

Characteristics and Applications of a New High-Speed Color Film — Anscochrome D/500

By F. C. FORSGARD, A. F. GIFFORD, C. M. WHITTEMORE and W. L. WIKE

THE CONTINUING NEED FOR information in the space program, oceanography, and industry, especially in situations where illumination is at a low level, has created a demand for high-speed color films having an exposure index of 500 to 1000. The general use of color film for aerial photography also demands high film speed in order to obtain data during marginal lighting periods encountered both early and late in the day. Anscochrome* D/500 is effective for meeting this requirement, having both a color reversal and color negative exposure index of 500 with normal processing and 1000 with forced processing, thus offering new horizons in informational photography. Sharpness and depth of field can be enhanced by using smaller lens openings for films of this speed, or faster shutter speeds may be employed for stop-action or increased frame rates.

Anscochrome D/500 has also opened a new field of interest as a reversal color film in the consumer market due to its remarkable color rendition when exposed to low-level available-lighting conditions. The dual high-speed color reversal and color negative image capability is of particular interest in aerial and press photography where color and black-and-white prints as well as reversal transparencies are often desirable. Other applications of Anscochrome D/500 as a high-speed negative film have not as yet been fully explored. Many potential uses, however, are envisioned.

The new film is available on acetate base (Type PF589) and on Gafstar† polyester base (Type PF486) which has been shown to exhibit excellent dimensional stability both prior to and after processing.

Sensitometric Characteristics — Reversal

The sensitometric curves for Anscochrome D/500 are shown in Fig. 1. These curves are integral densities for blue, green and red filtration. The new film is a high-contrast product having a gradient of 2.1 to 2.3 with normal processing and an exposure latitude of $\pm \frac{1}{2}$

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* "Anscochrome" is a registered trademark of General Aniline & Film Corp.

† "Gafstar" is a registered trademark of General Aniline & Film Corp.

stop. The contrast level provides clean highlights, high maximum density and optimum color saturation, all of which are normally desirable characteristics in aerial, instrumentation or other informational photography.

Figure 2 shows the relative spectral sensitivity curves for Anscochrome D/500. These curves are derived from integral density readings of a spectrogram exposed at equal energy. The evaluation net density used was 0.70. The spectral sensitivity characteristics for this new color film are the same as for Anscochrome D/50, T/100 and D/200. Figure 3 shows the spectral absorption characteristics of the dyes used for Anscochrome D/500 which are again identical for all Anscochrome camera films. D/500, therefore, can be compatibly intercut with other films in the Anscochrome family for either projection or printing.

Anscochrome products are relatively free from reciprocity law failure over the range of shutter speeds normally used in high-speed photography. Thus, no compensation in film speed or color balance need be made when changing shutter speeds between 1/50th s and 1/1500 s as shown in Fig. 4.

Daylight Exposure Guide (Incident Light) for Anscochrome D/500

Foot candles	f/stop at 24 frames/s
14 . . .	2.8
28 . . .	4
55 . . .	5.6
110 . . .	8
220 . . .	11
440 . . .	16
880 . . .	22
1,750 . . .	22 with N.D. 0.3 filter
3,500 . . .	22 with N.D. 0.6 filter
7,000 . . .	22 with N.D. 0.9 filter
14,000 . . .	22 with N.D. 1.2 filter

Daylight-Exposure Guide for High-Speed Cameras, for Average Incident Intensity of 7,500 fc

Frames/s	Shutter speed	f/stop
128 . . .	1/250 . . .	25
256 . . .	1/500 . . .	18
512 . . .	1/1,000 . . .	12
1,024 . . .	1/2,000 . . .	9
2,048 . . .	1/4,000 . . .	6.3
4,096 . . .	1/8,000 . . .	4.5
8,192 . . .	1/16,000 . . .	3.2
16,384 . . .	1/32,000 . . .	2.2

Image Quality Characteristics

Since Anscochrome D/500 is an extremely high-speed color film it might be expected to suffer in image quality. However, this is not the case. This new film is slightly coarser in grain than D/200 but the color saturation, color re-

production and image quality of each are quite similar. The following tables list the various characteristics of Anscochrome D/500 in comparison with Anscochrome D/200. Granularity range values represent the standard deviation of visual density fluctuations as mea-

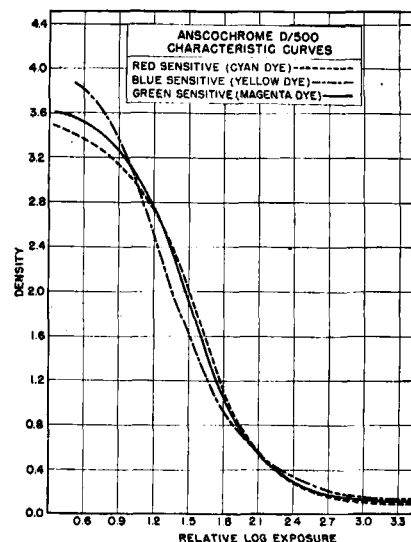


Fig. 1. Anscochrome D/500 characteristic curves.

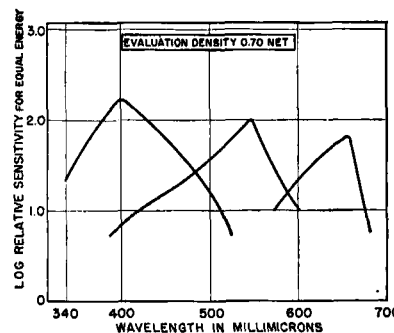


Fig. 2. Spectral sensitivity for Anscochrome films.

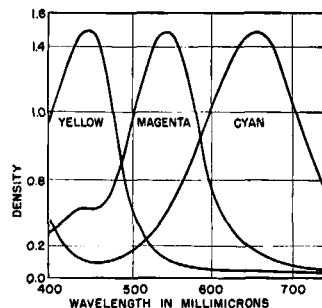
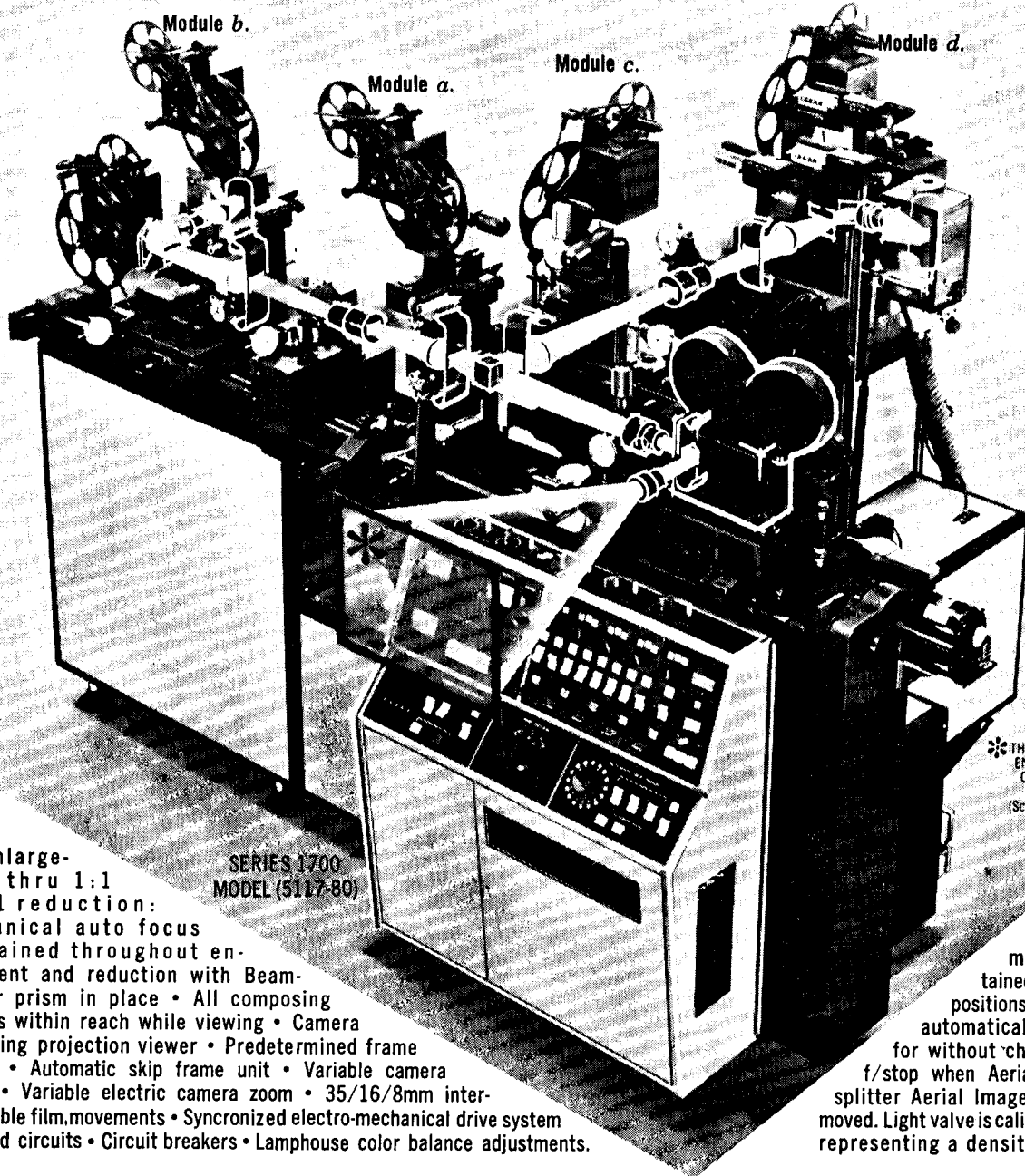


Fig. 3. Characteristic transmission curves for Anscochrome dyes.

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sured from film samples color balanced to approximate neutrality that have uniformly been exposed and processed to a density of 1.0. Resolving power and system modulation transfer acutance† were also determined with neutrally balanced films.

RMS Granularity Values

Ansochrome D/200 . . . 0.035
Ansochrome D/500 . . . 0.048

Resolving Power Values

1000:1 . . . 1.6:1

Ansochrome D/200 100 lines/mm 45 lines/mm
Ansochrome D/500 90 lines/mm 40 lines/mm

System Modulation Transfer Acutance Values
SMT Acutance

Ansochrome D/200 . . . 67
Ansochrome D/500 . . . 64

Reversal Processing

Ansochrome D/500 is processed in either the AR-1 or AR-2 Process using the same times and temperatures as for all other Ansochrome films. Both processes follow the principle of color reversal processing in regard to films with incorporated color couplers. The basic difference between the processes is in their respective overall processing cycle time as the AR-2 requires 20 min compared to 45 min for the AR-1. The reduction in time is primarily due to differences in chemistry between the respective developers as both processes are intended to be operated at a temperature of 80 F.

The AR-2 Process has ten steps; six are chemical solutions and four are wash steps, as shown in Table I.

Ansochrome D/500, although quite different from other Ansochrome products in emulsion technology does not require narrower tolerances in regard to processing. Extensive laboratory tests, as well as field surveys, have shown that this new film is readily adaptable to continuous machine processing as well as semi-manual operations. Minor processing variations do not alter its photographic characteristics to any great extent, the response to variations being the same as that of the other Ansochrome products.

Ansochrome D/500 can be force processed to a speed of 1000 by increasing the first development by 60%. Some sacrifice in maximum density and saturation is observed while graininess is slightly increased. Forced processing is recommended only when speed is absolutely essential.

Sensitometric Characteristics — Negative

As stated earlier in this paper, Ansochrome D/500 is unique as a high-speed reversal color film because it has the

† E. M. Crane, *Jour. SMPTE*, 73: 643, 1964.
M. C. Goddard and R. G. Gendron, *Phot. Sci. and Eng.*, 10: No. 2, 77 (March-April 1966).

Table I. AR-2.

Step		Time, min	Temperature F
1	First Developer # 505	3.5	80 ± ½
2	Shortstop Hardener #907	1.5	77-80
3	Wash & Re-exposure	2.0	75-80
4	Color Developer #625	4.0	80 ± ½
5	Shortstop Hardener #907	1.5	77-80
6	Wash	2.0	75-80
7	Bleach #718B	2.0	77-80
8	Wash	0.5	75-80
9	Fixer #806A	2.0	77-80
10	Wash	1.0	75-80

added capability of being processed to a color negative.

As a color negative, Ansochrome D/500 may be exposed at speed indexes ranging from 125 to 1000 and compensation for overexposure and underexposure can be made simply by changing the color development time. Table II shows the recommended time of development for a desired exposure index and also the approximate gradation that is obtained. At its normal exposure index of 500, this new film, when processed to a color negative, has an average gradient of 1.4. The stain or fog level for all filter densities is about 0.40, and the maximum integral density of the various layers will range between 3.0 and 3.4. An important feature of this film is its ability to maintain optimum curve conformity when processed to a reversal image or to a color negative. Practicable color or black-and-white prints can be made from these negatives on commercially available positive printing stocks.

Negative processing

A total of seven steps is required to process Ansochrome D/500 to a color negative. Four solution steps which include a color developer, shortstop hardener, bleach and fixer, plus three washes are utilized at a temperature of 80 F. Complete processing requires about 20 min. The secondary solutions recommended for this process are the same as employed in the AR-1 Process. A special color developer formula is required. Table III shows the processing procedure and states the identity of the solutions.

Table III. Processing Procedure for Ansochrome D/500 to a Color Negative.

Step		Time, min	Temperature °F
1	Color Developer #631	8	80 ± ½
2	Shortstop Hardener #907	2	77-80
3	Wash	2	75-80
4	Bleach #718B	2	77-80
5	Wash	2	75-80
6	Fixer #806A	2	77-80
7	Wash	2	75-80

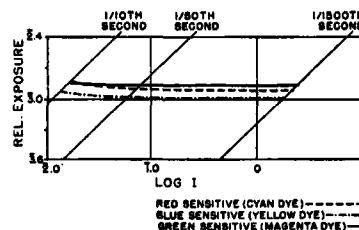


Fig. 4. Ansochrome D/500 reciprocity.

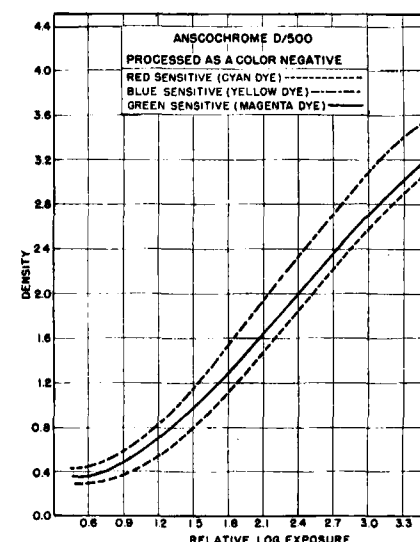


Fig. 5. Ansochrome D/500 processed as a color negative.

Table II. Ansochrome D/500, Processed to a Negative.

Exposure index	Developing time @ 80 F	Gradation
125	4.5 min	0.80
250	6 "	1.10
375	7 "	1.25
500	8 "	1.40
750	10 "	1.50
1000	13 "	1.65