

6. It is practicable with controlled temperature and humidity, modern low shrinkage film and paper, and micrometer adjustments to compensate for shrinkage and distortion observed, to produce composite prints correct within 0.01 inch (0.25 mm.).

7. It is practicable to exaggerate the stereoscopic relief to five times that of normal angle single lens photographs with attendant advantage in completely mapping relatively flat lands.

FILM AND PAPER

Films and paper in current use for air photography are described in the following paragraphs from information furnished by the respective manufacturers.

Agfa Films and Paper for Air Photography

1. Super Sensitive Panchromatic Aero Film: This is an all purpose panchromatic film of high color sensitivity for general air photography under normal weather conditions.

2. Supreme Aero Film: The Supreme Aero is a high speed film of brilliant gradation and extremely fine grain. The film has approximately twice the speed of regular Agfa S. S. Panchromatic film and a somewhat more brilliant gradation. It is coated on special gray base which offers anti-halation protection similar to that common to practically all 35 mm. motion picture film. The fine grain together with anti-halation protection give extremely high resolution. The film is useful for wide angle photography and for areas having little contrast as in desert regions.

3. Triple S Panchromatic Aero Film: This film has a speed of approximately four times, or two full stops, greater than the regular Agfa S. S. Panchromatic film. Color sensitivity quite similar to the S. S. Panchromatic film although it is slightly lower in relative red sensitivity. Its gradation and developing characteristics are practically identical to the regular S. S. Panchromatic and the grain size is slightly smaller.

While this film has not yet been announced to the market it is available in limited quantities.

It should be useful in northern latitudes for photography with wide angle lens of small apertures with filters, and for photography of terrains lacking in contrast.

4. "Mapping Special" Paper: This is a new type paper which has just been put on the market. It is of clear white stock with very low shrinkage characteristics for un laminated or un lacquered paper. The differential shrinkage averages as little as 0.04% and may frequently be less. At the present time, the paper is being supplied only with Brovira enlarging emulsion in three degrees of contrast, soft, medium, and hard.

Eastman Films for Air Photography

The Eastman Super Sensitive Panchromatic Aero Film has been used for general air photography for many years. Used with the Wratten Aero No. 1, Aero No. 2, No. 12, No. 25 filters, it has proved very satisfactory for vertical and oblique photography of most types of terrain.

As the result of the increasing use of aerial photography during the past few years, special conditions have been encountered in which the most desirable results could not be obtained by the use of the standard film. Three new types

of film for aerial photography that have therefore been introduced are: (1) Eastman Special Aero Panchromatic Film, (2) Eastman Aero Ortho Film, and (3) Eastman Infra-Red Aero Film.

1. Eastman Special Aero Panchromatic Film: This film has double the speed of Super Sensitive Aero Panchromatic Film and somewhat higher contrast. It is fully panchromatic, with a particularly high sensitivity in the red. The wedge spectrogram to daylight is shown in Fig. 1. It can be used with the normal aero film developers and its effective speed increases with increase of the development time. In most developers, such as D-87 and D-19B, it attains

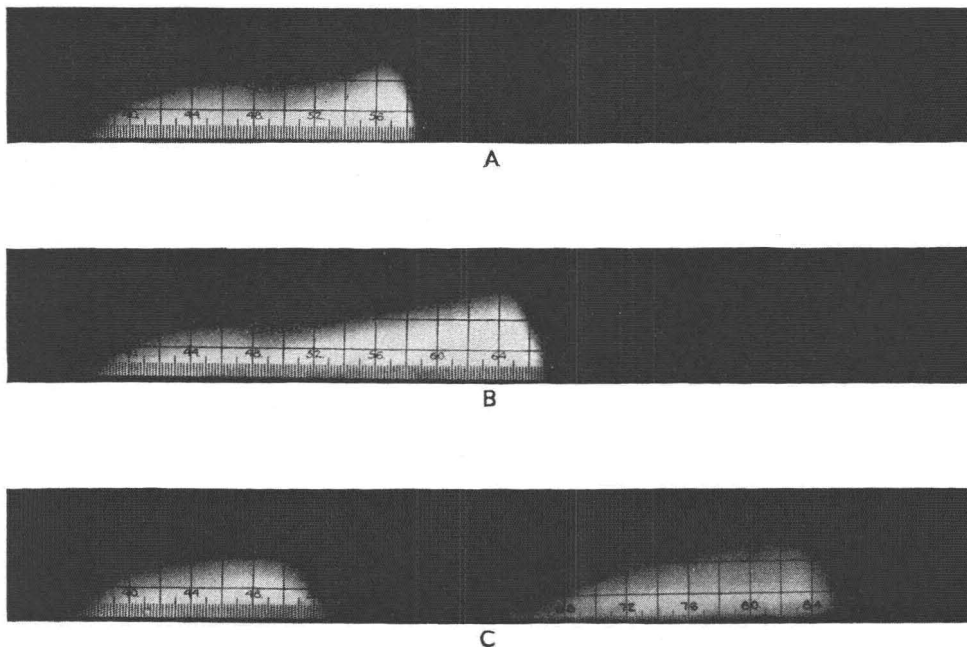


Fig. 1. Wedge Spectrograms by Light of Sunlight Quality of (A) Eastman Special Panchromatic Aero Film. (B) Eastman Ortho Aero Film. (C) Eastman Infra-Red Aero Film.

its maximum gamma very quickly, the result of further development being primarily an increase in speed. With the Borax MQ D-76 Developer, the gamma increases slowly with increasing time, therefore permitting gamma control, but the effective speed of the film in this developer is lower than that in the other developers. The film has very high latitude and gives somewhat higher contrast in the shadows than the standard film. The filter factors for this film with the common aerial filters are shown in Fig. 3, and the characteristic curve for normal development time in D-87 in Fig. 2.

2. Eastman Aero Ortho Film: This film is very similar in characteristics to the Eastman Special Aero Panchromatic Film with the exception that it has a very high sensitivity in the green, and no red sensitivity. Its wedge spectrogram is shown in Fig. 1, and the characteristic curve in D-87 in Fig. 2. Fig. 3 gives the filter factors for the commonly used filters.

3. Eastman Infra-Red Aero Film: This material is especially made for extreme haze penetration and is fast enough for use with lenses of aperture about $f/4.5$. It should always be exposed through a filter corresponding to the Wratten

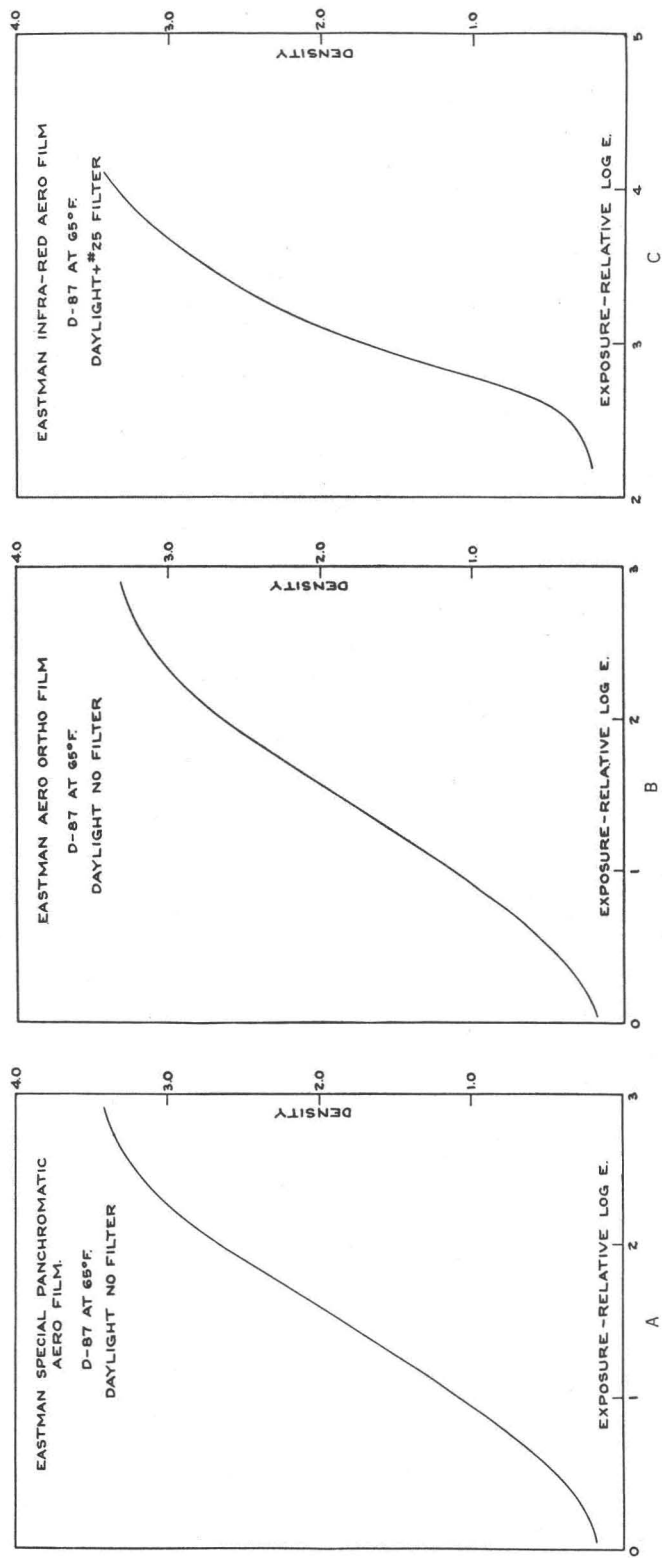


Fig. 2. Characteristic Curves for Normal Development in D-87 at 65° F., with Tank Agitation. (A) Eastman Special Panchromatic Aero Film. (B) Eastman Ortho Aero Film. (C) Eastman Infra-Red Aero Film.

No. 25 or, if somewhat more haze penetration is desired, the Wratten No. 89 or 89A. A wedge spectrogram showing the sensitizing of the film is in Fig. 1 and the filter factors are given in Fig. 3. The characteristic curve in D-87 is shown in Fig. 2.

4. Uses of the Materials: The Eastman Special Aero Panchromatic Film was developed to provide a material of extremely high speed, yet capable of the high degree of contrast which might be required for some types of work. The Eastman Aero Ortho Film was made primarily to permit the best differentiation of detail in terrain which is rather light in color, such as sand, associated with light green vegetation, such as scrub. This film has proved most satisfactory for survey in open, sandy areas, and for photography of forest areas with snow on the ground. The Eastman Infra-Red Aero Film was made to give the maximum of haze penetration corresponding with acceptable speed, and it is particularly suited for low obliques and long distance photography in general.

Film	Filter Factors						
	Aero 1	Aero 2	No. 12	No. 15	No. 25	No. 89	No. 89A
Special Aero							
Panchromatic	1.5	2.0	2.0	2.5	4.0	—	—
Aero Ortho	2.0	2.5	3.0	5.0	—	—	—
Infra-Red Aero	—	—	—	—	10.0	15.0	20.0

Fig. 3.

"Air Map Special" Projection and Contact Papers¹

"Air Map Special" papers are produced in contact and projection speeds; the contact in five grades of contrast (A—soft, B—medium, C—brilliant, D—contrast, E—hard) and the projection in three grades of contrast (soft, medium, and hard).

The raw stock which is white photographic 240 gram double weight is waterproofed with a back coat of lacquer and a face coat of cellulose. This reduces dimensional change in the finished stock due to processing to about "2 parts per 10,000" with the grain, and "3 parts per 10,000" across the grain when processing and subsequent storage for 48 hours are done at 70° Fahrenheit, 60° relative humidity.

The surface of Air Map Special papers is semi-glossy. It has sufficient tooth to retain notations in various pencils, inks, and crayons used in photogrammetry. Developers used with similar types of unwaterproofed papers may be used with both Air Map Special contact and projection papers.

In the standard fixing bath, the fixing is completed in 30 seconds and washing is completed in from two to four minutes.

¹ Manufactured by The Positype Corporation of America.

DIMENSIONAL CHANGES IN AERIAL PHOTOGRAPHIC FILMS AND PAPERS¹

Raymond Davis, Emory J. Stovall and C. I. Pope

The hygroscopic nature of film and paper makes it necessary to adopt, as standard, a fixed condition of temperature and moisture content of the air to which such materials may be subjected at the time of testing. The rate of approach to dimensional equilibrium with humidity was investigated for three films, and it was found that equilibrium was not reached even after two weeks

¹ In 1937 the National Bureau of Standards made an extensive investigation of the dimensional changes in the films and papers in current use for air photography.