderson, Alex Maxey and Ray Dolby, newly returned from the Army.

One Year Goal

In early 1955, the team made another demonstration to the company's Board of Directors, and in Ginsburg's words, "It put us in business for sure. We were given money, privacy, secrecy and more space—the works." The team now set a goal to demonstrate a viable video recording system to the public within one year.

Alex Poniatoff maintained a lively interest in the program from its inception. Ginsburg relates an incident which occurred early in the program. In 1952, Ginsburg was stymied for days trying to solve a complex formula for the capacitance of the video recorder's rotating cylinder, a vitally important parameter. Poniatoff, on a walk through the company's laboratories, poked his head in the door to ask Ginsburg how the work was going. Ginsburg merely shrugged and pointed at the blackboard. Poniatoff surveyed the trailing formulae and frowned. "Well, keep at it," he said, and went back to his office.

Later that afternoon Poniatoff came back with a sheet of paper, on which was the entire solution to the capacitance equation. "Will this help?" was all he said. It did.

One by one the problems were solved, and a workable system came closer to reality. A curved tape configuration, for example, was developed to

give consistent quality to the signal across the total width of the magnetic tape. Between the summer of 1954 and the summer of 1955, a workable frequency modulation system was invented to cope with the television signal frequencies. Successive demonstrations showed better and better pictures.

As progress continued, March 14, 1956 was set as the target date for the unveiling of the video recorder. The introduction was to take place at the National Association of Radio and Television Broadcasters (NAB) in Chicago. One year was left in which to solve some very important problems, and as Ginsburg remembers, "We worked hard for those first few years, but in that 12 months before the showing we virtually lived in the lab."

Although the video efforts of tiny Ampex went unnoticed, several major firms were also working to develop a magnetic videotape recorder, including RCA, G.E. and Bing Crosby Enterprises. RCA had been most vocal about its effort. Every time RCA made a special announcement, the Ampex team would hold its collective breath. They were in a race and they knew it.

While the engineering team maintained its faith in the project, not everyone had equal enthusiasm. At a board of directors meeting in February 1956, (just weeks before the product was to debut), a special marketing study was presented that said essentially "*if* this would happen, and *if* that would happen and *if* this were true, and *if that were true*—a whole string of impossible ifs—then we might expect to sell 30 machines by 1960 at about $30,000 each.

History has made this particular forecast look bad. By 1962, Ampex had delivered 1,000 video recorders, plus many accessories, at an average price of more than $50,000.

Six weeks before the fateful unveiling, Ampex invited several network representatives to visit the video recording lab. The company felt secure that the Ampex machine was far enough ahead of its competitors to warrant public exposure.

First Demonstration Planned

It was during this meeting that Ampex firmed up an agreement with CBS to unveil the VRX-1000 at a meeting of CBS affiliates the day before the convention in Chicago's Conrad Hilton Hotel. The machine would soon be renamed the Mark IV.

On the morning of April 14, 1956, managers of CBS affiliate stations gathered at the Conrad Hilton. As was the custom, a TV camera was focused on the speaker's dias, and several monitors were located around the room so that all attending could see the speaker clearly. Unknown to the attendees, the Ampex video recorder was set up in a small room behind the main conference hall, linked to to the camera and monitors. After the first portion of the meeting was completed, and at a prearranged signal from the president of CBS, one of the nervous Ampex engineers (probably Pfost) hit the playback button. "We were scared to death," Ginsburg says.

"At first there was just silence," he recalls. "Everyone was watching precisely what had happened minutes before, but at first they just couldn't believe it. We wondered if something had gone wrong. There must have been two or three minutes of excruciating silence, and then all hell broke loose. They were hollering and screaming and jumping out of their seats."

Before the session was even over and the closing remarks were presented, most of the CBS affiliates found Ginsburg, Anderson and the video recorder in the tiny room. They mobbed the Ampex men with questions about the machine delivery dates, prices. "I've-got-to-have-one-of-those" was the cry. It was late that night before Ginsburg and Anderson said good night to the last CBS affiliate.

The plan for the next day was to move the equipment from the second-floor conference room to the first-floor exhibit booth for display at the convention. It was a four-day meeting, and the Ampex crew had confidently planned an organized, well-timed pace for demonstrations and private interviews with interested networks and stations. But the same mob repeated itself. Lines formed with people trying to squeeze in ahead of others to get at the Ampex booth. A demonstration was required every 20 minutes, and an Ampex salesman was writing orders with the speed of a shorthand secretary. The telephones in the Ampex suite rang throughout the night. The reaction to the Ampex *coup*, to the mortification of all the larger firms with incomplete video research in their own labs, spread west to San Francisco and east to Boston within hours. Wall Street took note, and interest in Ampex soared.

Orders Soar

Firm orders taken at the meeting amounted to about $1 million, and within four weeks after the demonstration $4.5 million in orders were logged—this in a year when Ampex annual sales totaled $18,737,00. A year later, the television industry paid formal tribute to the dramatic Ampex achievement. In March of 1957, Ginsburg personally stepped forward to receive the coveted Emmy award on behalf of Ampex and especially on behalf of his team of hard-working engineers. Ginsburg was made manager of Advanced Video Development soon after.

The development of a practical video recorder has been acclaimed as one of the most significant inventions of the 20th century and has had tremendous impact on modern society. It was sorely needed to permit the growth of world television. Initially, it was used for delaying original productions for airing at appropriate hours in different time zones. In the 13 years since its dramatic unveiling, it has become a versatile and indispensable tool of television production, as will be described in a subsequent chapter.

The television industry and Ampex owe much to Charles Ginsburg, the radio engineer who sought a new challenge in 1951 and found one worthy of his skill and determination.

The Ampex Story
CHAPTER SIX

Video Recording And How it Grew

The British Broadcasting Company's decision in 1962 to change its broadcasting standard from 405 lines to the 625 lines used in most of Europe was to trigger an event in Ampex history which provided a proper encore to the introduction of the VR-1000, the world's first practical videotape recorder.

The BBC sought a videotape recorder that would provide more detail at the new broadcasting standard (the more lines the more detailed the picture: the U.S. standard is 525 lines).

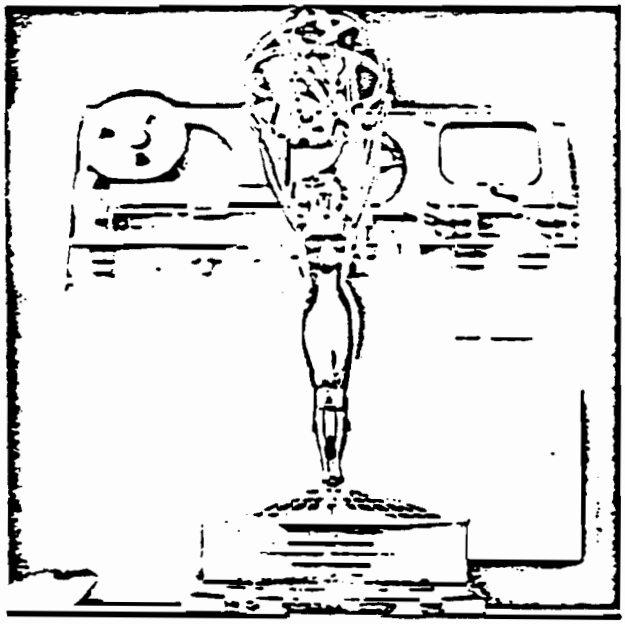
In response to the BBC contract to develop a black and white videotape recorder capable of meeting high picture fidelity, Ampex engineers equipped two VR-1000 recorders with transistorized components of a completely new design. The recorders demonstrated measurable improvement in picture quality and satisfied the BBC requirement for test vehicles. Known as VR-1000Ds, the two recorders were shipped to England in 1963. They were the only two Ds ever produced, but they set in motion one of the most important products in Ampex history, the high-band VR-2000.

Stimulated by the quality improvements embodied in the Ds, the video engineering staff continued work toward a new series of recorders and later in 1963, a complete design project was outlined. It called for a recorder with unprecedented reproduction fidelity. Building on the series of accessories developed over the years to improve the quality and flexibility of the VR-1000, the engineers planned a second generation recorder with a new high-band standard. Among other advances, it would be capable of producing second and third generation color dubs superior in quality to previous master recordings.

In 1963, as the company was still recovering from the difficulties of 1961, a project of this scope required considerable soul-searching before it could be undertaken. Most of the world's television stations had only recently acquired VR-1000 recorders, and it was difficult to see how even a superior product like the one proposed could stimulate a major re-equipment cycle at this point. Color broadcasting, where the new recorder's merits would be of major importance, had not yet reached full maturity.

Nevertheless, after careful evaluation, the decision to proceed was made. Ampex management was willing to bet substantial engineering dollars that a truly superior recorder would find its market.

The engineering team, headed by Grant Smith moved rapidly and by the spring of 1964 the VR-2000 was ready for unveiling at the National Association of Broadcasters convention in Chicago. As usual, the Ampex booth was active at the 1964 show, and the transistorized high band VR-2000 was a magnet for station managers and engineers.



The VR-2000 videotape recorder which helped promote worldwide color broadcasting, earned a second Emmy for Ampex from the National Academy of Television Arts and Sciences.

First orders came from the BBC which had followed the continuation of the VR-1000D effort with great interest. In fact, the first six VR-2000s were destined for the British network even before the NAB show.

Color Boom Arrives

Late in 1964, the color boom began. Along with the VR-2000, the Philips "Plumbicon" tube had emerged to guarantee greatly improved color camera fidelity. The tools seemed to be at hand to make color broadcasting successful. First NBC, and then the other U.S. networks committed themselves to virtually complete color-casting by the following fall season.

At the 1965 NAB show, the VR-2000 was no longer just a great engineering achievement. It was a vital necessity to stations throughout the United States to handle network color and local production. The high band VR-2000 was the only videotape recorder on the market capable of the kind of color fidelity needed to make good quality color broadcasting feasible.

For the next several years, Ampex couldn't produce VR-2000s fast enough to keep up with the demands, first in the U.S., then in Canada. The U.S. television industry acknowledged the VR-2000's contribution by awarding Ampex its second "Emmy" on June 4, 1967 in Los Angeles. Tom Davis, then Vice President-General Manager, Audio/Video Communications Division, accepted on behalf of the many Ampex people who contributed to its success.

By mid-1969, 1,000 Ampex VR-2000 high band recorders had been delivered. The VR-2000, and a second highband recorder, the VR-1200, continued to be the preferred recorders for color and monochrome broadcast use throughout the world. Sales are particularly brisk today in Europe and Japan, where the switch to color is taking place as it did earlier in the United States.

Videofile or computer terminal which will sit on her desk.

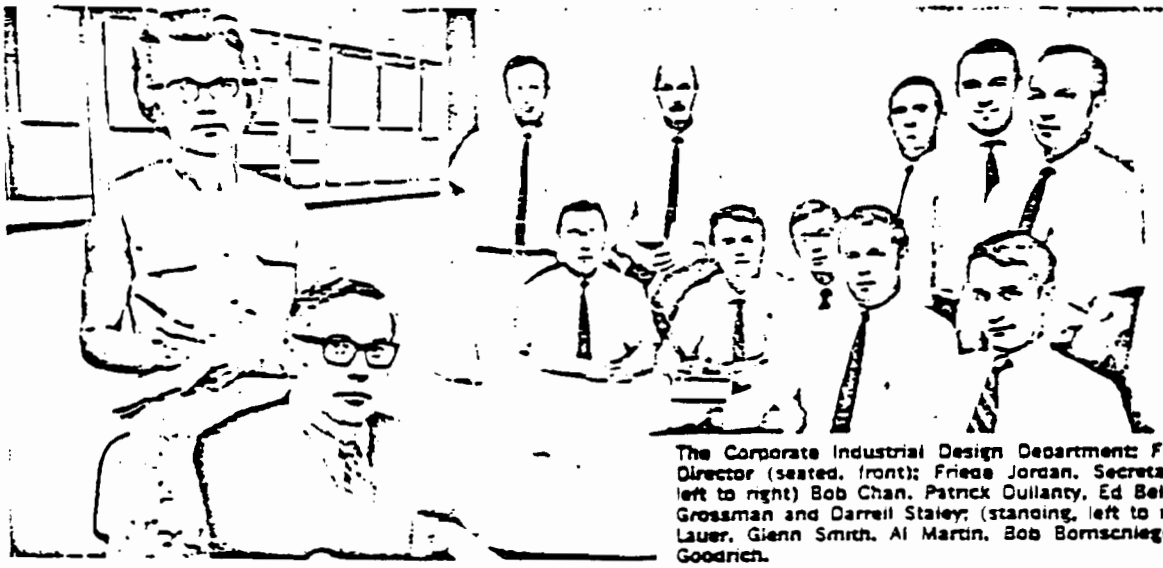
"This is one of the new directions for electronics design," Walsh explains. "Offices and labs are merging. It is becoming difficult to distinguish between the two. Desk top computers are already available and small computer stations will even be used in the home some day. When a person goes to the effort of outfitting his office or home in Herman Miller furnishings, he'll want all of his work equipment to reflect this same elegance.

"In personalizing products, the customer does not demand real woods, leathers and other natural materials," Walsh continued. "Quality man-made materials (and there are many on the market) which approximate the textures and quality we associate with personal objects, are readily accepted by the consumer and their durability is considered a bonus of the technology of our age."

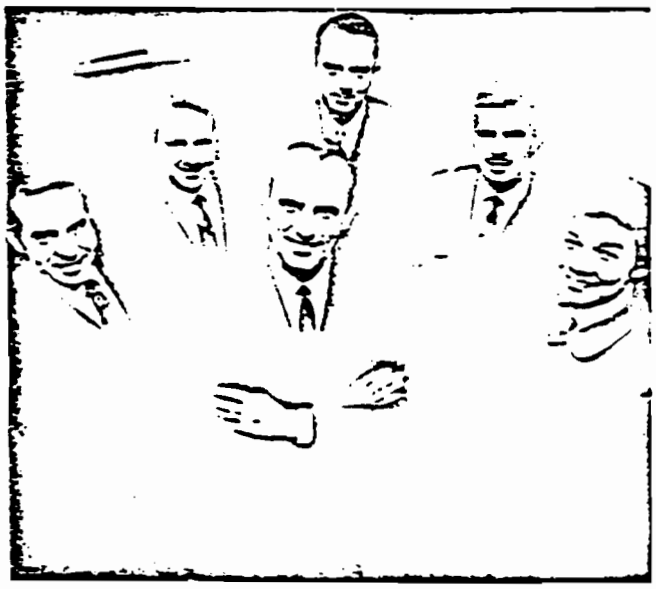
Each of the designers talked about the Ampex image which is evident throughout our product lines. The burden of projecting this image is not carried by our products alone. The Corporate Industrial Design Department is also responsible for developing, directing and maintaining graphics compatible with our product image for letterheads, business cards and the signs which identify company buildings.

New stationery and business cards which will soon go into use are a contemporary and individualistic expression of our corporate personality. The sign program which went into effect at the completion of the corporate headquarters building in 1963 now consistently identifies Ampex buildings throughout the United States.

As we've said, industrial designers are concerned with simple things—knobs, dials, paint, materials, signs, stationery. . . . But the way in which those simple things are combined results in the message stated to our customers . . . excellence.

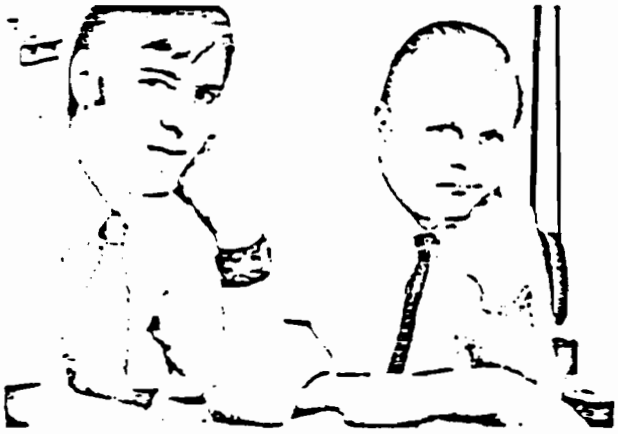


The Corporate Industrial Design Department: Frank Walsh, Director (seated, front); Frieda Jordan, Secretary; (seated, left to right) Bob Chan, Patrick Quillanty, Ed Bellandi, Chas. Grossman and Darrell Staley; (standing, left to right) Darrel Lauer, Glenn Smith, Al Martin, Bob Bomscniegel and Jack Goodrich.



At left, the Consumer and Educational Products Group Industrial Design Department: Arden Farey, Director (arms folded); (left to right) Don Leman, Al Johnson, Terry Taylor, Duke Larsen and Hari Matsuda.

Below, the Computer Products Industrial Design Group: Leon Sanderson, Manager (right); and David Crouch.



The years between the showing of the Mark IV videotape recorder (the first recorder Ampex demonstrated) and VR-2000 were not without their drama, achievement and anxiety. Returning from the momentous showing of the Mark IV in 1956, Ampex engineers had their work cut out for them.

Before a single recorder could be delivered, some additional design and development work had to be done. Most notably, a new processing amplifier was added to the system. The requirements for the design were identified in conferences with the Columbia Broadcasting System engineering staff and design development was a one-man show performed by Ray Dolby.

The heads on the VRX-1000 (the first 12 recorders to be delivered) were not interchangeable, and therefore a tape recorded on one unit could be played back only on the same unit.

Video tape recordings were so much better than kinescope replays that early problems were tolerated with reasonable equanimity by customers, but video engineers, with visions of a system capable of even greater performance, continued work on the recorder.

The small group of engineers responsible for the development of the videotape recorder now settled down to adding new capability to the VR-1000. It was a year before engineering turned the VR-1000 over to manufacturing, with reasonable assurance that it would offer excellent performance in any broadcasting application.

In the next few years a series of accessories was developed which greatly improved the quality of video recording. The color kit was first in 1958. For the first time, broadcasters had color-recording capability which far surpassed kinescope reproduction.

Of major importance was Intersync™, a high stability head and capstan servo. This allowed the recorder to be fully locked to local sync while switching from tape to film or vice versa in programming. Previously the engineer would manually fade to black and make a cut into or out of the tape. The viewer would see a rolling picture on his home screen at the point of the cut.

In March 1962, the Electronic Editor was offered to broadcasters by Ampex. This accessory allowed video tapes to be edited without cutting and splicing. The following year, a time element control system called Editec was added to the Electronic Editor which made possible programming of precise and automatic editing of video tapes with an accuracy good to a single frame.

As evidence of the eager acceptance of Ampex products, salesmen manning the booths in which the products were shown for the first time would never fail to sell the demonstration units. With Intersync, engineering was convinced that it was going to get its prototypes back after NAB in 1960 and took radical steps to insure their return. The first Intersync units went to NAB with fire engine red chassis.

The smug engineers, satisfied that they had finally thwarted the salesmen, sat back to await the reaction. They waited in vain. Attempting to track down the Intersync prototypes almost a week after they were shown, a salesman was pinned down and forced to admit that he, indeed, had sold them in spite of their color—"The customer didn't seem to mind."

While Intersync was being developed at Ampex, Ginsburg, Lawrence Welland (now Vice President-General Manager, Video Products Division); and Chuck Anderson (a member of the original videotape recorder team) visited WBBM in Chicago to meet one of the station's engineers and take a look at a project he had underway. This was 1959 and the engineer, Charles Coleman, had developed a device which he called Coletec, which corrected geometric distortion in videotape recordings. Virtually any geometric error was eliminated by his invention, thus ridding the home screen of distorted flag poles, wavy buildings, etc. Seeing the potential of Coletec, an agreement was quickly concluded with CBS, and Charles Coleman joined Ampex. In March, 1961, Ampex introduced the Amtec time element compensator to broadcasters and couldn't fill orders fast enough to satisfy customers.

Within months after the introduction of Amtec, another contribution to the video accessories line, Colortec, was credited to Charles Coleman -assisted by Pete Jensen. Colortec offered such high time base stability that broadcasters could for the first time meet high FCC-NTSC standards for color broadcasting. Predictions that this unit would stimulate the boom in color telecasting were premature, however.

Ampex Faces Competition

It was at this time, 1961, that RCA introduced its TR-22, the first fully transistorized broadcast videotape recorder. As soon as the wraps were taken off the new unit at the National Association of Broadcasters Convention, Ampex knew it faced powerful competition. Rising to meet the challenge, work was pushed on a new recorder (the VR-1100) which was to meet and even surpass all the attractions of the new RCA unit.

The following year, NAB delegates were introduced to the new Ampex VR-1100 recorder which was less expensive than anything on the market, fully transistorized and destined to draw customers from previously untapped markets.

From the beginning, videotape recording had intrigued users of closed circuit television in education, industrial and government communities. With the lower-priced early VR-1100 some significant installations took place. A particularly unusual new application was developed around the new recorder for the U.S. Navy. The recorders were installed in a closed circuit television system aboard aircraft carriers. The program, known as Pilot Landing Aid Television, is still being used to increase pilot proficiency in landing aboard carriers, and Ampex continues to sell the VR-1100.

Rapidly on the heels of the VR-1100 came the VR-2000 and there was no doubt of Ampex leadership in the broadcast videotape field.

The VR-2000 and its acceptance in the broadcasting industry again posed the question, "What next?" The industry had color recording of a quality which would satisfy the most discriminating viewer. Where would Ampex go from here?

The next move was toward increased mobility. Work was begun on the miniaturization of recording equipment for broadcasters. The first result of this effort was introduced in March 1967—a 50 pound battery-operated portable videotape recorder and camera combination: the smallest standard broadcast recorder ever built. Called the VR-3000, the new package was designed for use in taping remote news and sports events. For the first time, reporters could take videotape recording equipment directly to the site of newsworthy events without need for a complete mobile teleproduction van. Later that year, Ampex introduced the BC-100, the first color hand-held broadcast camera.

The camera development work conducted at Ampex moved the company into new professional video product areas. Beginning with a studio camera introduced in 1965, this diversification of interests in the video market set a pattern for the coming years. The VR-3000 portable highband recorder was teamed with a new monochrome camera, the BC-300, in 1967. The next year Ampex offered its first color broadcast television camera, the BC-210, for studio and remote use.

In 1969, the acquisition of Bogner Antenna Systems Corporation and Electromagnetic Radiation Laboratories and the purchase of the design and patent rights to AMP Inc. switchers enabled Ampex to offer complete products for a television studio from cameras to antenna output. In four years, Ampex moved from simply a supplier of video tape recording equipment to a producer of most of the major equipment required by broadcasters.

Video Recording on Disc

Meanwhile, video engineering was continuing long-range product development using the videotape recording concept. In 1966, ABC had tapped Ampex with a request that it develop a system for slow speed instant replay of important moments in sports action for their acclaimed "Wide World of Sports". It was decided that magnetic tape could not reliably handle slow motion because repetitive scans would cause the tape to deteriorate. Instead, the development team headed by John Poole, decided to attempt a new medium—the magnetic metal disc. Poole had managed the initial development of a magnetic metal disc buffer for the company's Videofile™ Information System before the Videofile Systems development was established as a separate corporate entity (more on this in a future chapter).

The medium was selected for this application because it could stand limitless head exposure and appeared to be an obvious choice for a slow motion recorder.

ABC went on the air with the Ampex-developed disc recorder, the HS-100, in March, 1967. The success of this first use of a magnetic disc for color video recording triggered a new family of Ampex products: the HS-200 recording system for teleproduction and, most recently, products for use in educational systems, x-ray technology and scientific experimentation.

Meanwhile, once the VR-1000 had been turned over to manufacturing, Charles Ginsburg formed and managed an advanced development laboratory which was responsible for developing new products and long range product plans using videotape recording. Out of the laboratory came a new videotape recording concept which was to spawn an entirely new product line for Ampex.

Ginsburg and his group of engineers had refined helical scan recording to the point that it was ready to be used in a marketable product. The helical system reduced the number of heads required for video recording from four to one or two making the system easier to manufacture and therefore far less expensive to produce. Wedding transistor technology with the helical scan principle, Ampex introduced the VR-1500 portable television recorder in December 1962. The VR-1500 was specifically designed for closed circuit applications in education, training, industry, medicine and sports. It offered the closed circuit field a videotape recorder for only $12,000; approximately one-third the cost of the VR-1100. The VR-660 which permits monochrome broadcast as well as closed circuit use succeeded the VR-1500. These two recorders had an important role in developing instructional television. A later "C" version of the VR-660 is still being sold. Reliability and five hour playing time per reel of tape have impressed and satisfied users.

Recorders like the VR-1500 and VR-660, priced dramatically lower than earlier broadcast recorders, whetted appetites for even lower-priced recorders for the closed circuit television field.

By 1964, new developments in helical recording were taking place rapidly in Elk Grove Village, Illinois, at the Consumer and Educational Products Division. Here engineers under Rein Narma and the late William Boyian with the counsel of Redwood City engineers, had made rapid progress on a simplified helical system using one-inch-wide tape, rather than the two-inch tape used on the VR-660.

CCTV Comes of Age

Since the introduction of the VR-7000 series of helical recorders by the Consumer and Educational Products Division in 1965 and 1966, the major part of Ampex closed circuit television activity has been in Elk Grove Village, Illinois. Here a succession of improved products has extended Ampex leadership in the closed circuit field. In addition to recorders ranging from $1100 to $21,000, camera and other accessories are offered. More than 16,000 Ampex one-inch video recorders for closed circuit use were sold between 1965 and mid-1969.

The lower cost, one-inch machines pioneered a host of new applications in education, industrial training and communications.

Today the Educational and Industrial Products Division markets color and monochrome closed circuit, helical scan recorders and accessories through a world-wide distribution system. The division also operates a videotape duplication laboratory to enable educators to build their tape instruction libraries and a closed circuit audio-video workshop which trains non-technical operators in production techniques and equipment service.

In 1966, another new trend further broadened Ampex video activities. In the 10 years following the introduction of the VR-1000, Ampex had been, for the most part, a supplier of this crucial component for systems developed by others.

The Special Products Division was organized to develop new product directions using existing technology, and to design and equip mobile videotape recording vans and complete television stations. In other words, to give Ampex the ability to sell complete systems consisting of Ampex and other companies' components.

One of the first major contracts handled by the Special Products Development Department was a full scale training system using broadcast video recorders for the United States Continental Army Command (CONARC). The first order covered five video vans and playback equipment which was installed at training centers in the CONARC system. For the first time, recruits had a taped instructor who never tired of taking them through the interior of Army vehicles or instructing them on the proper way to break down a rifle. The installation was so successful that in July, 1967, the Army awarded Ampex $3.7 million for additions to the videotape recording system.

The next major assignment came for the Special Products Development Department when UHF stations began to go on the air throughout the U.S. Businessmen entering broadcasting for the first time preferred to turn over the planning of their studios to experts. The Ampex name in the broadcast business, plus the SPDD organization which had developed experience in combining Ampex products with purchased components to result in complete packages attracted orders from many of the new UHF broadcasters.

New Directions for SPD

Because of the department's broad charter and its work with CONARC, it received an inquiry from the Oak Park and River Forest High School in late 1966, about the design of a random access instructional system to be used by students to augment classroom studies. At this time, no true random access teaching system existed which would allow instantaneous response to simultaneous requests for the same lesson. Existing systems served only the first request from beginning to end forcing second and later requests to receive the lesson already in progress.

Plotting out the school's needs and examining Ampex technology of the moment, SPD proposed an initial audio system using a recorder capable of responding to two or more requests within a minute and high speed duplication equipment which would deliver the taped lesson to student carrels. The result is the maximum time any student would wait to receive a lesson is 59 seconds.

After the successful completion of this $385,000 contract in March 1968, the high school placed two subsequent orders for expansion of the system: first adding additional student carrels and then video capability. Rapid random access to video material was made possible through newly developed magnetic disc technology combined with computer response.

The Oak Park system (now called Pyramid) launched Ampex into still another business. In May 1969, a second order for instructional equipment similar to the Oak Park installation was received from Pima College which was under construction in Tucson, Arizona. The Special Products Division (it attained divisional status in May 1968) now actively seeks contracts for its Pyramid random access instructional system and views technology in education as one of the answers to the current problem of developing individual instruction plans for each student. Through use of instructional systems, teachers could tailor study plans for each student by drawing from tape libraries and free themselves from repetitive classroom instruction in order to provide the counselling the student vitally needs to plan his overall education goals.

In spite of the overwhelming emphasis the development of the Pyramid system demanded, SPD never lost sight of its original missions. It continues to serve customers with specially modified standard products and plans and equips mobile recording studios and complete stations. Of particular significance was an order received from a recording company in 1967 for a multi-channel audio recorder which would allow the company to tape up to 16 channels of sound separately. The recording studio was looking for a device which would ease production problems by allowing them to record performers and any group of instruments separately to create special effects in the finished products. Special Products responded with a 16-channel recorder, using a videotape console as its base. The unit pleased the customer and stimulated a flood of requests from other recording companies, particularly those that specialize in rock releases. Rock music, which is largely improvisational and depends heavily on "manufactured" sound, found multi-channel recorders a boon to creativity and control.

Eventually, the interest in the recorder prompted the company to move its manufacture and marketing to the Professional Audio Division where it would be offered as a standard product. Called the MM-1000, the recorder can be constructed with up to 24 channels and has found homes in most major record studios and in virtually all of the new recording houses which serve the rock market.

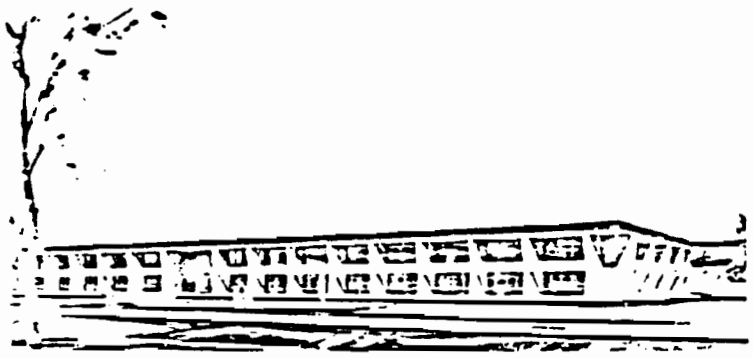
The original development of the videotape recorder has led Ampex into a number of new businesses in the last decade. Beyond the initial needs of the broadcast field it has moved to instrumentation for wide-band data recording, to closed circuit recording for education and industry, to disc recording for instant replay for teleproduction and closed circuit monitoring, to the Videofile Information Systems; and most recently into digital recording.

These achievements alone distinguish the video recording concept as one of the important developments of the century and its full promise has yet to be fulfilled.

*—Trademark-Philips

**—Trademark-Ampex Corporation

Progress Report



Computer Products has acquired a 20 acre site in the Marina del Rey area of Los Angeles to build a new 250,000-square-foot plant to house the division.

Construction will begin next April and the building will be occupied a year later.

The move will increase the division's operating floor space 47 percent over the 190,000 square feet presently leased in Culver City and West Los Angeles. Now contained in eight separate buildings, the division s development and production of information storage equipment and components for computers will be consolidated under one roof.

Eugene E. Prince, Vice President and Division General Manager, said the centralization of all the division's functions will increase operating efficiency and provide long-range economic benefits. He added that the site is less than five miles from the present Culver City division headquarters.

The new Computer Products Division building will include a two-story engineering and administrative section, manufacturing areas for tape and core memories and cores and a training center.

Ampex will construct a magnetic tape manufacturing plant in Battice, Belgium, primarily to furnish the Common Market, Scandinavian, North African and Middle East markets with tape for all magnetic recording applications.

Four Engineers from the Magnetic Tape Division in Opelika, Alabama, make up the task force assigned to oversee the plant construction and start-up operations. Bill Sawhill, Walter Newman, Sten Lundgren and Bill Brock departed from Opelika with their families last month for this special assignment.

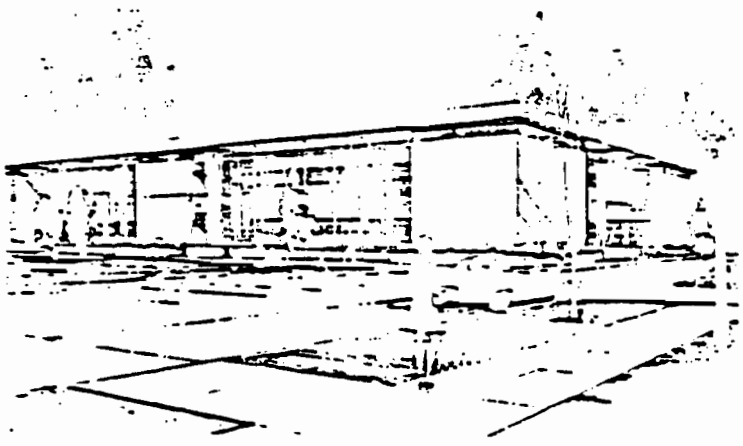
The construction of the modern, 80,000 square foot facility will begin immediately on a portion of a 34-acre site 70 miles from Brussels. The land was recently purchased by Ampex after an extensive search for a suitable European site.

All lines of Ampex audio tape, in reel-to-reel, cartridge and cassette format, and video, instrumentation and computer tapes, will be manufactured and packaged in the facility. The building will be occupied in 1970.

Products of the new plant will be marketed by the Europe, Africa, Middle East area of Ampex International.

The plant has been designed to be easily expanded as necessary to serve the growing magnetic tape market. Advanced material handling techniques for transporting raw materials and finished products will be installed to allow efficient, damage-fee handling. Custom-designed air flow systems in critical areas of the facility will provide precise temperature and humidity control and an "ultra-clean" environment. The firm designing the facility is Fernand Courtoy, S.A., of Brussels.

The magnetic tape plant will be the third Ampex manufacturing facility in the European area. Magnetic recording and data storage devices are built by Ampex International in Reading, England, and Nivelles, Belgium. An Ampex parts, service, and training center is located at Boeblingen, West Germany.



Construction was begun on a new facility to house the Magnetic Tape Laboratory adjacent to the corporate headquarters building in Redwood City in late July. The new laboratory will contain 54,000 square feet in two stories. The first floor will house pilot coating lines and administrative offices. Magnetic tape laboratories will be contained on the second floor of the completely incombustible structure. The exterior appearance of the new building will be similar to that of the building which presently houses research, engineering and corporate offices in Redwood City.

Construction will be complete in June, 1970, and personnel and equipment now housed in the present Magnetic Tape Laboratory in Redwood City will begin to take occupancy of the new facility at that time.

The Ampex Story
CHAPTER SEVEN

Target: The Consumer

The sounds of a ping pong game and a train roaring through the Ampex booth at the National Association of Music Merchants Show in the summer of 1955 announced the Ampex entry into an entirely new field. The sounds enticed many major music stores to take a look at a new Ampex recorder. The unit which drew their attention was the Model 612, the world's first stereophonic music system.

Having revolutionized radio, created instrumentation recording and developed a computer transport, Ampex was in pursuit of a new game—the consumer—and was using dramatic demonstration tapes to lure show visitors to the company booth.

Ampex had an eye on the home market for tape recording products for several years. The company's interest was prompted by the anticipated decline of professional audio sales. Once basic markets for the rugged and reliable professional recorders had been exhausted, there was little expectation of replacement business. By the mid-fifties, the durability of the Model 200 and 300 recorders had Ampex looking for new market areas for income.

The National Association of Music Merchants Show in 1955 was the first tentative tap Ampex gave the home market. The Model 612 was designed to appeal to the consumer with discriminating tastes and a bankroll to indulge them. Ampex faced the consumer with no forewarning of what to expect from this unfamiliar audience.

Train whistles came out of speakers to send a diesel crashing across the room, the ping-pong match had heads turning right to left and back again to follow the sound of the ball. A recorded conversation placed two men on opposite sides of the room, and a symphony orchestra surrounded and fascinated the audience with the separation of sound possible through this new concept in recording.

In the year following the demonstration of the Model 612, "Have you heard stereo?" became the buzz phrase in hi-fi circles.

Robert A. Miner, then Marketing Manager for the Audio Division, remembers well the first Ampex demonstration for the consumer, "Everyone was fascinated by stereo and the Ampex recorder which made it possible. But it was little more than a novelty—a conversation tidbit for the 'in' sound hobbyists. The music lover enjoyed the demonstrations but was not prompted to buy because there was only one prerecorded stereo tape on the market." Only a few dedicated sound hobbyists came forth to pay $700 for a 612 (at a time when they could purchase a monaural system in a console cabinet for about $300).

"We were ahead of our time and we knew it," says Miner today, "but someone had to take the first step. When we decided to go after the consumer market, we know that sales for home use couldn't offset the development costs of the new two-track recorder. Our main purpose in that first excursion into the consumer market was to whet appetites for Ampex quality when the home tape recorder became a profitable reality.

A year later, in 1956, Ampex introduced the Series A line of recorders, stereo units in table-top wooden cabinets. At the same time, a new distribution system was established, tailored to consumer products. Phil Gundy, the manager of the Audio Division, and his sales staff met with music merchants and representatives of America's leading music stores. Miner remembers, "We were overwhelmed by the reception we received. We had never experienced anything like it before."

Ampex had already established its name in the tight little community of radio and television broadcasters and record industry engineers, but it now faced a strange new audience—the consumer. For the first time, Ampex products were to appear in stores such as Marshall Field in Chicago, Grinnell's in Detroit, Wanamaker's in Philadelphia and Sherman-Clay in San Francisco. Stereo was an intriguing new concept, incomes were rising in the peacetime years after Korea, and Ampex quality was recognized by music lovers and hi-fi people.

In developing the Series A line, Ampex engineers had taken technology developed for professional recorders and, with economies in material and manufacturing costs, designed units appealing to serious music lovers and sound hobbyists.

"Our first customers," recalls Miner, "ran the economic gamut, but they had one common trait: they appreciated music and a company that provided the best recorded sound they had ever heard."

Price A Problem

Pricing, however, continued to be a problem. Ampex home recorders ranged from $500 for a recording deck to $1,000 for a complete console including record changer and AM/FM radio. This was out of the range of the man who "just likes music." Prerecorded tapes were more numerous, but also presented a price barrier. A seven-inch, two-track stereo tape could carry the same material contained on a less expensive long-playing record. There were buyers, but not enough to create a volume business.

Nevertheless, Ampex was stimulated by its introduction to the consumer market and soon announced formation of a subsidiary, Ampex Audio, Inc., which would be devoted exclusively to this market. In 1956, Ampex had annual sales of approximately $10 million and employed some 1,200 people housed in 17 buildings in Redwood City. On March 18, 1957, ground was broken in Sunnyvale, California, to accommodate the newly formed subsidiary. (Videofile Information Systems Division today occupies this building.)

In July of the following year, when Ampex Audio,

Inc., which was managed by Herb Brown, occupied its new quarters, the consumer line was expanded to include console models in various furniture styles. Now the company could offer a system for personal use in a formal living room, a den, even in an office. But the restraint that continued to bind the business—stereo tapes cost too much, were inconvenient to handle and offered only a fraction of the selections on long-play records. Soon stereo became available on disc. When manufacturers perceived stereo as the new direction for recorded music, they jumped on the bandwagon and conducted marketing campaigns which rapidly convinced consumers to turn up their noses at monaural music. Virtually all record players sold beginning in 1957 were stereophonic.

The problem of tape pricing stimulated the Ampex pioneering spirit. It knew it would have to create a method of building a more economical tape library. The company turned to the source of the answers to all its previous product problems—its engineers. After brief but concentrated withdrawal to the Ampex engineering laboratory, the company introduced the four-track stereophonic recording head in June 1958. This new head meant that a recorder could now accommodate a four-track tape, allowing one tape to contain as much material as two L.P. records and could make tape competitive with discs for the first time. The head allowed two channels of material to be recorded in one direction and, after turning the tape over, two channels in the opposite direction.

At the introduction of the four-track head, Ampex hoped to spur tape duplicators into immediately bringing out four-track prerecorded tapes, and thereby stimulating sales of stereo tape recorders. But as Ampex waited for a duplication company to see the potential in four-track tape, nothing happened. Again, Ampex was a step ahead of its time and became restless.

A New Business

The company saw four-track tape as an eventual profit maker and decided, since no one else would pick up its lead, Ampex would go into the prerecorded tape business itself. In July, 1959, Ampex Audio had rounded up tape duplication rights for some of the leading disc labels. In its initial four-track stereo tape library, marketed under the name United Stereo Tapes, were Verve, MGM, Warner Bros. and Mercury recordings. The UST facility was originally located in Bloomfield, New Jersey, close to the East Coast music market.

When the first Ampex prerecorded tape release, Ella Fitzgerald's "Like Someone in Love," appeared in the racks only a small number of devoted audiophiles acknowledged the event. The tape recorder market was small, and tape sales were meager. Almost ten years later, when an Aretha Franklin tape was introduced by Ampex, 40,000 copies were sold in 48 hours. Today, Ella also creates a stir when she comes out on a new Ampex album which will take its place next to 6,500 other selections in the Ampex Stereo Tapes (new name) library.

In 1959 Ampex gained a new label which was to become very significant in the early growth of the stereo tape field—London Records. London signed a five-year contract which has been renewed regularly since.

Within 18 months after Ampex introduced the four-track head in 1958, 750,000 tape recorders had been sold by major manufacturers. A true consumer market was in the making. Companies which had moved into the business were: Bell Sound, Viking, Pentron, Telectrosonic, Tandberg, Superscope, Magnecord, Revere-Webcore, Wollensak, Webster, Heath and Voice of Music.

Sales of recording products for the home increased quarter after quarter, providing a significant contribution to Ampex earnings. With the potential that the consumer market held clearly in sight, many manufacturers began developing products with lower price tags and lesser quality. Ampex retained its position as the quality leader in the market and for the new few years made no effort to develop lower cost lines.

If you look at the consumer market as a pyramid, with a small number of sales at the high quality, high price summit and rapidly widening sales as cost and quality come down, Ampex in 1962 was the leader in the top fifth of the pyramid. This was a position the company was confident it could retain but which offered little growth potential.

Broader Market Penetration

In 1963, as the company continued its recovery from losses incurred in 1961, the decision was made to move aggressively downward in the market pyramid, with products designed specifically for the entire upper third of the market. The Consumer and Educational Products Division was launched in August, 1963, initially with a dozen people in temporary quarters in Park Ridge, Illinois. In 1964, the rapidly growing division moved into a new building at 2201 Landmeier Road, Elk Grove Village. The midwestern location was chosen for proximity to major markets and sources of components and recognized that it represented a brand new business for Ampex.

Initially, the division assumed marketing of the high quality F-44 series of audio recorders developed by Ampex Audio in Sunnyvale and the UST-4, a temporary lower-cost unit manufactured for Ampex to permit development of a marketing organization in anticipation of the division's own new products. Significantly, United Stereo Tapes also became a part of the new division and changed its name to Ampex Stereo Tapes.

In June, 1964, the first products of the new division were introduced at a press conference in New York. The prestige earned by earlier Ampex innovations in tape recording assured wide interest in this major move into the consumer field. The market was not disappointed.

The initial products of the division, the 2000 and 1000 series recorders, established a new trend in consumer recorders. Gone was the old tube-tester look in tape recorders and in its place were beautifully styled models that would grace any room. The 2000 clearly reached out in a new direction to attract music lovers rather than hobbyists with two significant innovations—automatic reversing and simplified tape threading. With automatic reversing, the listener could for the first time play both sides of a tape "album" without handling the

tape—a clear-cut advantage over record players. The simplified threading device overcame many of the objections of previous recorder users who found threading reels a nuisance. With these features came the best performance specifications ever offered in the $300 to $500 range.

The 2000 Series has been credited with stimulating the subsequent rapid growth of the market for consumer tape recorders. Other manufacturers rapidly followed with competitive convenience features. Hand in hand with the new recorders—which clearly emphasized the music listening role of the recorder as opposed to the recording function—Ampex Stereo Tapes began aggressively expanding its catalogue, and prerecorded tape sales rose.

Over the next few years, Ampex carved out a substantial portion of a market it had never served before—the consumer market from roughly $300 and up. As Ampex and other firms brought unprecedented quality to these lower price ranges, the market grew rapidly, with vigorous activity in the lower end of this range.

As the division contemplated further penetration of the consumer market "pyramid," two other developments had major impact on management thinking. One was the development of the eight-track cartridge for automobile stereo systems by Lear Jet; the other the development of the cassette recorder by Philips of Holland.

The eight-track cartridge, which houses an endless loop of lubricated tape in a small plastic box, made its debut in 1965. It was not the first attempt at doing away with tape threading by enclosing tape in a small container, but it was the first to gain wide acceptance. The automobile industry adopted it as an optional accessory for new cars and gave it intensive promotion. By 1967, sales were soaring, almost exclusively for the automobile market. To satisfy demand for prerecorded eight-track music, Ampex Stereo Tapes expanded its offering and began a period of unprecedented growth.

Efforts to make the eight-track cartridge popular for home use as well as the automobile made less headway, partly because of the virtual impossibility of recording with the cartridge. It remains essentially a playback system. The Consumer and Educational Products Division considered the possibility of marketing eight-track players for the home but decided against it because of the cassette.

The Cassette Bows

A fourth the size of the cartridge, the cassette was introduced in 1963 by Philips. It again is a plastic box housing tape but contains two reels rather than the endless loop of the cartridge. It easily permits recording as well as playback. In fact it was originally marketed only in a monaural format for voice recording. Battery-powered cassette recorders gained widespread acceptance first in Europe then rapidly throughout the world as many manufacturers adopted the concept under license to Philips.

In 1966, Philips introduced stereo units for home listening as well as recording. Ampex management saw in the cassette the best approach for broadening participation in the lower end of the consumer market. While not a high fidelity device, the cassette recorder/player had the potential of making tape truly popular as a means of hearing music—at home, in the car, or virtually anywhere.

In 1967, Ampex became the first U.S. manufacturer to introduce cassette stereo units, a move which had great impact on the U.S. market. Of equal important, Ampex Stereo Tapes became the first major source of prerecorded cassette music, without which the equipment could not succeed.

Today, the newly established Consumer Equipment Division (formed by a reorganization of the Consumer and Education Products Division) offers a wide array of monaural and stereo cassette recorders and players starting at $30, with lines of open-reel units in the higher end. Ampex Stereo Tapes Division is a leading producer of all major formats of prerecorded music and entertainment.

To support the widespread marketing effort such a broad product line requires, the Ampex Service Company was formed in 1966 and was given independent division status in September of 1968. With factory service centers in more than 15 locations and contract service representatives in more than 200 others, Ampex has certainly come a long way since the recorded ping pong game and the diesel engine in 1955.

At the same time Ampex was establishing new trends in audio recording, the consumer market was being tantalized by the prospect of a home videotape recorder—a device that will permit instant home "movies" or the recording and playback of prized television entertainment. As the initial developer of videotape recording, Ampex has long been aware of the potentialities of such a device, such a market.

Home Video Recording

As it had with early stereo machines, Ampex dramatized the potential of a home videotape recorder in 1963 by building several futuristic home entertainment systems that incorporated the new VR-660 videotape recorder. Called the Signature V, the 10-foot console system was featured in the famous Neiman-Marcus Christmas catalogue of 1963 with a dazzling $30,000 price tag. Subsequently it was used at trade shows and consumer exhibits where the concept of videotape recording and Ampex received wide comment and attention.

In 1965, the Consumer and Educational Products Division introduced a new series of helical-scan videotape recorders for closed-circuit use—the VR-7000 and VR-6000 series. Priced from approximately $1,000 to $3,000, these recorders launched an important market for closed circuit television training and communications. To capitalize on consumer industry interest in the home videotape recorder, early models were offered in furniture configurations; a few were sold as consumer recorders.

However, the home videotape recorder continues to await further reduction in size and the availability of good quality color cameras and recorders at a lower price. In the meantime, thousands of users in industry, government and education are becoming accustomed to the videotape recorder as a valuable tool. The true home videotape recorder represents an important future chapter of the Ampex story.

The Ampex Story

CHAPTER EIGHT

Ampex Goes Abroad

by Dave Chapman

Alexander M. Poniatoff was born in Russia and received his technical education in Germany. During the first world war, he escaped to England. After the Bolsheviks won control of Russia, he crossed the border into Manchuria and then into China. From China, he came to the United States.

Poniatoff came to the U.S. with a broad view of the world, so it was completely natural that when he formed his company it should look outside the U.S. for sales.

Ampex found a ready market for its products in international markets. Radio stations were expanding rapidly after the second world war, and they turned to Ampex recorders for help in their work. The first Ampex audio recorders were put to use in Japan, France, England and Vatican City in 1948. When the videotape television recorder came along in 1956, international executives were on hand to witness early demonstrations and were in the early line-up of customers for the first videotape recorders.

Somewhat to the consternation of Ampex patent attorneys, the French word for tape recorder became L'Ampex and the infinitive verb to tape was Ampexer.

Like most electronics companies, Ampex began its international ventures through an export firm. Rocke International in New York had a well-developed network of sales agents throughout the world by 1947 and it was through this company that Ampex first began to sell abroad. Overseas sales in these early years of tape recording never exceeded $200 thousand per year, but to the young Ampex, this represented good business.

By 1954 Ampex took its first major step outside the U.S. Kevin Mallen, a member of Ayala Associates, and then a member of the Board of Directors of Ampex, spent twelve months in Europe "finding out the peculiarities of the various countries" as a memo of the period put it.

Mallen's early investigation of the Ampex future overseas resulted in the decision to establish a European sales office in London. Even in the first ventures into the international marketplaces, Ampex realized that to participate fully in these markets, it would have to manufacture products abroad. Duties, tariffs and the lower costs of manufacturing would eventually push U.S.-made Ampex products out of economic competition abroad.

Ampex of Canada

In May 1955, a first attempt was made to organize for international business. Significantly, in the small group that laid the groundwork for Ampex penetration of international markets were Jack Porter, Lee Cross and Ralph Endersby who are still in management positions with the company. It was at this time that the Ampex Canadian office was established in Toronto, with one employee. Today, more than 130 people are employed by Ampex of Canada, Ltd.

This study, like Caesar's first look at Gaul, divided the world into three parts. Europe, Canada and Latin America. There was a footnote with a category of "other" which included the Far East, Africa and the Middle East. It was determined that "other" would continue to be handled by Rocke while Ampex began to establish direct relationship in the three "main" parts of the world.

The Toronto office had been opened in May 1955, by Ralph Endersby, a young English engineer who had been a salesman for our Canadian distributor, CGE. Endersby went on to play a key role in the formation of Ampex International, as Marketing Manager and later as Manager of Western Hemisphere operations.

In Redwood City, during May and June 1955, the International Division was established, along with Ampex American Corporation, a Western Hemisphere trading corporation. This first International Division would last one year then be dissolved in 1956. With this move the London office was closed. Ampex American Corporation continued, however, until 1965, having been replaced earlier by the present Ampex Pan American Company.

Jack Porter, manager of International Administration, went back to the Audio Division in 1956, and had a second International career from 1962 to 1967 as Finance Manager of the second International Division. Today, Porter is Vice President, General Manager of the Magnetic Tape Division.

The responsibility for selling products outside the United States from 1956 to 1959 reverted to the individual product divisions. This was a period of expansion for intelligence gathering networks in Europe, of the construction of the Woomera rocket range in Australia, and of the beginning of a hoped-for European space program. Russ McBride, Export Sales Manager of the Instrumentation Division and his colleagues worked closely with the ministries of defense in major countries and were able to secure orders for FR-100, FR-1100, FR-200, and AR-10 instrumentation recorders throughout the world. Many of those first instrumentation units sold abroad are still operating in tracking stations in Germany, France, Scandinavia, England, and in Canadian, Italian and Japanese aircraft.

Ralph Endersby, after heading the Canadian office for one year, was brought to Redwood City to become Export Sales Manager for the Professional Products Division.

Jim Cellor was named to replace Endersby in Canada. Cellor still heads the Canadian company, having seen it grow from a few hundred thousand

dollars in annual sales to well over ten million dollars forecast today.

Endersby's first assistant in the Professional Products Division was a young man from Berkeley, named Lee Cross who had an AB in political science and a mind full of electronics terminology imposed by the U.S. Air Force. Cross joined Ampex in 1955, went to Europe in 1959 to set up an operation in Fribourg, Switzerland, and then to the Far East to set up Ampex Australia and Ampex International—Hong Kong. Today, Cross is Area Manager of the Far East.

Ampex Fame Spreads

During this period, Ampex video and instrumentation recorders became well established in world markets. Broadcasters outside the U.S. were as ecstatic at having a method of recording pictures on tape as those in America. The Japanese were the first to receive an Ampex video recorder, since their system was a 525 line, 60 field standard identical to the American system. The Canadians and English placed orders at NAB, as did the Germans, but Ampex had further development work to do before it could deliver the 405 and 625 line versions of the video recorder. The first modifications of the VR-1000 for international use were performed in the field by an engineer attached to the Export Manager's staff. Later standards modification was taken on by Siemens and Halske in Germany and Rank Cintel in the United Kingdom; the Ampex video sales agents for these countries.

Today, almost every television studio in the world contains at least one Ampex video tape recorder. All three Olympics held since 1960 have utilized Ampex video recorders for worldwide distribution of the coverage of the games.

By 1958, Ampex video recorder sales abroad were several million dollars per year and were beginning to represent a sizeable portion of Ampex business prompting management to devote greater attention to the development of this market which held such great potential.

While the video recorder was forcing Ampex attention to the total world market, the company was also experiencing a steady growth in audio and instrumentation product sales overseas; particularly in Europe. Video recorder orders came in, not only from Cuba, but also from Finland, Singapore, Manila, Spain, Nigeria, Peru, Yugoslavia, Thailand and a host of other countries where Ampex had been previously unknown.

The broad scale demand for Ampex products together with the obvious continuing opportunity for further sales abroad led Ampex to consider ways in which it could better serve its worldwide customers.

New Organization

In September 1958, Ralph Endersby made a presentation to Ampex top management proposing a new International Division. The presentation was held in the home of Joseph McMicking, then a member of the Board of Directors and a large stockholder in Ampex. Joseph McMicking is an authority on international business through his extensive interests in the Philippines and his business travels throughout the world.

After reviewing Endersby's proposal, Ampex management agreed that further investigation was necessary to take full advantage of the demonstrated opportunities outside the U.S.

As the first step, Ralph Endersby and George Long, then President of Ampex Corporation, departed on a round-the-world fact gathering trip to Europe and then to the Far East. (Endersby remembers that trip from Copenhagen to Anchorage and on to Tokyo took 27 hours in a DC-6.) They talked to major customers such as the BBC, Radio Televisione Francaise, the Royal Radar Establishment, the German Institut fur Rundfunktechnick, Italy's Olivetti, Holland's Philips, Japan's Nippon Hoso Kyokai and others. They also talked to our overseas agents: Sakata Shokai in Japan, Rank Cintel-United Kingdom, and Siemens and Halske-Germany.

At the end of the trip, Long turned to his seat companion and said, "Ralph, I've written to the Board of Directors and told them that there is a great deal of business outside the United States and we should exploit our opportunities. You can't run a railroad from ten thousand miles away."

In December 1958, the decision was made to reopen the English office and charter it to investigate the possibility of local manufacturing when this would enhance the Ampex profitability abroad in addition to handling the sale of U.S.-manufactured products.

Ampex Electronics Ltd.

Dr. Peter Axon was hired in December 1958 to head the new British activity as Managing Director of Ampex Electronics Ltd.

Axon has a Ph.D. from London University and had been with the BBC advanced research group and participated in the development of VERA, Visual Electronic Recording Apparatus. VERA was the BBC's attempt to record pictures on tape. It used brute force longitudinal technique, with all the disadvantages—large reels, huge motors and jitter.

The reason Reading was chosen was not, as U.S. cynics today remember, that the first Americans over there took the wrong train and thought they were in London. The British government limited the areas for new manufacturing operations. Investors had their choice of northern Scotland, Wales or Reading. Ampex chose Reading, and it has turned out to be a fortunate choice both for Ampex and the community.

Vice President Philip Gundy was assigned the responsibility for the prospective International Division in January 1959, and the new organization was franchised to begin operations May 1, 1959. That summer, another event occurred which would make a major mark in Ampex history.

The 1959 Moscow Trade Fair was to have a complete color television studio with video recording capability. Ampex was invited to participate in the exhibit as it was the only manufacturer of a color video tape recorder. A crew of engineers left for Moscow in the summer of 1959 to oversee the installation and operation of the Ampex videotape

recorder. Gundy arrived at the Fair for its opening and was on hand during the famous Krushchev-Nixon walk through the trade exhibits. It was in the kitchen exhibit that the famous debate between the two politicians took place. Unknown to Krushchev, the Ampex crew recorded the exchange on videotape. When Nixon and Krushchev reached the color studio on their tour, Krushchev was invited to push the start button on the video recorder which activated a replay of the now famous "Kitchen" debate. Krushchev was enchanted with the video playback. "We have nothing like this in Russia," he said later.

It was subsequently agreed that the tape could be shown to the world, and Gundy, without allowing time for a change of mind, spirited the tape out of Moscow buried in the soiled shirts in his suitcase.

In New York, Gundy took the tape to NBC, CBS and ABC. All three networks broadcast it in its entirety and kinescope duplicates were made for distribution throughout the free world.

Following Krushchev's introduction to the video recorder, Russian television people paid closer attention to Ampex, but no sale. The U.S. government forbid the sale of video recorders to any of the Iron Curtain countries. Even today, video tape recorders are a licensed commodity and every order is carefully scrutinized by Ampex and federal government departments before a recorder can be shipped. Long after the trade fair was over, however, Russian delegations made attempts to buy large quantities of television recorders. Sometimes the attempts were through third parties, sometimes direct. During the Moscow Trade Fair the recording heads used on the Ampex video recorder were stored each night in the American Embassy in Moscow and released only to Ampex personnel for remounting on the machine the next day.

During its first 12 months of operation as a separate division, from May 1, 1959 to April 30, 1960, the International Division achieved $9 million in sales. Ten years later, annual projections are nearly eight times that figure (excluding Mandrel).

The early International Division was strongly centralized. In order to launch the new organization, a group of international specialists went out from Redwood City to work with distributors and customers and to train the now-forming overseas staffs.

The first field salesmen were added in early 1960. Tom Dalzell of Ampex Canada went to England to become marketing manager for Redwood City Engineering, Ltd. (which was later to be called Ampex Great Britain, Ltd.) in the summer of that year. Dalzell had emigrated from England to Canada two years earlier and now found himself back in his home country, working for an American company.

Ampex created a fairly sophisticated corporate structure overseas and established headquarters for activities in Fribourg, Switzerland.

Fribourg is a small, somewhat crowzy town halfway between Bern and Lausanne. It was exactly on the border of the German and French speaking sections of Switzerland. (As you approach Fribourg, the service stations advertise Shell Mit TCP, and as you leave, it is Shel Avec TCP.)

At this time back home in Redwood City, the International staff continued to grow as new talents were added. In October 1960, Phil Gundy moved to Senior Vice President, responsible for the International, Audio, Video and Computer divisions and Biff Gale replaced him as Manager of International. Gale, came from Business International, a newspaper and marketing intelligence service. He left for Studebaker International one year later in October 1961 and was replaced by B. A. "Bill" Olerich, who had joined Ampex in September 1960, as Finance Manager for International and has since guided the growth of Ampex International operations as its President and an Ampex Group Vice President.

An ardent mid-70s golfer and father of six, Bill Olerich was born in the small town of Rolfe, Iowa. He graduated from Drake University, served with General Electric and then joined Abbott, a leading manufacturer of pharmaceuticals. At Abbott International, he rose to the position of Vice President and Finance Manager. He became an Ampex Vice President in October 1961, and a Group Vice President in 1967.

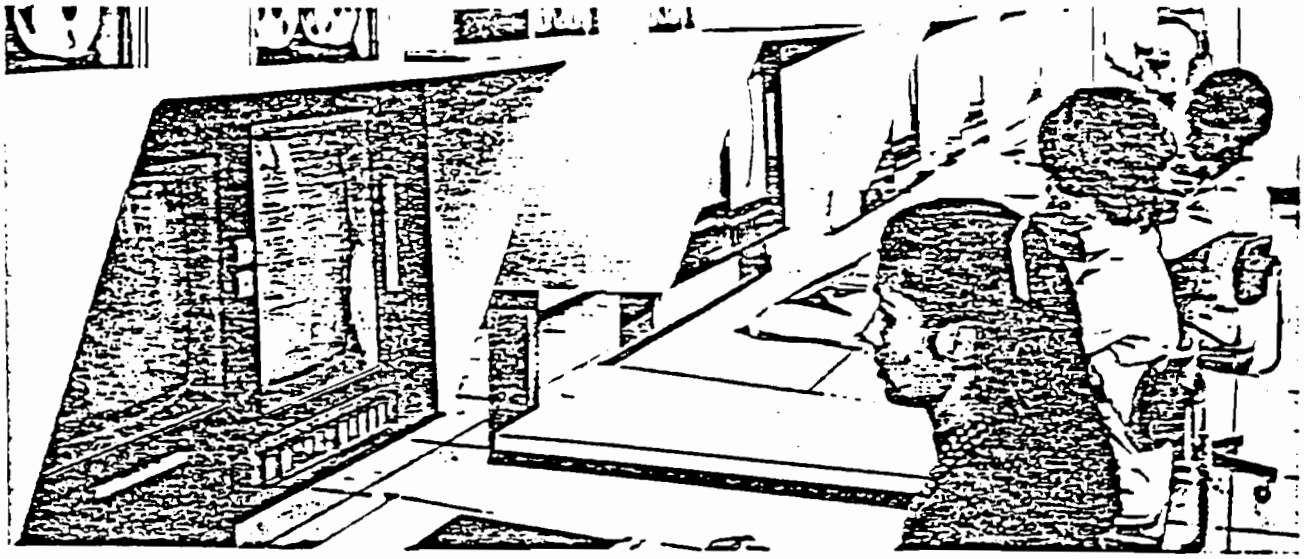
The new Ampex President, William E. Roberts, had arrived at Ampex in August 1961, and indicated a great deal of interest in the international portion of Ampex business. Roberts had been directly responsible for the international operations of his previous company and he knew the world market potential well. His dynamic support of International operations became effective on the date of his arrival.

By 1962, the centralized marketing group in Redwood City was no longer pertinent to the development of the International organization. It was decided then to transfer many of the direct product functions International had maintained to the product divisions or overseas. At the same time, prime responsibility for marketing was assigned to each of three management "areas."

Ralph Endersby was named to head the Western Hemisphere Area. Dr. Peter Axon was named Manager of the EAME (Europe, Africa, Middle East) Area and Lee Cross was appointed Manager of the Far East Area. Western Hemisphere was made up of Canada, and Latin America. Having established three major International areas, these were then broken down into regions. This, of course, resulted in a proliferation of strange names as national companies were formed: Ampex de Mexico, Ampex GMBH in Frankfurt, Ampex SARL in Paris—some two dozen in all (excluding Mandrel).

In the Far East, Lee Cross had been building a network of sales agents throughout the Orient. Ampex Australia was established as an entity and is presently managed by Henry Sacerle, a native Czech and former Tokyo resident. Cross set up headquarters on the island of Hong Kong, and later moved to the present headquarters overlooking the Star Ferry on the Kowloon side.

The three areas concentrated on sales of the complete Ampex product line in their markets.



The first commercial Videofile Information Storage and Retrieval System was installed at the Southern Pacific Railroad Company's San Francisco headquarters in 1968.

The Ampex Story
CHAPTER TEN

Paper Stampede Tamed by Television

by Patrick Murphy

Unveiling the first practical videotape recorder in Chicago created a whirlwind of activity that out-blew the city's own gusty April, kicking up national headlines and hard-dollar orders in the weeks that followed the 1956 Ampex announcement.

But there was something more in the air: the seeds of yet another concept which would itself burst forth as a technological revolution eight years later. It was born with videotape recording, brought to maturity by advanced engineering, and kept alive through that long period by the faith of a few men in the face of doubt and controversy.

The new concept was filing by television.

Today it is embodied in the Videofile* information system, which combines television recording and computer techniques to store visual records as magnetic recordings on video tape. By keypunching a series of letters or numbers, a user may call up a document as an image on a television screen, a printed copy, or both. In 1956, however, it was little more than an idea in a marketing manager's mind.

The idea soon spread to other minds. The marketing manager, Robert A. Miner, was in a free-thinking, pioneering atmosphere. Charles Ginsburg, developer of the first videotape recorder was engineering manager of the same Ampex division. By the time the first VR-1000 was delivered in the summer of 1956, Miner had discussed the idea not only with Ginsburg but with many other technical experts in the company.

Inspiration from Film

The idea was inspired by what had been done with motion picture film in the 1930s. A "motion" picture is really a series of single-frame still pictures. The pictures are run so quickly (commercial movies are shown at 24 frames per second) that the human eye cannot distinguish among the individual frames and sees only the continuation of the picture—motion.

Eastman Kodak engineers developed the idea of using the same film to photograph documents as still pictures, one document in one frame. In this way a library could store a complete issue of the New York Times, for example, one page occupying one frame of film in a tiny roll of film. Because the film is much smaller than film normally used to photograph still pictures, the new method was called microfilm storage.

Recording television pictures on video tape is not exactly the same as frame-by-frame photography on film but Miner saw similarities. Why not focus a television camera on a single document and take one picture, then focus the camera on another document and take another single television picture? The result would be a series of document recordings on video tape—a videotape file.

The Videofile system would save a great amount of space in storing voluminous files, but microfilm already did that. It would make documents viewable in a short time, but so did microfilm.

The key difference between what already was being done with microfilm and what might be done with video tape was flexibility.

Images on microfilm are permanent; they cannot be changed. Thus microfilm files are static. Images on magnetic tape can be permanent too, but they can *also* be changed. A videotape recording may be erased and a new recording put in its place. Or it may be transferred electronically from one part of a tape to another.

A static file might be fine for a library which does not want to change or update the text and newspaper pages on file. But an insurance company

which not only wants to reduce the physical size of its huge files but needs to update those files constantly with new documents must have a dynamic file.

Such operations were stuck with slow, inefficient manual filing methods because there was no micro-file with the flexibility needed for high-speed, automatic handling of visual documents in large, active files.

Now, for the first time, a dynamic micro-filing method was conceivable.

Technical Obstacles

Conceivable did not mean immediately do-able. For the next three years the many technical problems standing in the way of a Videofile system were examined and re-examined by Miner and every engineer whose interest he could capture. During this period many engineers came up with innovative ideas, large and small, which ultimately would help in some way to make the Videofile system practical.

Miner, too, continued his market research into the size of market and identity of likely customers. He also obtained the go-ahead to engage an outside market survey company, whose study agreed with Miner's research in pin-pointing such industries as transportation, insurance, real estate, law enforcement and various government agencies as needing automated micro-filing of visual documents.

In 1959, Miner went a step further. Based on probable cost figures which Robert Markevitch had broken out in a feasibility report, Miner authored the first Videofile system product plan.

The plan made it obvious that developing such a system would cost Ampex many millions of dollars.

Company funds and engineering talent earmarked for advanced development were tied up in vital projects to increase Ampex leadership in broadcast videotape recording. The Videofile project could not be funded although some technical progress was being made. In 1960, an English engineer of widely recognized talents who joined Ampex was assigned to do a deeply technical feasibility study on the Videofile system.

"It was one of the best breaks the project ever received," according to Miner. The engineer crystalized the engineering problem, identifying specifically the technical obstacles that could be overcome only by engineering advancements. Many new techniques—such as single-frame recording control had to be developed to make the Videofile system practical.

The English engineer, Michael Felix, was to become so familiar with the problems through his assignment that five years later he would be named chief engineer of the newly formed Videofile Information Systems Department.

For now, however, without development funds to hurdle the technical problems it appeared the forward motion of the Videofile system dream had been stopped, still behind the line of scrimmage.

Then William E. Roberts came to Ampex as president and chief executive officer. From this, it would later be clear, stemmed the principal force in putting the Videofile system plan on a course to fulfillment.

Not long after Roberts assumed command, Miner was in his office with a slide presentation on Videofile. Roberts talked to many other people about the potential of the system. In 1962 the program funds were provided for a further feasibility study.

The next year brought perhaps the decisive breakthrough. One of the key engineering problems remaining was the lack of sophisticated single-frame recording techniques. In 1963, another English engineer named Norman Bounsall, at the time a video engineer for Ampex International, perfected the EDITEC* unit. This unit gave broadcast television editors frame-by-frame recording control, simplifying tape editing and making animation effects possible.

EDITEC, when applied to Videofile system needs, permitted the one-position manipulation of recorded material that was essential to accurate recording, erasing and replacing of single-frame document recordings.

A practical Videofile system now seemed closer than ever. A formal Videofile system product plan was developed in 1963. Roberts authorized commencing the first step of the product plan—find that key first customer.

Initial Customer

The National Aeronautics and Space Administration (NASA), in Huntsville, Alabama became interested in a system to be used in the storage and retrieval of parts-reliability information. An Ampex team was established with Charlie Steinberg, Bob Miner, Don Rule, Bill Cassell, Charlie Anderson and Norm Bounsall. Steinberg and Miner directed the effort. Don Rule, who was later to become Manager of Marketing Support for the Videofile Division, was responsible for generating the proposal. Bill Cassell who was later to become Contracts Manager for the division was responsible for the contractual matters. Charlie Anderson and Norm Bounsall were responsible for the technical efforts.

Product management responsibility for the system was established through the video and instrumentation division. Named as product manager was an energetic young engineer-manager from New York—Charles A. Steinberg—whose experiences had been in two worlds: the industrial and the academic. Before joining Ampex in 1963, he had held engineering management posts with Airborne Instruments Laboratory and the Bell Telephone Laboratories. At the Massachusetts Institute of Technology, he had obtained his graduate degree, taught electrical engineering courses and conducted research in computer technology.

Steinberg and Miner practically lived in Huntsville through those weeks of working with the customer. You might say we were sweating it out from several viewpoints," he smiled, "the negotiations, the competition, and the Huntsville humidity."

But the perspiration paid off. In June 1964, NASA contracted for the world's first Videofile information system. Eight years after its conception, development of a Videofile system began. Norman Bounsall, developer of the EDITEC system, was named project engineer.

Events accelerated from that point. A demonstration system was built, to use with potential

customers. That same summer, a management group from Southern Pacific Company including the firm's president visited Ampex, viewed a demonstration of the Videofile concept, and early the next year ordered the first system for commercial application.

Roberts, from the start one of the strongest believers in the system's potential for Ampex, increased the funding of what has become more than a $10,000,000 Ampex investment in the Videofile system program. It made possible the development of cameras, tape drives, disc recording techniques, displays and printer equipment specifically designed for document storage and retrieval.

Early in 1965, the Videofile Information Systems Department was formed with Steinberg as manager, Miner as product manager, Bounsall as systems engineering manager, Rule as marketing support manager, Cassell as contracts manager and soon afterward, Felix was brought in as chief engineer. In October, 1968, the department was made a division; Steinberg was named general manager and in January, 1969, elected a corporate vice president.

As the Southern Pacific system took form, the engineering team began to "pay back" the priceless new technology it had previously borrowed from other divisions. An example is the Ampex HS-100 magnetic disc recording system used for slow-motion, color instant replay in sports telecasts. The HS-100 grew out of a disc buffer developed for the Videofile system.

New Marketing Concept

The initial marketing efforts were complex and lengthy. Selling a Videofile information system was not like selling a videotape recorder. It was much more like selling a complete computer system—a system that as yet had not been used anywhere.

"The company or government agency which buys a Videofile system is stepping onto completely new ground in two ways," Steinberg explained. "First, the customer is investing millions of dollars in a system which is as new and complicated as the early computers. Selling a Videofile system requires long periods of application analysis with the customer. It requires, too, the development of a rapport and trust between the salesman and customer to a degree that is not required in many marketing situations.

"Second, the customer will often be the first in his field or industry to use this new, this revolutionary approach, to handling active files. In one sense he has the distinction of being a pioneer; in another sense, he is in a fish-bowl. Everyone else in his field is watching him closely, waiting to judge the wisdom of his innovative step.

"It is still a critical major decision often requiring board of directors or presidential approval for the customer to commit himself to the Videofile system."

More organizations took that "first step" in their respective fields. In the two years following the Southern Pacific order, they included several government agencies, American National Insurance Company, to handle life insurance documents; American Republic Insurance Company, to handle accident and casualty insurance records. Later, the Los Angeles County Sheriff's Department contracted for a county-wide Videofile system enabling outlying Sheriff's stations to file and retrieve any of 18 million police records in the downtown central file as television images. At $5,600,000, the Sheriff's Department contract is the largest single order ever received by Ampex.

These and more were typical of the pioneer users that were sought from the beginning—organizations which recognized that the much-discussed "paper blizzard" inundating the nation's business offices, civilian and government alike, was costing them enormous chunks of money each year.

But how many potential users are there still, in how many fields? And within each of those fields, how many organizations likely to consider following in a pioneer's footsteps? Market surveys done by Ampex and others have identified specific industries and applications. The available figures stagger most imaginations.

In a sweeping market research report, Arthur D. Little, Inc., has said, in effect, that there is an area of potential business for the Videofile system approach which lies like a vast, unsettled continent between computer storage and microfilm files—organizations with filing needs too large and active for microfilm and too visual in nature for a computer's numbers-and-letters storage.

By 1973, the report predicts, that growing market will be worth $700 million, and moving up.

And how high is up for the Videofile system and Ampex?

Roberts predicts that in the next decade, annual Videofile system sales may be as great as the entire corporation's annual sales figure at the end of the 1960s—or about $300 million.

Its applications will be broader, too, according to Steinberg. He pointed to huge central banks of visual data accessible to Videofile system users around the country, or the world. Large Videofile systems will take their place beside large computer systems, the computer storing, retrieving and processing digital data, Videofile storing and retrieving graphic information.

"Within a decade it should be possible for a sheriff's office in Oregon; for example, to ask for and receive, via communications satellite, the television image of a mug shot and fingerprints from a central file in Washington, D. C.—all in seconds and for a cost of a few cents," he said.

The age of doubt and reticence is ended. Buoyed by the hard evidence of reliable system operation under 24 hour-a-day customer use at Southern Pacific, anyone exposed to the Videofile system recognizes that this field is unlike its many more mundane technological brothers. In this field, today's sometimes startling prophesies have an excellent chance of ripening into dramatic fact only a few years out.

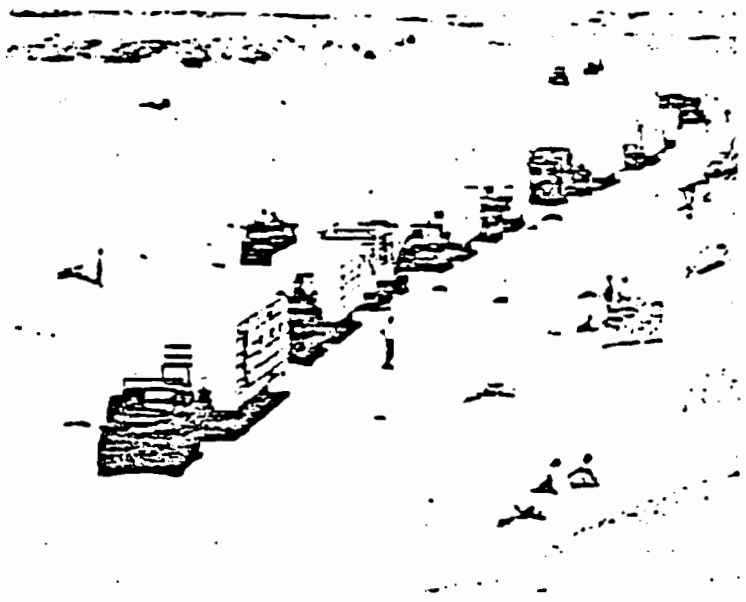
In a 1964 memo of commendation to the Ampex team which contributed to landing the first Videofile system contract, Roberts wrote:

"When we look back, some ten years from today, this could well have been the single most important order that Ampex has written in its history."

For filing by television, the limits of growth have yet to be found.

The Ampex Story
CHAPTER ELEVEN

New Directions Through Merger



Mandrel geophysical crews are at work on land (above) and the seas in search of petroleum. Mandrel electronic color sorting equipment is used by food processors (below) to sort acceptable foodstuffs from substandard products.

In the early 1960s digital computer technology began to revolutionize American industry. Although the full impact of this revolution on petroleum exploration was still some five years in the future, its effects were to be far reaching.

Typically, detection of geologic structures favorable to the accumulation of oil has been accomplished by generating a seismic signal and recording the reflection of this signal from the earth's substrata. From the timing and continuity of these data, the experienced geophysicist can "map" the subsurface structure, and hence recommend suitable drilling sites.

As equipment and techniques became increasingly sophisticated, the geophysicist was able to obtain vastly larger quantities of data for a given area of interest. By the early 1950s, analog magnetic recorders provided a means of conveniently storing these data for subsequent processing with highly specialized analog computers. It is interesting to note that Ampex made a contribution to this advance in geophysics, having provided one of the first practical geophysical analog recorders to Magnolia Petroleum Company's Field Research Group in 1950.

Although analog processing was a definite advance in geophysical data handling, the analog computer was severely limited in the volume of work it could handle and in the variety of analytic techniques it could economically apply to the data.

Thus, in the first half of the 1960s, the geophysical exploration industry began the conversion to digital recording equipment and the development of computer programs for digitally analyzing and processing geophysical data.

It was during this transition period that Mandrel was seeking technological assistance to prepare for the digital era in geophysics. Mandrel's major competitors in this field already were wedded to high-technology companies—Litton and Texas Instruments. To remain competitive, Mandrel required a similar technological base.

From the Ampex point of view, Mandrel represented a substantial foothold in and diversification into two fields foreign to the company's operations—the earth sciences, and automated photoelectric sorting equipment. On October 18, 1963, Mandrel and Ampex agreed to an exchange of Ampex stock for Mandrel stock, with the Houston-

based company becoming a subsidiary of Ampex.

The name "Mandrel" had been adopted in 1956 to symbolize the diversity already built into the company. According to Webster, the word means a core around which other material may be cast, molded or shaped, an appropriate expression for describing what the company was and might become.

Today, Mandrel is a blend of several prior mergers which are represented in its four divisions: the Electric Sorting Machine Division (1931), the oldest; the Ray Geophysical Division (1962), the largest; the Electro-Technical Labs Division (1959), and the Cable & Sensor Division (1968), the newest.

From the point of historical record, the story of Mandrel begins in 1931 in the bean fields of Michigan.

Electric Sorting Machines

The goal of the Electric Sorting Machine Company was to take some of the human effort error and accompanying expense out of the judgement of the quality of Michigan white beans. The company founders, Dave Cox and Alonzo Curtis, saw great potential in applying electro-optical techniques to sorting foods automatically. The first sorting machine developed by the company was put to use in 1936 and used a version of the pinhole camera to scan each bean. The beans passed in front of a tube-like device with a tiny hole on its tip through which light entered. Each bean was viewed by the camera and according to preset levels of acceptable light reflection, it was accepted or rejected from the stream of beans which passed in the camera viewing path.

One early problem in this first version of the automatic food sorter was that beans were often rejected for the shadow the camera cast rather than their own surface reflection. This was eliminated by shortening the viewing tube and adding a simple lens to the camera. This increased the efficiency of the bean "reading" by more than 200 times and made it possible for the machine to match a human's sorting speed—approximately 60 pounds of beans an hour.

The beans were first fed into a hopper where an upright spoked wheel picked them up in small vacuum openings at the end of each spoke. The bean was carried to the 12 o'clock position of the wheel and drawn into the viewing chamber.

Once the beans were placed into the supply hopper, the sorting process became automatic. Depending on the amount of light the bean reflected it was accepted and went on into a preparation or packing area or was rejected from the stream of moving beans into a cull hopper. This first machine could detect only those beans that were too dark in color. Soon advances in the system allowed objects that were too light to be identified and rejected. This optical scanning method is technically known as "monochromatic reflectivity" or more commonly, "brightness selection." The basic concepts in the first ESM machines are used today. Refinements in the methods through which foodstuffs are carried to and from the viewing area and in the viewing process itself have increased the speed of the sorting machines until today, a bean sorter processes 700 pounds per hour compared to the 1936 rate of only one pound of beans a minute.

Reading Color

The Electric Sorting Machine Company continued with its basic machine applying it to foods such as nuts and other varieties of beans until 1942. It was at this time that the brightness barrier was broken. ESM's initial bean sorter and subsequent machines were limited to determining the brightness of the objects processed and could not distinguish hue. This confined the machine to limited use in the food industry. It was in 1942 that ESM began production of an electro-mechanical sorter which could read the color of foodstuffs. The food product was inspected by four phototubes, two with red filters, two with blue. Using oscilloscopes, the phototubes register the color of the product as a two-axis resultant on the oscilloscope screen. Special color masks fitted to the scopes prevent registration of acceptable standards but allow a dot to appear when a product that does not meet color acceptability passes the phototubes. An ejection signal is then relayed to the phototube telling it to "get rid of that one." Because of the oscilloscope masks, new criteria for judging can be established simply by changing the mask, allowing different kinds of products to be handled by the same sorter.

The sorter remained limited to small food items like beans, peas, nuts, etc. until 1952 when a larger sorter was developed to allow the handling of lemons and other similar size foodstuffs. In 1959, further advances resulted in the introduction by Mandrel of a sorter which, for the first time, made possible the sorting of wet food products and fresh fruits and vegetables. This equipment added efficiency and speed to the handling of potato cubes, cherries, olives, cocktail onions and diced apples. Products could be washed, peeled and diced, then sorted to eliminate cubes with blemishes or remaining skins. By this time, Mandrel had formed a company, ELEXSO Corporation, to handle sales abroad, and had established manufacturing sales and service activities in Canada and France.

At the time Ampex acquired Mandrel Industries, Inc. in 1963, the Electric Sorting Machine Division of the company had refined its products in size and capability, offering machines that could distinguish color and could handle foodstuffs ranging in size from grains to lemons. Improvements in conveyance methods, which occurred shortly after the acquisition, allowed Mandrel to introduce a system capable of handling large products such as whole peeled potatoes. This sophisticated equipment uses nine scanning eyes to view whole potatoes. Another machine under development at this time perfected the handling of cylindrical objects such as cans. By premarking the cans with black bands at given heights, a mixed batch of canned goods such as fruits and vegetables which require similar cooking time can go into cookers at the same time and then be sorted after cooking.

Throughout this build-up of marketing organization it became increasingly evident that to be truly competitive in international markets Ampex would have to manufacture in the markets it served.

Manufacturing Abroad

In August 1959, the first products to be manufactured outside the United States were produced at the plant at Reading, England. Production began with instrumentation recorders. A gradual build-up of capability at the British plant continued until, today, audio, computer, instrumentation and broadcast video products are manufactured at Reading. The early prediction that Ampex would force itself out of international competition if it continued to rely solely on U.S.-manufactured products for overseas markets soon proved to be fact.

At this time Ampex was beginning to feel the first pressure in overseas markets from competitor companies who had the benefit of European and Far Eastern manufacturing operations.

The first Ampex parts and service center was opened in 1962 at Boeblingen, Germany, to serve customers in Europe, North Africa, and the Middle East. Later, the Boeblingen facility was modernized and expanded to include a customer training workshop in closed circuit television products and service techniques.

Mandrel Broadens Scope

When Mandrel Industries, Inc., was merged into Ampex in 1963 its products and services brought with them much broader penetration in international markets and increased Ampex revenues from sales abroad. Mandrel, a major geophysical contractor and manufacturer of geophysical equipment and electro-mechanical color sorting machinery, had a well-etsablished position in world markets. More on this Ampex subsidiary in a future chapter.

In 1963, Ampex announced that it would begin construction on an addition to the Reading plant which would more than double the capacity of the British manufacturing facility. At the same time, plans were announced for another European plant in Nivelles, Belgium, to manufacture instrumentation and computer equipment to serve the Common Market. The Nivelles plant was officially opened in 1965 and in 1967 it was expanded to allow for production of audio and video products. Video products such as the VR-2000 are assembled from kits provided by the Redwood City manufacturing activity.

Japan had long represented lucrative opportunities for sales of video and computer equipment. But this country also offered some special obstacles. Between 1956 and 1960 some 40 video tape recorders had been delivered to Japanese television stations. At this time, the country's Ministry of Industry and Trade (MITI) placed an embargo on the import of video equipment. This embargo was not lifted until two important points could be resolved. First, in September 1964, a joint venture agreement with Toshiba (Tokyo-Shibaura Electric Company) was validated by the Japanese Government. Toshiba is to Japan as General Electric is to the U.S. This new company was to produce video and computer products. And, second, Ampex granted license rights to its patents covering video tape recording techniques to several Japanese companies. The result of the joint manufacturing agreement is Toamco (Toshiba-Ampex K.K.). Toamco shared a portion of a Toshiba building in Kawasaki, Japan. In 1968, Toamco purchased four acres of land near Yokohama to construct and occupy a facility of its own to house its employees and activities. By that time, Toamco employment had grown to more than 200.

In 1961, a core memory stack production plant in Hong Kong called Ferrotec, Ltd., was established to augment the production of the Computer Products Division in Culver City, California, as an overseas arm of that plant. Expanding demand for cores and arrays led to an expansion of the Hong Kong plant in May 1965, which more than doubled manufacturing capacity to meet the growing needs for core products.

Manufacturing in Canada

The first manufacturing in Canada began in 1967 with three lines of audio recorders for home use. The decision to manufacture in Canada was promoted by the high import tariffs on recording products. By 1968, Ampex of Canada had added closed circuit video recorders to its manufacturing capability. Shortly thereafter, the Canadian government dropped its import duties on recording products almost one-half, making its economically unrealistic to continue Canadian manufacturing when these products could be supplied easily from the U.S. It was decided to discontinue the Canadian manufacture of recording products in March 1968. Fortunately, Ampex had identified the growing market for pre-recorded music in Canada and quickly substituted a Canadian Ampex Stereo Tapes duplication center allowing Ampex to maintain the key employees who had been involved in the initial manufacturing venture. Presently, some 50 people are involved in the CAST activity and the duplication center has plans for continued expansion as the pre-recorded tape market in Canada increases.

Ampex of Canada also maintains a highly effective special products group within its organization to handle product modifications and the design and construction of complete television studios and mobile vans. Recent projects of the special products group have been a $1,300,000 complete mobile television production facility and special mobile units to house the HS-100 variable speed disc recorder.

This international manufacturing expansion was conducted under the direction of Olerich, Andy Andersen, and James Walsh. Andersen went to Nivelles, Belgium, in 1963 to oversee the construction and start-up of the plant there and was promoted to Manufacturing Director of the EAME area in 1965 with responsibility for all manufacturing operations in this area. In 1966, Andersen returned to the United States as Manufacturing Operations Manager for the Computer Products Division headquartered in Culver City, California. On Andersen's

return to the U.S.. James Walsh, formerly Manufacturing Manager on Olerich's headquarters staff, was named Manufacturing Director for EAME. Robert Weismann, Ampex Vice President and formerly Manager of the Instrumentation Division, replaced Walsh on the International headquarters staff.

Following Dr. Axon's resignation in 1968, Walsh was named EAME Area Manager. In August 1969, Walsh resigned the post, and Andersen returned to England as Area Manager of EAME.

In March of 1969, construction and occupancy of a 40,000-square-foot plant in Tao-Yuan, Taiwan, was complete. The Taiwan plant will initially manufacture sub-assemblies for tape memory systems for the Computer Products Division and sub-assemblies for consumer video products.

Also in 1969, the Magnetic Tape Division announced plans for the construction of an 80,000-square-foot facility in Battice, Belgium, which will furnish international markets with Ampex recording tape.

Because of economics, many of the parts and materials used to construct products abroad are purchased from sources within the country in which the plant is located. However, the overseas plants continue to rely on domestic plants for engineering designs and some of the more sophisticated parts and sub-assemblies.

International Employment Grows

Today, Ampex has more than 3,000 people (excluding Mandrel personnel) employed outside of the United States and less than one percent of these employees are American. The company prefers, wherever possible, to hire and train nationals to conduct the company's business abroad.

International Division sales have grown at a faster rate than the domestic operations of the company and when combined with Mandrel revenue abroad represented 28 percent of the total Ampex income in Fiscal Year 1969. The rapid expansion has been attributed to the increased concentration on sales, service and manufacturing within the international markets themselves. The latest arms of the International Division are Electronica Ampex Argentina, S.P., and a company in South Africa.

For the International Division, history is yesterday. There is no pause in the growth and development of the Ampex organization which serves the countries of the United States, and no logical point where a neat knot can be tied and one can say this is Ampex International. Under Bill Olerich, the Ampex International organization has remained malleable and ready to meet the changing needs of the customers and the corporation in Ampex markets abroad.