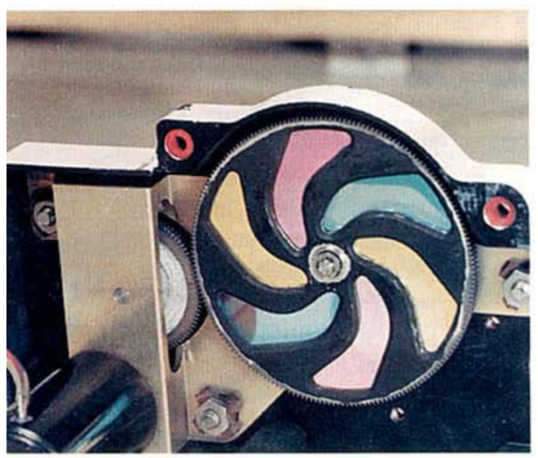
The Color War Goes to the Moon

BY STANLEY LEBAR

IN THE WINTER 1997 ISSUE OF THIS MAGAZINE, DAVID E. AND Marshall Jon Fisher chronicled the take-no-prisoners battle over whose technology would define color television, CBS's mechanical system or RCA's electronic one. Peter Goldmark of CBS finally conceded defeat to David Sarnoff and a triumphant RCA in 1953, but the story doesn't end there. I was one of a small group of dedicated Westinghouse engineers who inadvertently opened the old wounds more than a decade later. We had to pick a system for NASA's Apollo Television Camera Program. We ended up going with the vanquished CBS approach—and winning an Emmy for the outstanding technical achievement in television for 1969.

AS A SOLDIER in the conflict recalls, it wasn't all over yet when RCA's color TV system defeated CBS's to become the industry standard

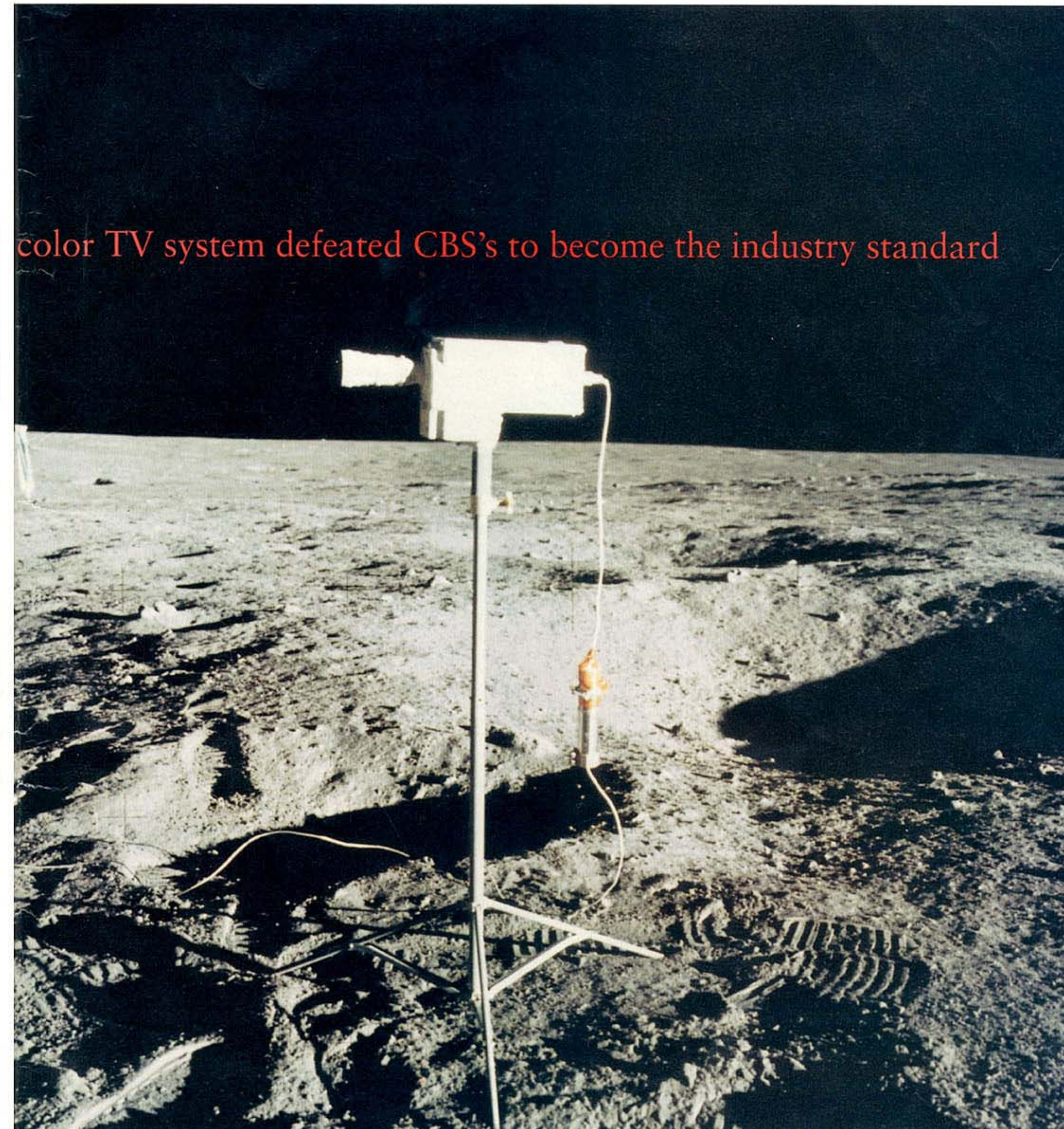


In the color camera that went to the moon, a 3.5-inch disk rotated ten times a second, scanning the image through red, green, and yellow filters. Back on earth, the components were combined into a regular television signal.

In 1964 Westinghouse won a competition to be the developer of a small black-and-white TV camera for astronauts to use in Apollo spacecraft and on the moon. In 1969 that camera recorded one of history's most exciting moments as the astronaut Neil Armstrong stepped onto the moon. For me, as the Apollo TV program manager, the thrill was a double one, for I had spent the preceding five years having a recurring nightmare in which the whole world stared at its television sets and no image ever appeared. I can hardly express the elation I felt seeing that first beautiful fuzzy transmission from the moon.

NASA had ensured in 1960 that the image would be fuzzy by allocating only a 700-kilohertz bandwidth for the signal and imposing other technical limitations. We realized early on that low-resolution black-and-white TV would do for that first lunar exploration but would not satisfy the needs of the program and scientists on future missions. NASA was going to need color TV in space too. In 1968, a year before *Apollo 11*, we set out to define a color camera system that would be small, portable, simple to use, and able to withstand the moon's extreme environment.

AS IN THE 1950S, THERE WERE BASICALLY TWO OPTIONS. We would have to use either the now-industry-standard NTSC system that RCA had established (so called for the National Television System Committee), which split and recombined the colors in an image electronically, or the CBS system, which used a spinning wheel to do the same jobs mechanically. Because of the problems of making the old CBS system compatible with NTSC, our initial choice was to go with the latter. But a detailed review of the NTSC camera design, with its multiple tubes and precision alignments of lenses and mirrors, made it questionable for use on the lunar surface. The large broadcast-studio color cameras of the time could work only in controlled, benign environments; taking that delicate technology to the moon would involve myriad unknown risks. Also, the best NTSC camera we could make would likely



The camera was first used on the lunar surface during Apollo 12. Forty-four minutes into the initial broadcast, an astronaut pointed it at the sun, burning out its image tube and rendering it useless.

LEFT: COURTESY OF THE AUTHOR; OPPOSITE PAGE: NASA

be very large and heavy, not the small, low-powered device NASA was demanding.

The CBS sequential-color-wheel system, on the other hand, could offer small size, low power, and rugged single-tube construction, all of which we needed. If we could find a way to make it compatible with NTSC once its signal was received on earth, we'd have the best of both worlds.

The compatibility problem had stymied Peter Goldmark in 1950. No existing black-and-white TV could have received his color broadcasts. As the Westinghouse program manager for the new project I outlined the challenge to Westinghouse's research engineers, and they came up with a conversion system. They used the latest magnetic devices to store the transmitted sequential color fields (red, green, and blue) received at NASA and then electronically converted them into the simultaneous commercial broadcast signal used by the networks.

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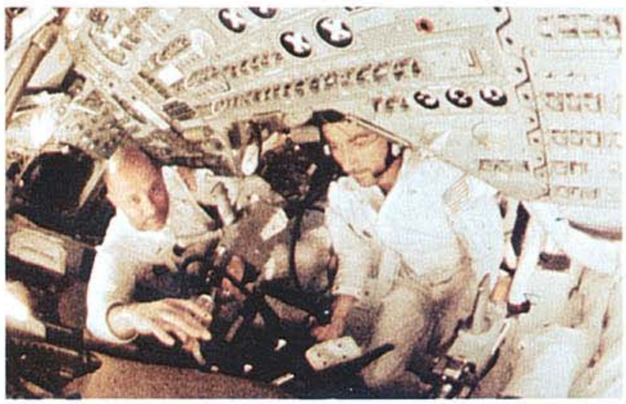

Top: Eugene Cernan inside the *Apollo 10* command module. Above: Tom Stafford and John Young on the same mission. Both shots are from the Westinghouse camera.

IN OTHER WORDS, WE WERE USING CUTTING-EDGE technology to revive a broadcast system pronounced mortally obsolete a decade and a half before. That obsolete system allowed us to build a color camera that was small, light, low-powered, and capable of working in dim, lunar light. Now we truly did have the best of both worlds. By early 1969 we had built and tested a camera, and our research engineers were working with NASA to implement the conversion system. We got Tom Stafford, commander of *Apollo 10*, to try out the system eight weeks before that mission orbited the moon. He liked it enough to say that if we could have the camera space-tested in time, he'd get it on board. We did and he did.

Apollo 10's color imagery got a thumbs-up from NASA, the public, and the television industry, so we knew that color TV from space had arrived. The camera traveled to the moon with *Apollo 11*, and though it was not used on the moon walk, it did transmit from inside the command module and give a color tour of the lunar excursion module. From *Apollo 12* on, the camera ventured out onto the moon itself.

RCA, which had made its name synonymous with color TV technology, could hardly sit by while Westinghouse broadcast the first TV from the moon and used a CBS type of color camera. RCA had provided an unsolicited proposal to NASA for an NTSC color camera for the moon, but as we had expected, the device would have had to be too large, heavy, and unwieldy for lunar-mission use. With solid-state camera sensors just beginning to be developed, time was against RCA to get one of its color cameras on an Apollo flight.

A camera designed and built by RCA did finally make it to the moon with *Apollo 15*, in 1971. But it wasn't an NTSC camera; it was what the company called an RCA Sequential Color Wheel System. David Sarnoff's son and successor, Robert, had cashed in all his chips to get the RCA logo on the moon. The camera performed extremely well, and it did RCA proud, but public interest in Apollo missions had waned by then, and whatever public relations battle Sarnoff was fighting he had already lost in the earlier Apollo flights. The Apollo experience was undoubtedly a frustrating one for Sarnoff, especially since Westinghouse went on to provide the cameras for Skylab and the joint U.S.-Soviet Apollo-Soyuz venture.

As for Peter Goldmark and CBS, they had finally beaten out their nemesis, RCA, and that should have felt good. But it didn't. Goldmark himself was but a footnote, not a major player, in what became the most successful use of sequential-color-wheel technology in the history of television. He and his company were given credit for the basic concept in all the press releases, but he cannot have enjoyed standing on the sidelines through it all.

So in a way Peter Goldmark and David Sarnoff both lost the final battle in their color war. But by then they both had also left an indelible imprint on an industry that has become part of the lives of everyone the world over. ★

Stanley Lebar retired from an engineering career with Westinghouse in 1988.

BOTH: NASA