

NASA CR-  
141601

SENSITOMETRIC CROSSOVER FOR 2485 IN BALLOON  
OBSERVATION ASTRONOMICAL PROGRAM

Prepared Under

Contract NAS 9-11500  
Task Order HT-64

PREPARED BY

Lincoln Perry  
Photoscientist

January 1973

(NASA-CR-141601)	SENSITOMETRIC CROSSOVER	N75-16786
FOR 2485 IN BALLOON OBSERVATION ASTRONOMICAL		
PROGRAM (Technicolor, Inc., Houston, Tex.)		
9 p HC \$3.25	CSSL 14E	Unclas
	G3/35	09079

Photographic Technology Division  
National Aeronautics and Space Administration  
Manned Spacecraft Center  
Houston, Texas



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
**ROUTING SLIP**

MAIL CODE		NAME	Action
	JL	BRINKMANN	Approval
			Call Me
			Concurrence
			File
			Information
			Investigate and Advise
			Note and Forward
			Note and Return
			Per Request
			Per Telephone Conversation
			Recommendation
			See Me
			Signature <input checked="" type="checkbox"/>
			Circulate and Destroy

10 COPIES  
 7 DISTRIBUTED INTERNALLY  
 3 EXTERNAL.

NAME  
 LAMAR

TEL. NO. (or code) & EXT.

CODE (or other designation)

DATE  
 2/1/73

SENSITOMETRIC CROSSOVER FOR 2485 IN BALLOON


OBSERVATION ASTRONOMICAL PROGRAM

This Report has been reviewed  
and is approved.

SUBMITTED BY:

  
Lincoln Perry, Photoscientist

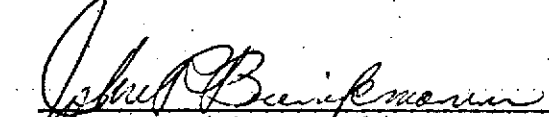
APPROVED:

  
Gerard E. Sauer, Supervisor  
Photo Science Office

APPROVED:

  
Noel T. Lamar, Technical Monitor

CONCURRENCE BY:

  
John R. Brinkmann, Chief  
Photographic Technology Division

## SENSITOMETRIC CROSSOVER FOR 2485 IN BALLOON

### OBSERVATION ASTRONOMICAL PROGRAM

#### Introduction:

The Photographic Technology Division was requested to provide processing support to the CREPE IV Project, a high-altitude balloon study of cosmic radiation. The film was delivered to PTD by the Principal Investigators, Larry Pinsky and Zack Osborne. Prior to that time, there had been no communication regarding film types or sizes.

#### Procedures:

The film was originally received at PTD in 12" x 12" sheets. Since it was desired to process the film with good sensitometric control, hand processing had to be ruled out, as did all machine processors able to accommodate this film size. It was therefore necessary to cut the film into 6" x 12" sheets in order to process the film in a Versamat or similar processor. This cutting was accomplished by the Principal Investigator.

Two thickness of film were used. One was a thick base film measuring 9.2 mils (0.0092 inches) total thickness. The other was a thin base film measuring 4.0 mils (0.004 inches) total thickness.

Initial tests on sample sheets of the thin base film run in the Versamat processor showed that it was too thin to transport dependably. The film was therefore spliced together in rolls, 64 sheets to a roll, using a heat splicer. In this way, only about 1/4 inch of each end of the imagery was masked by the splice.

Tests on samples of the thick base film showed that it also would not transport dependably in the Versamat. Splicing this film was impractical for several reasons. First, the thick base would create a greater tension on the splice when negotiating a machine turnaround. Second, the total thickness at the splice would be about 12 mils (0.012 inch), possibly causing damage to the Versamat.

An alternative processor, the GAF Transflo, was selected. This machine has no turnarounds; the film traverses a straight path through the processor.

#### Sensitometric Data:

All processing was done using Kodak's MX-641 developer. Using a control stock (2485-33-1) an H & D curve having maximum contrast without an appreciable increase in fog was obtained (Solid Curve, Figure 1). Sensitometric strips from the two emulsions used in the project were then run in the same machine configuration. The resulting sensitometric curves are shown in Figures 2 and 3. The upper and lower limits of the sensitometric response for all control film processed is shown by the dotted lines in Figure 1.

#### Results:

The processing of 1536 sheets of 6" x 12" film was accomplished, requiring approximately three months to complete.

#### Damage:

One sheet of the thin base film (#64-65) was lost in the splicing operation. Approximately 12 sheets of the thick base film were damaged or fogged due to processor problems.

None of the thick sheets can be considered a total data loss.

Anomalies:

Both thin and thick base films exhibited a very high fog level. Some of this fog is inherent in the film. The remainder is most likely accumulated from storage and the radiation environment during the balloon flight.

The thin base film exhibited numerous pinholes, streaks, and base irregularities. An examination of raw stock samples (unprocessed) showed these same defects, apparently due to manufacture.

Recommendations:

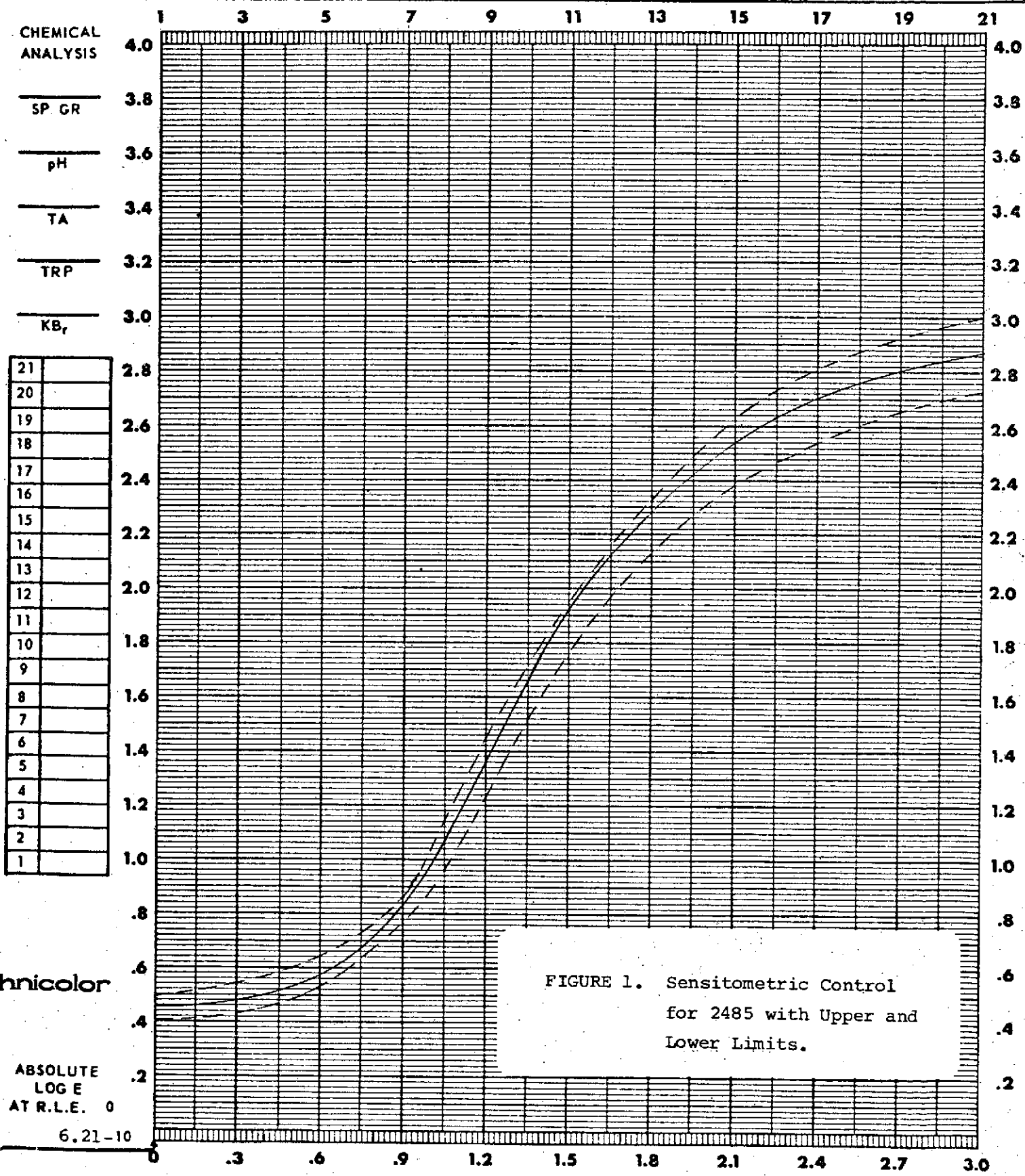
In an experiment of this size, more consideration should be given to the photographic processing aspect of the data reduction. It is highly desirable that the PTD Photo Science Office be consulted during the experiment planning stage, so that recommendations of film types, thicknesses, processing, etc. can be made.

The chief difficulty encountered in the processing of this film, and the reason for the unusually long time required for processing, was the nonstandard size and thickness of the materials used. In any future experiments, the following limitations should be observed.

1. Film sizes wider than 9 1/2" should not be used. This will eliminate the necessity of cutting the film.
2. Film thickness should be restricted to standard sizes, preferably between 4 and 7 mils.

3. If the experiment can be designed to use roll film, this will greatly simplify and speed the processing.
4. If the experimenter can tolerate the loss of about one inch on one end of each film sheet, this will simplify processing by allowing us to either round off the film corners or tape the film to a leader bullet.
5. Some of the raw stock should be examined in white light upon receipt from the manufacturer. In this way, film defects can be discovered before the experiment is run.
6. PTD should procure and calibrate the film to be used in order to ensure optimum film speed and fog level.

EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY	
SENSITOMETER	<u>I-B</u>	PROCESSOR	<u>Versamat &amp; Trans</u>	INSTRUMENT	<u>MacBeth</u>
ILLUMINANT	<u>2850 °K</u>	CHEMISTRY	<u>MX-641</u>	TYPE	<u>TD217DR</u>
TIME	<u>1/100<sup>SEC.</sup></u>	SPEED	_____ TANKS _____ FPM	APERTURE SIZE	<u>2</u> MM
FILTER	<u>1.60ND</u>	TEMP °F	_____ TIME _____	FILTER	<u>Visual</u>
				SPEED (Avg. AFS)	<u>1930</u>
				D-MAX (Avg.)	<u>2.86</u>
				GAMMA (Avg.)	<u>1.85</u>
				BASE + FOG (Avg.)	<u>0.46</u>





Thin Base

EXPOSURE DATA		PROCESSING DATA			DENSITOMETRY			
SENSITOMETER	I-B	PROCESSOR	Versamat 11C-M		INSTRUMENT	MacBeth	SPEED (A/F'S)	1843
ILLUMINANT	2850 °K	CHEMISTRY	MX-641		TYPE	TD217DR	D-MAX	1.74
TIME	1/100 SEC.	SPEED	2	TANKS	4	FPM	GAMMA	0.83
FILTER	1.60ND	TEMP °F	85	TIME			BASE + FOG	0.68

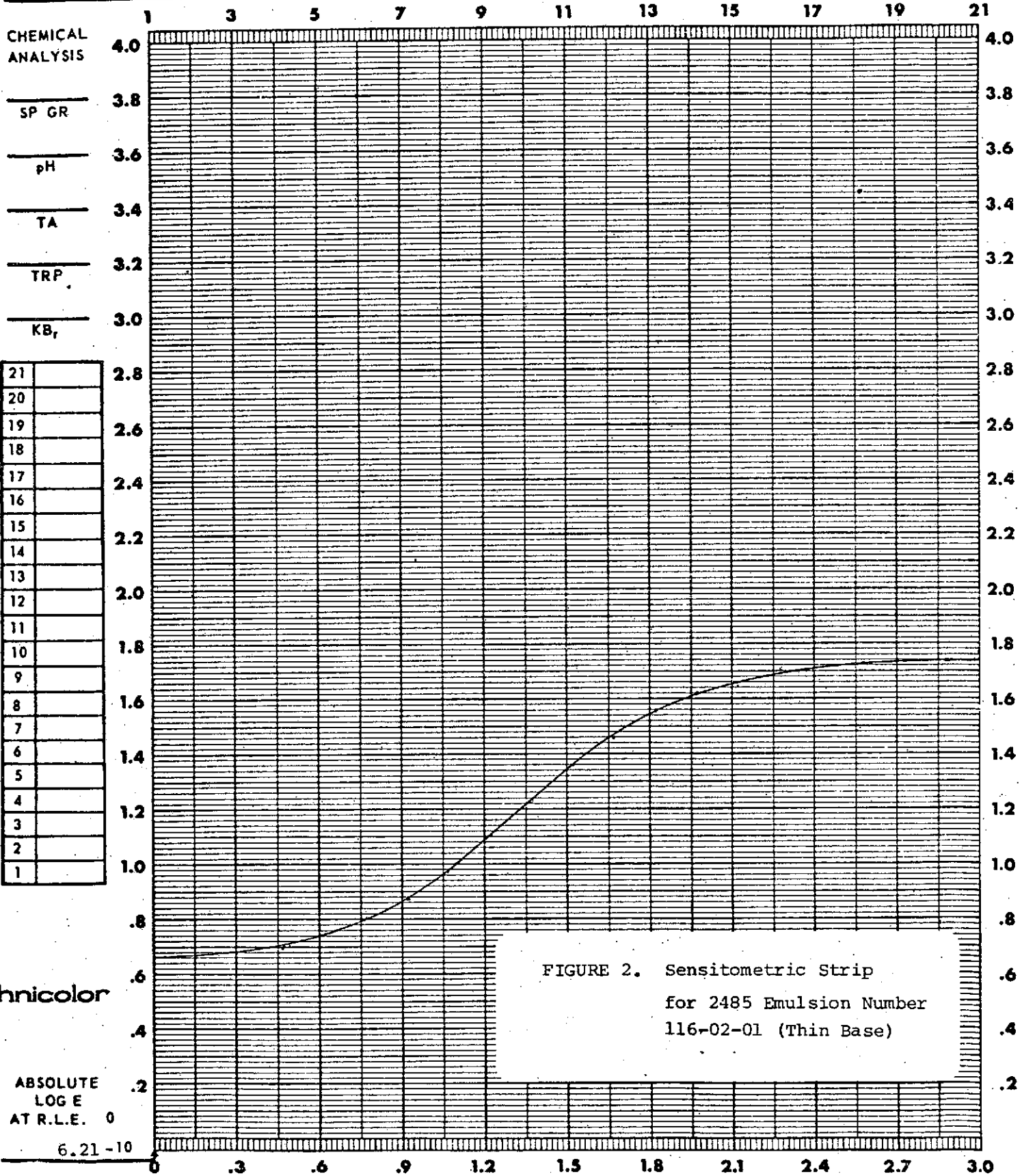


FIGURE 2. Sensitometric Strip  
for 2485 Emulsion Number  
116-02-01 (Thin Base)

Technicolor

ABSOLUTE  
LOG E  
AT R.L.E. 0

6.21 -10

Thick Base

EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY	
SENSITOMETER	I-B	PROCESSOR	Versamat 11C-M	INSTRUMENT	MacBeth
ILLUMINANT	2850 °K	CHEMISTRY	MX-641	TYPE	TD217DR
TIME	1/100 SEC.	SPEED	2 TANKS 4 FPM	APERTURE SIZE	2 MM
FILTER	1.60ND	TEMP °F	85 TIME	FILTER	Visual
				SPEED ( AFS )	1219
				D-MAX	2.47
				GAMMA	1.64
				BASE + FOG	0.36

