4-1944

Photographic Interpretation Handbook, United States Forces: Section 06 Reconnaissance Photography

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SECTION 6
PHOTOGRAPHY

6.01 —— 6.99

CAMERA DATA

AERIAL CAMERAS USED BY THE AMERICAN FORCES

TYPE	FOCAL LENGTH	LENS SPEED	SHUTTER SPEED	TYPE OF FOCAL PLANE	MAG. NO.	NEG. SIZE	FILM LOAD SIZE	NO. OF EXP.	APPROX. WT. IN POUNDS OF LOADED CAMERA	MOUNTS USED	METHOD OF OPERATION	USES
F-1	7" 10" 20" Telescopic	f/4.5 f/4.5 f/5.6	1/50,1/100,1/150	Detachable,interchangeable roll film magazine with glass contact plate and actuated metal pressure plate.	65 65 --	5 x 7" 5 x 7"	7" x 12 1/4' 7" x 25' --------- Cut film or plate	25 50 12 12	7" - 28 20" - 33	None	Manual	Obliques
F-8 (K-10) New F8	10" 15" Telescopic	F/4.5 f/5.6	1/50 to 1/200 with nine intermediate speeds. 1/125 to 1/500	Film chamber part of camera body. Glass contact plate and fixed metal pressure plate attached to cover.	Attached	5 x 7" 5 x 7"	7" x 12 1/4' 7" x 25' Cut film or plate	25 50 12	18	A-7	Manual	Verticals and Obliques. Focus range from 8' to infinity. 15" is fixed focus
F-14	8 1/4"	f/4.0	1/35,1/50,1/100, 1/150	Detachable,interchangeable roll film magazine with piston and cylinder providing a self-contained vacuum back.	151	7 x 7" 5 x 7"	7" x 25' 7" x 62' 7" x 125' Cut film or plate	40 100 200 12	31	F-14,F-25, F-56 Navy Mount A.	Manual and Electrical (12 volts)	Obliques and Vertical Mapping. Superseded by F-25.
F-25	8 1/4"	f/4.0	1/35,1/50,1/100, 1/150	Detachable,interchangeable roll film magazine with piston and cylinder providing a self-contained vacuum back.	187	7 x 7" 5 x 7"	7" x 25' 7" x 62' 7" x 125' Cut film or plate	40 100 200 1	35	F-14,F-25, F-56 Navy Mount A	Manual and Electrical (12 volts)	Obliques and Vertical Mapping. Superseded by F-56. Recording chamber
F-48 (old K-20) Same as F-8	6 3/8"	f/4.5	1/50,1/100,1/200	Roll film magazine with piston and cylinder providing a self contained vacuum back.	Attached	4 x 5"	5 1/4" x 4 1/2' 5 1/4" x 9' 5 1/4" x 19 1/2'	12 25 50	11	None	Manual	Obliques. Superseded by new K-20.
F-56 *1	5 1/4" 8 1/4" 20" Telescopic 40" Telescopic	f/6.3 f/4.0 f/5.6 f/8.0	1/35,1/50,1/100, 1/150	Detachable,interchangeable roll film magazine with piston and cylinder providing a self-contained vacuum back.	273	7 x 7" 5 x 7"	7" x 25' 7" x 62' 7" x 125' Cut film or plate	40 100 200 12	5 1/4" - 33 8 1/4" - 40 20" - 48 40" - 60	F-14,F-25, F-56 Navy Mount A	Manual and Electrical (12 and 24 volts)	High altitude verticals and obliques. Recording chamber
K-3A (K-3)	12"	f/4.5	1/35,1/50,1/100, 1/150	Detachable,interchangeable roll film magazine with glass contact plate and actuated metal pressure plate.	A-1A	7 x 9"	9 1/2" x 75'	110	45	K-3,K-3A, K-3B Navy Mount B	Manual and Electrical (12 volts)	Vertical mapping. Obsolete.
K-3B	6" 8 1/4" 12" 24"	f/6.3 f/5.0 f/5.0 f/6.0	1/50,1/100,1/200,1/300 1/50,1/100,1/150 1/50,1/100,1/150 1/50,1/100,1/150	Detachable,interchangeable roll film magazine with vacuum back utilizing suction from outside source.	A-1B A-5 A-9 B-1	7 x 9" 9 x 9" 9 x 9" 8 x 10"	9 1/2" x 75' 9 1/2" x 150' 9 1/2" x 410' Cut film	110 190 500 12	6" - 40	K-3,K-3A, K-3B Navy Mount B A-8,A-11	Manual and Electrical (12 volts)	Day reconnaissance. Vertical and oblique.
K-12	13 1/2"	f/3.5	1/20,1/30,1/40-old type. 1/30,1/40,1/70-new type.	Open frame utilizing B-1 cut film magazine with amplifier box attached.	B-1	8 x 10"	Cut film	2	64	A-8, A-11	Manual and Electrical (12 volt)	Night photography when used with photo-flash bomb. Superseded by K-19.
K-15	20" Telescopic 40" Telescopic	f/5.6 f/8.0	1/200,1/400,1/600 1/100,1/200,1/300	Film chamber part of camera body. Glass contact plate and fixed metal pressure plate attached to cover.	Attached	5 x 7" 5 x 7"	7" x 15' Cut film	30 12	40	A-8, A-11 with adapter	Manual. 40" has adapter ring to change focus for infra-red.	High altitude obliques.
K-15A	40" Telescopic	f/8.0	1/200,1/400,1/600	Same as K-15.	Attached	5 x 7"	7" x 15' 7" x 36'	30 90	50	A-8, A-11 with adapter	Electrical (24 volt)	High altitude observation.
*K-17 (K-17A)	6" 12" 24"	f/6.3 f/5.0 f/6.0	1/50,1/100,1/200,1/300 1/75,1/150,1/225 1/50,1/100,1/150	Detachable,interchangeable roll film magazine with vacuum back utilizing suction from outside source.	A-5 A-1B --- A-9 B-1	9 x 9" 7 x 9" 9 x 9" 8 x 10"	9 1/2" x 150' 9 1/2" x 75' 9 1/2" x 200' 9 1/2" x 410' Cut film	190 110 250 500 2	6" - 57 12" - 54 24" - 77	K-3B and Navy Mount B. A-8, A-11.	Manual and Electrical (K-17 has 24 volt and K-17A has 12 volt operation.	All purpose camera. Supersedes K-3B.
K-17B	6" Metrogon	f/6.3	1/50,1/100,1/200,1/300	Same as K-17	A-5, A-1B A-9 B-1	9 x 9" 7 x 9" 9 x 9" 8 x 10"	9 1/2" x 150' 9 1/2" x 75' 9 1/2" x 410' Cut film	190 110 500 2	57	A-8, A-11	Electrical(24 volt)	Vertical wide-angle photography. Used in tri-metrogon hook-up.
K-18 (K-7C) K-18A	24"	f/6.0	1/50,1/100,1/150	Detachable,interchangeable roll film magazine with vacuum back utilizing suction from outside source.	A-7 A-8	9 x 18" 9 x 18"	9 1/2" x 75' 9 1/2" x 150' 9 1/2" x 410'	47 95 260	88	K-7C A-8 A-11	Manual and Electrical (24 volt). K-7C is not electrically operated. K-18A is 12 volt operated.	Vertical and oblique on large size negatives.
K-19	13 1/2"	f/3.5	1/25,1/50,1/100	Detachable,interchangeable roll film magazine with vacuum back utilizing suction from outside source.	A-5 A-1B A-9 B-1	9 x 9" 7 x 9" 9 x 9" 8 x 10"	9 1/2" x 150' 9 1/2" x 75' 9 1/2" x 410' Cut film	190 110 500 2	64	A-8, A-11	Manual and Electrical (24 volt). New type magnetically operated shutter - supersedes K-12	Night photography with photo-flash bomb.

* F56 8¼" High speed 1/75, 1/150, 1/225

20" High speed 1/75, 1/150, 1/225

AERIAL CAMERAS USED BY THE AMERICAN FORCES

* CAMERAS MOST WIDELY USED BY U.S. NAVY

TYPE	FOCAL LENGTH	LENS SPEED	SHUTTER SPEED	TYPE OF FOCAL PLANE	MAG. NO.	NEG. SIZE	FILM LOAD SIZE	NO. OF EXP.	APPROX. WT. IN POUNDS OF LOADED CAMERA	MOUNTS USED	METHOD OF OPERATION	USES
*K-19A *K-19B	12"	f/2.5	1/25,1/50,1/100	Same as K-19	A-5 A-1B A-9 B-1	9 x 9" 7 x 9" 9 x 9" 8 x 10"	9 1/2" x 150' 9 1/2" x 75' 9 1/2" x 410' Cut film	190 110 500 2	64	A-8, A-11	K-19A has 24 volt electrical operation only. K-19B has increased sensitivity of photo-electric cell.	Night photography with photo-flash bomb.
*K-20	6 3/8"	f/4.5	1/125,1/250,1/500	Film chamber part of camera body. Piston and cylinder provides self-contained vacuum back.	Attached	4 x 5"	5 1/4" x 20'	50	11	Hand held	Manual	Rapid action obliques.
K-21	7"	f/2.5	1/300,1/600,time	Film chamber part of camera.	Attached	5 x 7"	7" x 61' 7" x 15'	10 30	26	A-17	Electrical(24 volt)	Orientation and night photography.
K-22	6" 12" 24" 40"	f/6.3 f/5.0 f/6.0 f/8.0	Curtain A-1/150,1/350 Curtain B-1/350,1/800	Detachable,interchangeable roll film magazine with vacuum back utilizing suction from outside source.	A-1B A-5 A-9 B-1	7 x 9" 9 x 9" 9 x 9" 8 x 10"	9 1/2" x 75' 9 1/2" x 150' 9 1/2" x 410' Cut film	110 190 500 2	A-8, A-11	Electrical(24 volt)	Vertical and oblique day reconnaissance. Wide range of uses.	Vertical and oblique day reconnaissance. Wide range of uses.
K-23	12"	f/2.5	1/25 to 1/150	Detachable,interchangeable roll film magazine with vacuum back utilizing suction from outside source.	A-5 A-9 A-1B	9 x 9" 9 x 9" 7 x 9"	9 1/2" x 150' 9 1/2" x 410' 9 1/2" x 75'	190 500 110	75	A-8, A-11	Manual and Electrical (24 volts)	Night photography. This camera has not yet been supplied to field units.
K-24	6 3/8" 12" 20"	f/4.5 f/2.5 f/5.6	1/150,1/500,1/900, time Seperate curtains	Film chamber part of camera.	Attached	5 x 5"	5 1/2" x 61' 5 1/2" x 26' 5 1/2" x 56'	12 55 125	7" - 25	A-17	Electrical(24 volt)	Orientation, day and night reconnaissance.
K-25	6 3/8"	f/4.5	1/125,1/250,1/500	Film chamber part of camera body. Actuated metal pressure plate. No contact glass.	Attached	4 x 5"	5 1/4" x 20'	50	12.	Special fixed installation.	Electrical(24 volt) wired for remote control.	Low altitude spotting. Electrical version of K-20.
T-3A (5 lens) T-3A (10 lens)	150 mm	f/6.3	1/40,1/60,1/90	External vacuum back. 5 chambers and 10 chambers.	Special	5 1/2 x 6"	6" x 120'	200	5 lens -91 10 lens -182	Special	Manual and Electrical (12 volts)	Reconnaissance mapping of large areas.
T-5	6" metrogon	f/6.3	1/50,1/100,1/200,1/300	Detachable magazine with actuated vacuum back utilizing suction from outside source.	Special	9 x 9"	9 1/2" x 150'	190	106	Special A-22	Manual and Electrical (24 volt). Intervalo-meter and view finder are integral with camera.	Precise topographic mapping.
T-7 (3 lens)	6" Metrogon	f/6.3	1/50,1/100,1/200,1/300	3 K-17B cones attached to magazine	Special	9 x 9"	?	300	?	Special	Electrical 24 volt	Charting tri-metrogon
F-24	3 1/4" 5" 8" 14"	f/6.3 f/4.0 f/5.0 f/4.5	Curtain A-1/40,1/120 Curtain B-1/200,1/300	Same as K-24	Attached	5 x 5"	5 1/2" x 61' 5 1/2" x 26' 5 1/2" x 56'	12 50 125	17	3 1/4"-Br.25 5" -Br.26 8" -Br.1 14"-U.S.A-17	Manual and Electrical (12 or 24 volts)	Orientation. Day and night reconnaissance.
L-2A	8 1/4" 10"	f/5.0 f/4.5	1/30 for night 1/150 for day	?	Attached 356	4 x 4" Perforated edges	4 3/4" x 80'	200	?	Special.	Electrical(12 and 24 volt)	Recording hits made in bombing. Effective operational conditions at altitudes from 1,000' to 20,000' and at ground speeds from 100 to 400 m.p.h.
Strip Somé	90 mm.	f 3.5	No shutter	Film travels in camera. Reostat adjusts film travel to compensate with ground speed of plane.		9" x any desired length.	9 1/2" x 250'	one continuous exp.	65	Special	Electrical 24 Volt	This camera is still in the experimental stage.

Refinements of interpretation are sometimes possible thru the use of special film and filter combinations. The following recommendations should be considered preliminary, pending further investigation:

PANCHROMATIC:- Used with a yellow (minus-blue) filter this is the standard combination. A red filter is used to attain better haze penetration at the expense of stronger contrasts. Panchromatic without a filter at medium and low altitudes has proved valuable in penetrating water for off shore interpretation.

INFRA-RED:- Infra-red film, with a #89(red) filter and focused for infra-red rays, offers many advantages, especially when used in direct comparison with panchromatic. The following characteristics should be understood in order to recognize the circumstances under which infra-red film will be advantageous:

It differs from standard pan aero in the following four asspects:
(1) Green matter (chlorophyll) registers as a light tone instead of dark. Therefore dark objects will be in contrast with vegetation. The degree of freshness of the vegetation determines the amount of infra-red light reflected. Hence, dead foliage used for camouflage purposes will be in contrast with growing matter.
(2) With the standard red filter infra-red film gives haze penetration superior to that of panchromatic with either a red or a yellow filter. Good contrasts will result in photography of distant subjects, especially in high altitude obliques and survey verticals. The British use infra-red for mapping and Army cooperation work.
(3) Shadows will register as true blacks and shaded areas will be correspondingly darkened.
(4) Most paints and natural substances have an infra-red reflective factor which will change the tones ordinarily achieved with panchromatic, often resulting in sharper contrasts. This characteristic is helpful in camouflage detection and in distinguishing between colors and textures which may register as the same value in panchromatic. Water is recorded as a uniform dark tone, whereas it may vary from dark to light in panchromatic. The advantage in using infra-red lies in determining tide lines, swamps, streams, damp ground, etc.

COLOR:- There are many advantages in knowing the actual color of an object, noteably in detailed analysis of terrain and in model work. Color film will give an excellent black and white print, in which form it is useful in underwater interpretation and in depth determination. Color may also be important in the briefing of pilots. Inasmuch as a great deal of the tonal range, actual color, and sharpness is lost in printing, color film should be studied in the form of a transparency,

CAMOUFLAGE DETECTION FILM:- This is color film with an infra-red sensitized layer added. Its use has been too limited to date to permit an evaluation.

PHOTOGRAPHY

FILM TYPES & PRINTS (CONT.)

Both infra-red and color photography should be used only when the situation warrants. Neither is suitable for all purposes.

TRANSPARENCIES:- Negative or positive transparencies in all types of film offer a greater scale of tone to the interpreter. Detail is often revealed on transparencies which is completely lost in paper prints. Underexposed areas, such as those in shade or shadow, may be examined by masking the remainder of the transparency and increasing the intensity of the light.

PRINTS:- Often particular negatives or parts of negatives may be better printed by using paper having a contrast other than normal. There are six types of paper, numbered from #0 thru #5, the low numbers giving the least and the high the greatest contrasts. For example, a shadow on #0 paper will be a light, transparent gray, while on #5 paper it will be an opaque black.

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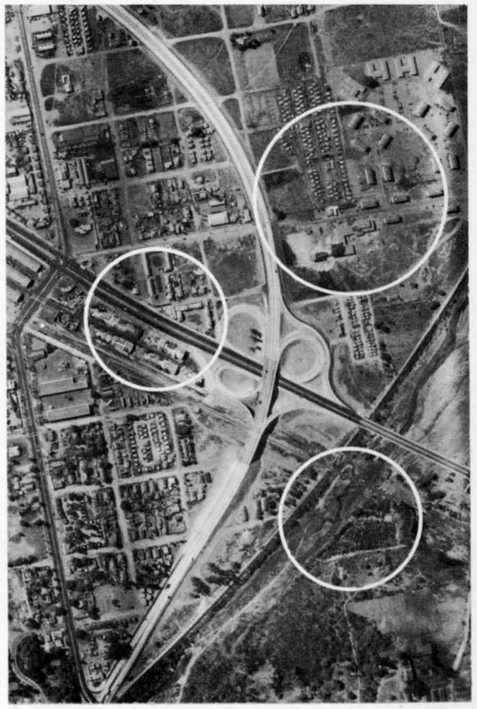
The two prints shown below illustrate some of the differences between panchromatic and infra-red film.

INFRA-RED



PANCHROMATIC

PHOTOGRAPHY

TITLING

NAVY

NEGATIVE NUMBER / RUN	SOURCE OF PHOTOS (1 ST MARINE PHOTO SQUAD.)	SORTIE NUMBER	SUBJECT GROUP	MONTH / DAY / YEAR	FOCAL LENGTH	CAMERA POSITION (LEFT) IF MORE THAN ONE	ANGLE OF CAMERA (VERTICAL)	TIME / ZONE	ALTITUDE	SUBJECT	LAST NEGATIVE IN GROUP
15/7	VDI	56	A	2-25-43	24"	L.	V.	1510Z	19000'	MUNDA AIRFIELD	END

ARMY

ORGANIZATION	YEAR / MISSION	ROLL NUMBER / CAMERA POSITION	NEGATIVE NUMBER	MONTH / DAY / TIME	FOCAL LENGTH / ALTITUDE	TYPE OF PHOTO	LATITUDE / LONGITUDE	DESCRIPTIVE TITLE	CLASSIFICATION
137PS	3MI09	11-V	121	12:28:1330	12:20000	0-45°	842S14826E	BUNA NEW GUINEA	CONFIDENTIAL

UNITED KINGDOM

(a) Negative serial number
(b) Sortie Number
(c) Unit Number
(d) Date (Day - Month - Year)
(e) Focal length of lens in inches
(f) Arrow denoting direction of flight

The four figure serial numbering of the negatives indicates the positions of the cameras:

0001 - 0600 - Oblique camera
1001 - 1600 - Port wing camera
2001 - 2600 - Starboard wing camera
3001 - 3600 - Port rear camera
4001 - 4600 - Starboard rear camera
5001 - 5600 - Vertical rear camera

Older systems used letters to indicate the camera and position:

O - oblique, S - starboard, P - port

INFORMATION FROM NIGHT PHOTOGRAPHS

a. Navigational - Where the aircraft has been.

b. Operational - Where the aircraft dropped bombs.
Where other aircraft dropped bombs.
Where there were flares.

c. Intelligence:
1. Fires: sizes and duration.
2. Flak: type, intensity, and mode of operation.
3. Searchlights: spacing and mode of operation.
4. Decoys: appearance in operation and mode of operation.
5. Lighting systems: flare paths, airfield lighting, flashing beacons, etc.

LOCATION OF FIRES

Fires appear differently in night photographs, depending on the time of exposure used:

A. If the exposure is instantaneous; i.e., if a photo-electric cell trips the camera shutter at the explosion of the flash bomb, fires will appear on the photographic print each as a white dot in its correct ground location in relation to the ground detail recorded.

B. If the shutter remains open for a period of seconds at sometime during which the flash bomb explodes, each fire will appear as a line or track. In the case of such time exposures, two types of track are observed: Complete tracks begin and end in the field of the photograph (a Plate 1.). Incomplete tracks either begin or end out of the field of the photograph.

To locate the correct ground location of fires in the case of time exposures, two photographs are necessary showing, with accompanying ground detail, tracks of the same fires (Plate 1 and Plate 2). The tracks must be complete in at least one photograph. When the corresponding ground detail in the two photographs has been superimposed, the ground location of the fires may be pinpointed at the intersection of the tracks (Plate 3).

PHOTOGRAPH FROM AIRCRAFT # 1

PLATE 1

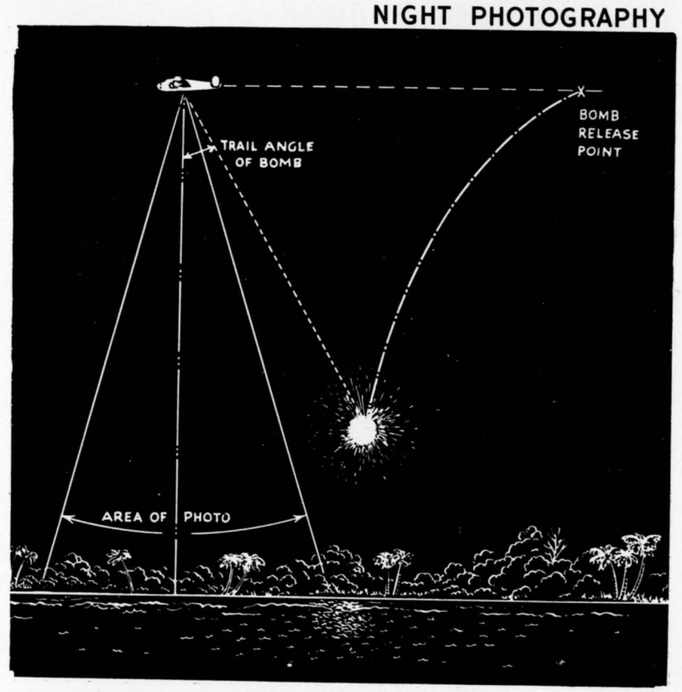
PHOTOGRAPH FROM AIRCRAFT # 2

PLATE 2

SUPERIMPOSED FIRETRACKS

PLATE 3

The fuse is set so that the photo bomb will explode and its flash powder will ignite at a point behind the plane. This causes a photo-electric cell to work the shutter. The actual flash is not seen in the resulting picture.

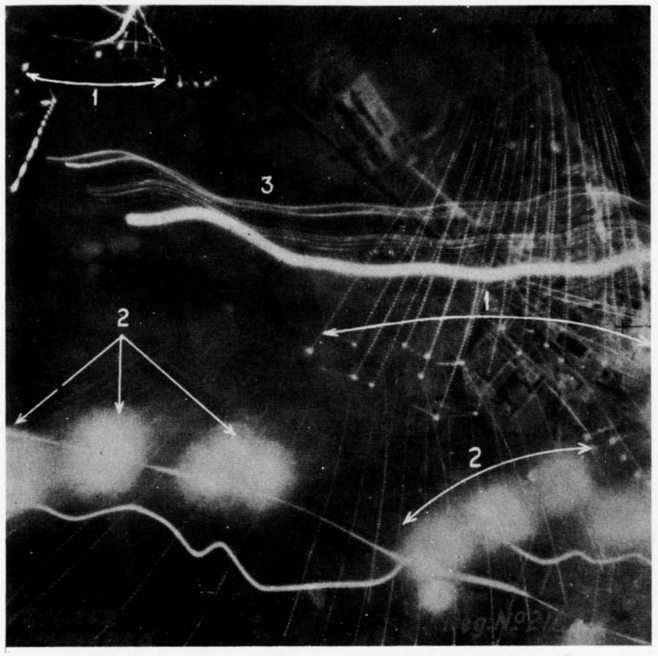


NIGHT PHOTOGRAPHY- METHOD

(1) Bomb flame recorded before flash bomb explodes with typical comet tail narrowing from the nucleous.

(2) Bomb burst recorded by light from flash bomb. Ground detail ties in here.
Distance from (1) to (2) shows distance plane has travelled.
If the explosion of the bomb occurs after the photo flash explodes, the burst cannot be recorded.

HIGH EXPLOSIVE BOMBS

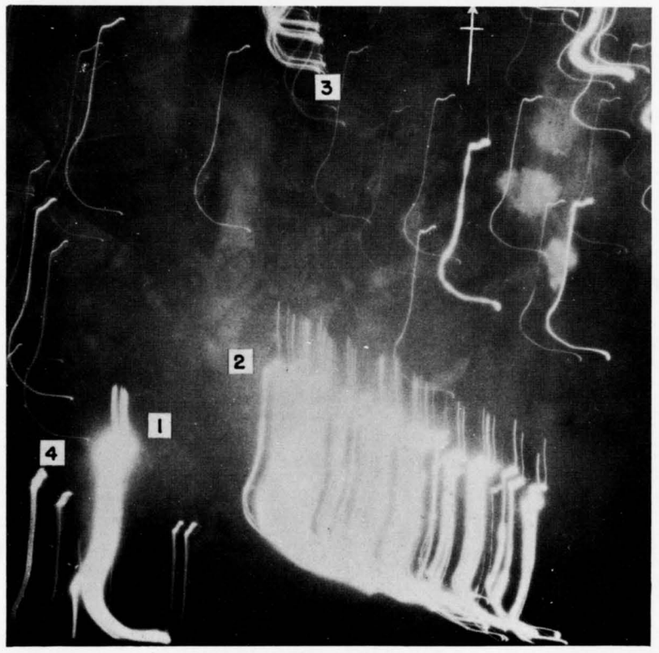


A. A. AND FIRE TRACKS

1. Tracer paths.

2. Muzzle blasts.

3. Fire tracks - identified by the relationship of the curves which conform to the direction of the plane's flight. This shows that light sources are at fixed points on ground and are of long duration.



INCENDIARIES

1. Farmhouse on fire.

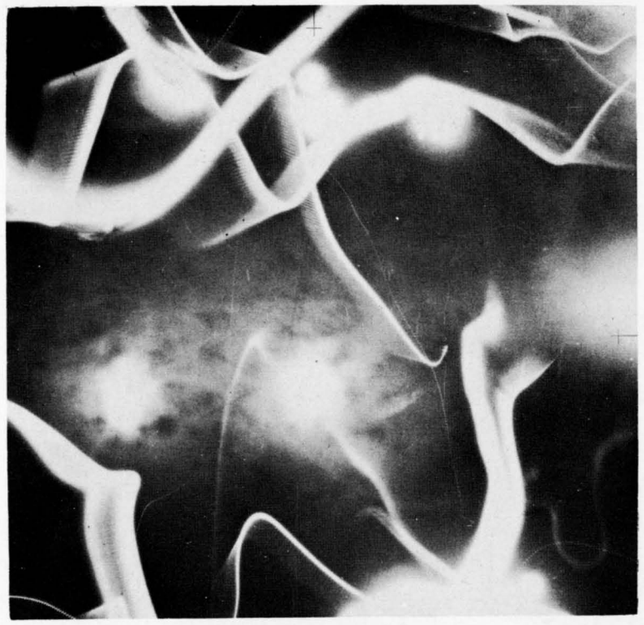
2. 4LB incendiaries - owing to the large trail angle of 4LB incendiaries an aircraft is very seldom able to photograph its own 4LB incendiaries starting to burn.

3. 30LB incendiaries.

4. 250LB incendiaries - the trajectories of 30LB and 250LB incendiaries are similar to those of general purpose bombs; 30LB and 250LB incendiaries can be photographed bursting into flame by the aircraft dropping them.

Note typical hem and curtain; the hem being the track of the bowl of the light in a fixed ground position, the curtain being the beam.

Owing to the fact that searchlights may be extinguished at any time, their tracks may appear complete when in fact they are incomplete. For this reason, the method of plotting fires must be used with discretion when plotting the ground location of searchlights.



SEARCHLIGHT TRACKS

1. Photoflash.

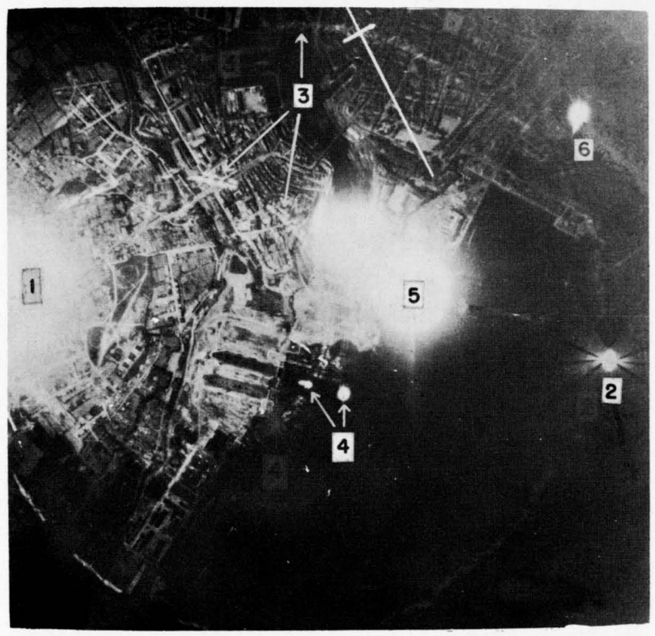
2. Reflection of photoflash - often known as the 'Lighthouse' from its characteristic appearance.

3. Halos - there is an inner and an outer halo; the photoflash lies on the circumference of both, the 'Lighthouse' on the circumference of the outer halo.

4. Bomb flash.

5. Flare.

6. Heavy flak.



INTRALENS REFLECTION ("LIGHTHOUSE")