CRAWFORD H. GREENEWALT'S BIRD PHOTOGRAPHY

By

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I have been photographing birds for many years, at first relying on natural available light and, to avoid blurred images, waiting for moments when the birds were not moving. With the invention of flash bulbs that could be synchronized with the camera shutter, it became possible to increase greatly the illumination of closeup subjects - birds at their nests - and thus permit the use of much smaller lens apertures to improve definition and increase depth of field. Blurring of active subjects was not, however, significantly reduced since exposure times were still determined by shutter speeds usually not faster than 1/200 of a second.

In 1941 stroboscopic photography was developed by Harold Edgerton at M.I.T. Stopped motion pictures of his were published of such fast moving events as a bullet smashing a light bulb, splashing water, and a golfer making a drive, which revealed details of action not perceivable visually. But what especially attracted my attention was a color photograph of a Ruby-throated Hummingbird hovering before a flower. This was not a studio study, it had been made under natural outdoor

conditions. Here was a technique that could be adapted to bird photography in general. I wrote to Edgerton and he very generously supplied me with directions for building a portable strobe and with the addresses of suppliers of necessary components.

I built the equipment but since its light output was much less than from flash bulbs, I got little use out of it. Soon after this disappointment I heard about Strobo Research in Milwaukee, a firm that would custom build electronic flash equipment. I got them to build for me an outfit that delivered 1000 watt-sec. of power at 1/5000 seconds. With this light output I was able to photograph birds in motion at the smallest lens apertures. Powered by a 6 volt storage battery the unit consisted of a bank of capacitors, vacuum tube circuitry requiring frequent replacement of parts and three flash tubes. The equipment was very heavy and not easily portable. Most of the photographs I obtained with this equipment were rather static because I could not react fast enough to trigger the shutter manually at the precise second when the birds were alighting or taking off. I consulted Strobo Research about this problem and they came up with a device to trigger the shutter photoelectrically. The arrangement was to set up crossed light beams which when interrupted simultaneously at the point of intersection would trigger the flash. A bird flying through this point would automatically take its own picture. The

equipment was cumbersome but it worked.

After working with this strobe unit for several years, I sought more portable and more trouble-free equipment. The American Speedlight Corporation designed a system made up of three transistorized power packs that could be used singly or connected together when the total output was equal to the Strobo Research unit. Being in three parts, it was more portable and the solid state circuitry was less subject to failure than vacuum tubes.

Sometime in 1954 I must have seen for the first time and was much impressed by the bird photography of Crawford Greenewalt, president of Du Pont. I don't recall the exact circumstances of the occasion, but I sent him a color print of a painted bunting that I had photographed that same year in Florida. In his friendly reply of December 27 thanking me for the print, he went on to tell me that by an amazing coincidence he was going to Florida in January to photograph the same bird. He reciprocated by sending me a Mockingbird photograph he had made in Delaware, and said that he was doing more flight pictures than any other kind. He had persuaded Harold Edgerton to design a special flash unit for him to pursue what he termed a frustrating occupation because of the necessity for compromising between flash duration and light output.

Our correspondence was not resumed until 1960 when Greenwalt's celebrated book on Hummingbirds was published by

Doubleday for the American Museum of Natural History. I bought a copy immediately and wrote to him in December, "I have recently acquired your beautiful and amazing book on hummingbirds. Everybody I know, and I too, consider it a great contribution to ornithology and to the art of bird photography. You have certainly mastered in an extraordinarily short period of time the technique of photographing this very interesting group of birds." In the last chapter on Methods and Equipment, Greenewalt gave only a sketchy description of his apparatus because he felt that most readers would be deterred from pursuing these birds with the hundreds of pounds of gear he considered necessary for best results. Being one of those undeterred by the weight of the equipment, I sent him a brief outline of mine and asked if he would be willing to supply me with a more detailed description of his.

A few days later I received a five page reply in which he offered to help me in any way he could, included a reprint from a National Geographic Magazine article he had written on hummingbird photography with photographs of his setups; and he gave a lengthy description of all features of the equipment including details of his motor driven Hasselblad camera, and ended his letter with this most generous suggestion. "I might add also that a little conversation is worth dozens of letters and if you have any plans at all to be in the east, let me

know and I can show you not only everything I have, but what is probably better, I can introduce you to the extremely competent electronics people who have developed my equipment for me. If, on the other hand, you would like to look at the wiring diagrams, say the word and I will send them along."

The part of his letter describing equipment that interested me most was about the photocell triggering device which seemed to me was just what I needed to replace my cumbersome crossed beam gadget. I was puzzled, however, by the Geographic picture that showed no activator light for the photocell. Where was it and what was it like? I wrote Greenewalt again in January thanking him for his very kind letter and as a token of my appreciation for all the trouble he was taking on my behalf sent him a photograph of Red-faced Warblers I had made in Arizona. I told him that I was planning to be in the east in the spring and would like very much to come down to Wilmington to see his equipment. I also mentioned my puzzlement about the activation of his photocell and described briefly the difficulties I was having with crossed beams.

Greenewalt responded almost immediately, first telling me where he had the color reproductions made for his Hummingbird book, which I had asked him about because at that time I was trying to find a publisher for my Thoreau book. Then he took up my query about photocell triggering. His photocell is so sensitive, placed in the end of a narrow tube blackened inside

that it needed no activator light. Outdoors pointed towards the sky, it would respond to a bird flying above it. To activate the cell on cloudy days or indoors, he used a small flashlight designed to produce a thin collimated beam of light. Crossed beams he found were never really necessary, serving only to complicate the setup; by intelligent placing of the cell and light one beam was sufficient. Since I was planning to come east, he suggested the weekend of April 15 as a time most convenient for him and then he proposed that it might be best for me to experiment with his equipment before we met, and would send me his device to try out. If I found it suitable for my purpose and would like to have similar equipment, he was sure his technician would be willing to make one for me.

Naturally I was delighted by his offer and accepted right away. He sent off the equipment promptly with full instructions and at the same time asked that I postpone my visit until May because the earlier time conflicted now with a trip to Europe. The device came in a small box. It was very compact, sophisticated in operation and beautifully constructed. When set up according to the instructions with the control box connected to the shutter, the photocell and the remote control cable, the operator could choose between photocell or manual triggering. The photocell is so sensitive that when pointed skyward by a hummingbird feeder, it is sometimes triggered by bees attracted to the sugar water. The flashlight for activating

the cell in dim light is not much larger than an old fashioned fountain pen. It contains a battery, a grain of wheat bulb and a lens to produce a pencil beam of light. Altogether, the equipment is extremely ingenious and well engineered, a great improvement over my crude device, comparable to the difference between a modern pocket computer and a mechanical adding machine. It was obvious that with this equipment, I should be able to photograph birds in flight with much less struggle, pain and disappointment. It fitted my needs so well that Greenewalt gave me the name and address of his technician so that I could make arrangements directly with him to duplicate it for me.

The triggering mechanism was just one of the innovations developed by Crawford Greenewalt for photographing birds in flight in general and for investigating hummingbird flight in particular. Hummingbirds par excellence are the aerial acrobats of the bird world, an adaptation to their mode of life and manner of feeding and related to their small size. Like miniature helicopters, the control of their wings may be more closely related to that of insects than to any other birds. Greenewalt set out to investigate this amazing adaptation and devised the apparatus with which to do it. I was eager to learn more about his methods at our forth-coming meeting which took place on a weekend in May.

I flew to Wilmington from Washington on a Friday afternoon and met Greenewalt in his office in the Du Pont Building. Following a short conversation, he drove me out to his home in the country, a large stone mansion set in spacious grounds. We entered a wide hall from which a stairway ascended to the upper floors. Across the hall, if my memory serves me right, was a sitting room which opened to a garden through French doors. But what caught my attention immediately was the room to the right, as large as the hall and sitting room combined, which must have been planned as a reception room when the house was built, but had been converted into a machine shop and laboratory. Here the president of Du Pont worked at his avocational interests, away from his responsibilities to the company he heads. The room contained all the machines found in a well equipped shop, lathe, drill press, band saw, miller and much more. After being shown to my room, I rejoined Greenewalt in the shop where he showed me all his photographic gear, his motorized Hasselblad camera given to him by Victor Hasselblad, to which he had added a motor drive before this feature became optional equipment, the strobe unit built into a Halliburton case by Harold Edgerton with which he photographed hummingbirds all up and down the Western Hemisphere. Finally, a motion picture camera especially engineered for investigating the mechanics of hummingbird flight. In principle, its operation was very simple consisting of a shutterless lens, a track

for guiding the film at the focal plane of the lens, and an inertial mechanism for transporting the film at high speed through the track. Repeated exposures were made by a high output stroboscope that delivered extremely short duration but intense flashes of light very closely spaced in time. Since the energy for the flashes was provided by a capacitor charged at high voltage, and since the flashes had to be repeated at high frequency, a great deal of power was needed for rapid re-charging. I asked Greenewalt how he managed that and he said by bringing in a special power line. When in operation, the camera was set up at a hummingbird feeder in the garden. (Only Ruby-throated Hummingbirds occur in the east.) A fly-wheel, part of the inertial device, is set spinning and when a hummingbird comes to the feeder a clutch in the drive mechanism can be engaged to yank the film past the lens, and at the same instant activate the strobe. The artificial light is so intense that at small apertures the weaker daylight has no effect on the film. The whirring and flashing caused by engaging the clutch usually frightens the hummingbird, but before it can make its escape, its image has been recorded at least a dozen times as it breaks away.

That evening at dinner, an engineer from the research division of Du Pont was present. The conversation was about birds, cameras and electronics. Mrs. Greenewalt is a birder

in her own right and spends much time on bird walks on the estate, keeps a record of breeding birds by their songs and a count of migrants in the spring. I asked the engineer whether he participated in any of Mr. Greenewalt's photographic activities and he said, meaning himself and probably other members of his department, "Oh, we try to keep him happy, he has so many responsibilities." When the time came to go to bed and I was saying goodnight to Mrs. Greenewalt, she said she wouldn't see me in the morning because she was going out at dawn on a singing bird count. After breakfast, I was driven to the airport by the chauffeur to catch a plane back to Washington.

Crawford Greenewalt began his career in Du Pont in the research department, rose rapidly in the organization until he reached the top. He is a person of wide scientific and technical interests which he has continued to cultivate, even as his commitments to the company became increasingly demanding. He is blessed with the curiosity of a scientist which his directorships and managerial functions could not completely satisfy. To fulfill his extra-corporate aspirations, he has actively pursued, as time in a busy schedule permitted, his private interests and research which focused on photography, partly as an instrument for his investigations and partly as a means of expression in itself. His book on hummingbirds clearly

illustrates this dual concern. The acclaim which this work has received is, I believe, in the minds of most photographers and many ornithologists based on the excellence and beauty of the color photographs themselves which he spent several years obtaining in travels throughout the United States, the Caribbean Islands, Central and South America with equipment specifically developed for this purpose. These pictures reflect only one aspect of his personality, that which is attuned to an appreciation of the beauty in the natural world and is aesthetic rather than scientific.

His other concern, to probe the depths of phenomena for clarification and ultimate explanations is represented in the book by his research into the mechanisms of the bird's flight and the iridescence of its feathers. The flight research involved analyses of the bird's anatomy, physiology and the aerodynamics of wings as a driving force. The elucidation of feather iridescence led from morphological structure into optics and optical as well as electron microscopy. The investigations were motivated by scientific curiosity.

That Crawford Greenewalt has been able to hold high positions in the corporate structure of the United States and at the same time indulge creative aspirations on the one hand and satisfy scientific curiosity by original investigations on the other testifies to the incredible energy he is able to mobilize.

He has continued his photography of birds in tropical South America with unabated enthusiasm, concentrating on stereoscopic and behavior pictures of hummingbirds.