"Motion Picture Technology — From the Past to the Future"

Keynote Address by Petro Vlahos, March 21, 1997

First Annual SMPTE Spring Film Conference, Los Angeles, Calif.

Mr. Chairman, Ladies, and Gentlemen: When Ed DiGiulio asked me to be your keynote speaker, I said, "Surely you can find someone better qualified."

"No," he said, "We want you."

I asked, "Well, what do you want me to talk about?"

He said, "The theme is 'Motion Picture Technology, Past, Present, and Future,' so talk about that."

"Ed! I can't talk about motion picture technology past, present, and future in 20 minutes!"

He said, "Well — take 25."

So let's consider my predictions for the future ... I have made predictions in the past. For example, I was in New York when color television was first being demonstrated. I called my wife and told her about it. I said color will never take hold. There aren't any stations broadcasting in color, so who wants to buy a color set? Without color sets, who wants to broadcast in color? And besides, the image quality is inferior.

When I first started the Ultimatte Corp., I said to my son Paul (known to many of you), "Paul, I believe there is a world market for our Ultimatte compositing devices for about 20 units." We passed 20, then 200, then 2,000, and we're still expanding. From time to time, Paul reminds me of this prediction.

I also told Paul that when the Dow Jones reached 4,000, the stock market would collapse. Well it didn't collapse at 4,000, or 5,000, or 6,000, or 7,000.

In view of my past record of predicting the future, I'm now certain that I have no talent in this area. And what value would you place on any prediction I might make today? We are all pretty much aware of today's state of the art, except for the new technology being developed in various research departments. Of course, I'm not privy to this information, except for the exciting new technology being developed at Ultimatte. I wanted to tell you about it, but they keep saying, "Not now, not until all of the patents are filed." That takes care of the future and the present.

If we look into the past, I must confess that I may know less than you since I'm not much of a historian. However, a great many things have happened since I began my engineering career in 1941. I want to touch on three events that occurred many years ago which may be of interest. Obviously, there is very little I can teach one in his own field, although I have done so occasionally. Also, it's very unlikely that I'll say anything that will change your life, or lift your spirits, although on some occasions I have made people feel better, or sometimes worse, but that was not my objective.

I joined the Motion Picture Research Council in 1946, as its assistant manager. The Research Council consisted of Mr. Kelly, myself, and two very competent girls; our secretary and our accountant. The Research Council was based on the premise that the studios would cooperate in technology and freely exchange technical information; we were to assist in this exchange. This was done through monthly meetings of committees consisting of the department heads of the sound, camera, electrical, and other departments.

I had three jobs. First, to attend these meetings and write the minutes. Second, to order, calibrate, and ship test films. And third, to visit member company studios and examine production methods. This was the job I liked best. The purpose of examining production was that, with my engineering background, I might notice something that could be discussed by one of the committees.

The first thing I noticed was that all the pretty girls on the lot smiled at me. But it didn't take long for me to realize they weren't smiling at me, but at a young man in a suit and tie who just might be a studio executive or someone equally important. So I smiled back, politely, but kept right on walking.

One day I visited a set at Warner Brothers that filled the entire stage. It appeared to be the great room of a castle. There were knights and noblemen in their fancy clothes and women in long gowns. Tapestries lined the walls. Up in the catwalks near the ceiling, the full length of the stage on both sides was lined with Brute arc lamps. I believe there were a total of 20 lamps.

At the start of each take, Karl Freund, the cinematographer, would call for lights, and these twenty lamps would strike their arcs. At least one, and sometimes two or three of the arcs would flicker wildly and emit a loud high-pitched wailing scream. There was nothing to do but wait one, two, or three minutes for the carbon arc to quiet down and stabilize. By the end of the day, Karl was totally frustrated by these delays.

I introduced myself and said I'd look into the problem with the arc lamps. He thanked me, and I'm sure he thought I was at least well-meaning and sympathetic. I called Max Hankins, chief engineer at Mole-Richardson, and said I'd like to come over and talk about the noise and flicker problem on the Brute lamp. When I got there Max had a lamp set up, and also had the National Carbon man present. I learned that the arc was struck by bringing the two carbons together momentarily.

This action sometimes caused the end of the carbon to shatter and sometimes form an inch-long crack. It was the hot gases escaping through this crack that caused the high-pitched screaming sound. National Carbon

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Text of the keynote address presented by Petro Vlahos on March 21, 1997, during the First Annual SMPTE Spring Film Conference and Exhibit held in Los Angeles, Calif. Petro Vlahos is retired from the Ultimatte Corp.

was about to do some research to try to improve the carbon.

Since the lamp was set up, I asked if I could examine it. The Brute arc was a marvel of engineering. The positive carbon was about 1/2-in. in diameter, and about 18 in. long. It was mounted horizontally and slowly rotated and advanced as the carbon was burned. The negative rod was smaller and set at an angle below the positive. There was a small screen on the side of the lamp onto which an image of the arc appeared. This screen was marked to show the proper position of the ends of these two carbons.

With the power off, I moved the starting lever to observe its action. I noticed that the negative carbon moved up to touch the positive carbon about 1/8-in. from its tip. I realized that when these two carbons touched to ignite the arc, the point of contact would go from room temperature to 6000 degrees Kelvin instantly. By definition, this is an explosion. At contact, the inrush current of 450 amperes can shatter the end of the carbon, and likely cause it to split.

I turned the small crank that positions the positive carbon and found that two turns counterclockwise caused the negative carbon to touch the positive at its very end. Believing I'd discovered something, I called out to Max to turn on the power. I wanted to strike that arc, and I did, about 30 times. In every case the lamp was stable and ready in about two seconds.

We all agreed that there was no need to modify the lamp, nor to improve the carbon. All one needed to do was turn the crank two turns counterclockwise before striking the arc, then immediately return it to its proper burning position. I was to notify our member companies of our results. Here's where one's youth and ignorance can dampen one's enthusiasm.

I called the head of the electrical department at Warner Brothers and asked him to set up a Brute arc and have his operators on hand for a demonstration. I arrived at the appointed time and gave a short description of the effects of rapid thermal expansion to a group of about 19 skeptical lamp operators. I said while demonstrating, "All you need to do is turn the crank two turns back, strike the arc, and turn the crank two turns forward. Notice that the arc is stable and ready immediately."

There were several smiles, and I was asked to do it again, which I did. They knew one could strike an arc sometimes as many as 10 or 12 times without a problem. So they kept saying, "Do it again. Do it again. Do it again." After about 15 strikes, four of the men slowly turned and walked away. The rest kept saying, "Do it again."

By twos and threes they turned and walked away as the number of strikes increased. Finally, only two men were left, and by now the arc had been struck at least 30 times. They looked at each other for a few moments in silence then turned and walked away. I was left standing alongside the lamp, all by myself. No one said anything, not even thank you. I shut off the arc and drove back to the office. I decided to inform all the other studios by writing a bulletin.

I don't believe I made those operators feel better. I made my boss, Mr. Kelly, very unhappy. We weren't the ones who were supposed to solve problems. We were supposed to write minutes. Other people and organizations were supposed to solve problems. I had created a problem for Mr. Kelly because studios might now look to us to solve other problems, and all we had in the way of facilities was an office desk. Actually, that's all I needed for solving a large number of problems. Cinematographer Karl Freund was very happy with me. He took me to lunch, and introduced me to Clark Gable, who was sitting at the next table.

One day I got a call from Watty Watson of Universal. He said he had received complaints about the sound in one of his review rooms. His engineers could find nothing wrong, and he wanted me to come out and have a look. I made all the same tests — frequency response, acoustic decay time, flutter — and also found nothing wrong with the sound system. As I sat in this room trying to understand the source of the complaints, I began to notice that I felt a little depressed. Was it because I had failed to find the problem? Then I noticed the worn carpet, the worn seating, the dark and dreary walls. I concluded that this was a depressing room.

I wrote Watty a memo about my test and about the room ambience. Some months later I received a call from Watty. He had acted on my suggestion and had the art department redo the whole room. He said this was now the most requested of his review rooms, and there were no complaints about the sound.

One day I got a call from Doug Shearer at MGM. He said, "Pete, you did a great job developing the sodium matte system for Disney, and I hope you can do something for us. You see, we're making a picture called *Ben Hur* in 70mm. We can't use your sodium system because there are no 70mm dual film cameras. We know that the matte shots in Paramount's *Ten Commandments* delayed the release of the picture by seven months while three shifts worked around the clock trying to assemble the matte shots. Even then they were of poor quality. We expect to have the same problem and have budgeted $1.2 million for the matte work. Can you develop something for us?" I said I would try.

My office was on the top floor of the Taft Building at Hollywood and Vine. My window faced north, giving me a perfect view of the Hollywood sign up on the hillside. For the next six months I sat back in my chair, feet propped up, and stared at that sign.

What I am about to describe involves a little film technology. If I lose you, be patient, this part lasts only a minute or two. With only one film in the camera, there was no choice but to use a bluescreen as the backing. There was little point in actually making film tests before I had something to test. In my mind I could expose the color negative to a color chart, and examine the colors as they would have appeared on the negative, with blue, green, and red becoming yellow, magenta, and cyan.

I mentally made black and white separations, and observed the densities on those separations. The red and green separations were black in the blue backing area, which was ideal because they could print directly to the color negative with very little cover matte. The blue separation was the problem. It was clear in the blue backing area. One had to manually make a dense matte to cover all of this

clear area. This matte never truly fit the subject.

Month after month I would mentally generate mattes and observe the results, which were always unsatisfactory. I no longer needed to use the blackboard. It was now imprinted in my mind.

Whenever there was any cross-screen motion, the edge of the subject would blur and be semitransparent. One would see the blur of a rapidly moving hand and also see through the blurred hand to the blue backing behind it. After six months I concluded that no satisfactory matte could ever be made to cover the blue separation in the area of a blurred subject, because the backing and the subject occupied the same area. This meant the blue separation could not be used in compositing. This was a major turning point. Looking back, I can't believe it took me six months to come to this conclusion!

Being limited to the green and red separations, one could print the green separation twice, once with green light and once with blue light. Just how bad could this be? All shades of gray, including black and white, would be properly reproduced, as well as the colors red, cyan, and flesh tones. The only problem was that yellow would become white, and green would become cyan. I didn't consider this to be a serious problem since one could simply exclude these colors from the wardrobe. At this point I began to feel a little excitement. Now if I could only get a little more density on the green separation for green and yellow objects, I would have an ideal substitute for the blue separation.

It took me a week to realize that the blue record on the color negative and the green separation positive were simultaneously clear to blue light only in areas occupied by green and yellow objects. By putting the green separation on top of the color negative and printing with blue light onto black and white film, I would have recorded their color difference. And what would this color difference film look like? It would be a perfectly clear film except for little areas of density where objects were yellow or green. By superimposing this color difference film over the green separation, one could synthesize a perfect blue separation in the subject area, but with the blue backing area being black instead of clear. Now all three separations had a black background and the problem was solved.

I called Doug Shearer: "Mr. Shearer, I have developed a new blue screen traveling matte system that can be used with a single color negative, in any camera. There is no blue leakage even on rapid cross-screen motion, or when reproducing smoke and other semitransparent objects. Furthermore, the mattes are low gamma and noncritical. Other than the color of the backing, there are no restrictions on the use of foreground colors. This system is better than sodium because you can paint the floor blue and get the person fully into the background scene. It uses your present lamps without need for any filters. It is about as ideal as you could have hoped for." Talk about self-confidence! I added, "Of course it's only on paper, so we need to make a test."

I showed up the next day at the MGM matte department. There I met Bob Hoag, who was a little amused that I was going to teach him something about traveling mattes. We went out onto the blue stage where Glenn Ford was making a western. "Glenn, come on over and sit on this stool, we want to make a test. And by the way, light up a cigar and blow some smoke."

A few days later I went back to view the tests. There was Glenn on the screen blowing smoke which you could see through, and not a hint of blue backing anywhere. And there was Bob Hoag with a pleased look on his face. Bob called me about two weeks later with a touch of excitement in his voice. He said, "I spliced together all 17 of our *Ben Hur* bluescreen shots and just ran them through as a test, hoping one or two would be acceptable. When the management saw them, they said, "Don't touch them, don't change a thing, these are the best we've ever seen, put them in the picture as is."

I felt very good. Bob Hoag became quite friendly. Doug Shearer was extremely pleased. And I think MGM was happy to save the $1.2 million. You can see why I love being in this business. It's challenging, rewarding, and it's fun. But there's another important reason.

When I was about 12, my mother would take me to church. Each Sunday the preacher would shout that we were all sinners and would burn in hell forever unless we would repent of our sins and seek forgiveness. I couldn't remember committing any sins, and I wasn't really sure what a sin was. So I walked home from church feeling guilty and depressed.

But on Saturday afternoons I went to the movies. Often a western movie would be playing. The good guys were honest, rational, knowledgeable, resourceful, self-confident, creative, courageous, and had no inclination to harm their fellow man. They exhibited an image of man as he could be and should be. They usually wore white hats.

I also remember being thrilled by the singing of Jeanette MacDonald and Nelson Eddy. I would leave the theater, spirit uplifted, and walking on air. The movies of that era had a major impact in forming my character. The characters in those movies were role models.

About 20 years ago Gene Roddenberry created the "Star Trek" series, which was very popular. I heard William Shatner being interviewed on television, and he was asked why "Star Trek" was so popular. He said, "I have no idea." If I could meet him I would answer that question. It was because Captain Kirk and his crew exhibited a view of a man as he could be and should be: honest, rational, knowledgeable, resourceful, self-confident, creative, courageous, and with no inclination to harm his fellow man.

So where are all the men in white hats today? Being rational, many gravitate to science and engineering. It's only the rational that can succeed in a field that requires rational thinking. *You* are the men in white hats. Associating with such men and women is the other reason I enjoy working in this industry.