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AAF MANUAL 95-101-1

Radar

PHOTOGRAPHY

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Published by
HEADQUARTERS ARMY AIR FORCES

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AAF MANUAL 95-101-1

Radar PHOTOGRAPHY

HEADQUARTERS, ARMY AIR FORCES
Washington, 30 May 1945

Air Forces Manual 95-101-1 is published for the information and guidance of all concerned.

BY COMMAND OF GENERAL ARNOLD:

IRA C. EAKER
Lieutenant General, United States Army
Deputy Commander, Army Air Forces

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foreword

TO ALL RADAR OBSERVERS, BOMBARDMENT

Although still in the stage of rapid development, radar scope photography has increased the dependability and accuracy of every phase of the radar mission from planning to evaluation. In radar navigation, bombing, and maintenance, radar scope photographs provide valuable data for action. Properly used, this data can contribute greatly to the success of every mission.

As radar operator, the responsibility for taking scope photographs falls on your shoulders and the quality of the pictures depends on how well you operate the equipment. To do a good job, you must understand the principles of radar scope photography and you must be able to operate efficiently any camera assembly you might have to use.

In this manual you will find a simple, nontechnical explanation of the various camera assemblies now in use or contemplated and the procedure to follow in operating each of these assemblies. If you familiarize yourself with this material, your job will be greatly facilitated.

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introduction

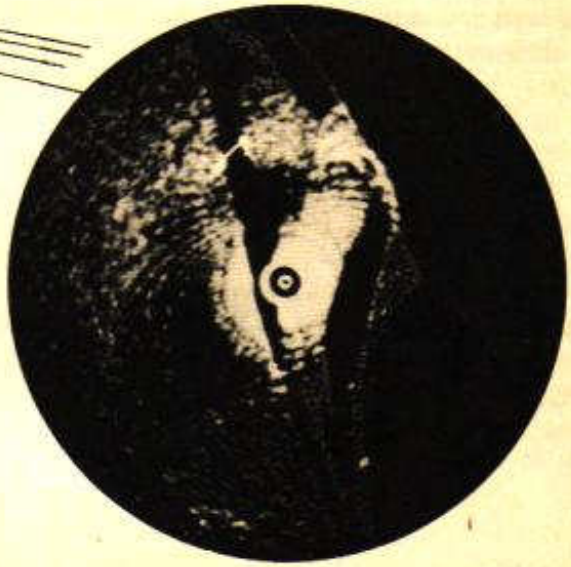
Quite early in the development of modern radar it became apparent that photographs of radar scope displays would be of great value. However, no equipment had been developed for this specific purpose, and to meet their needs, individual stations began to modify the photographic equipment they had on hand. They developed ingenious camera assemblies, worked out techniques, and took many scope photographs. They attacked their problems independently, and developed a great variety of radar photographic devices to serve their immediate needs.

As radar scope photography grew in importance, however, it became necessary to perfect and standardize this radar photographic equipment. To accomplish this, scope photography requirements were studied and steps were taken to design, perfect, and produce equipment that would meet those requirements. This equipment is now being distributed to the various stations in the AAF.

It is now important that all stations in the radar bombardment program standardize their methods of using this equipment so that the training of radar operators in scope photography can be a continuous operation throughout the Training Command and Continental Air Forces. This publication is designed to aid in the accomplishment of this task.

section 1

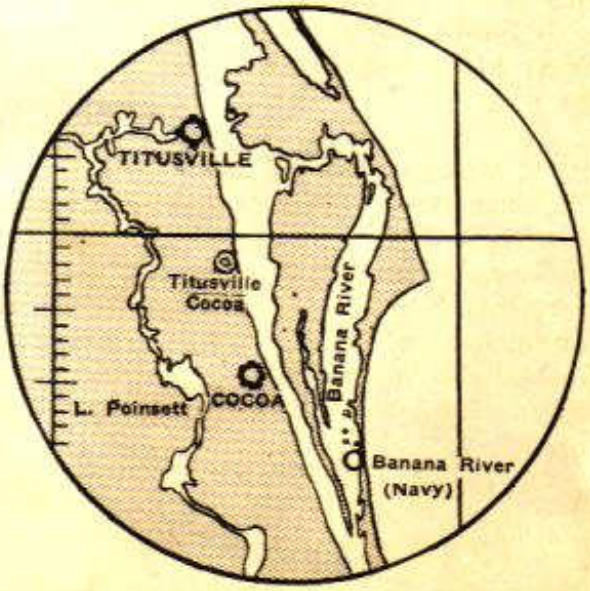
the functions of radar scope photography



Note Bridge at Titusville on Scope Photograph. Map Fails to Show it.

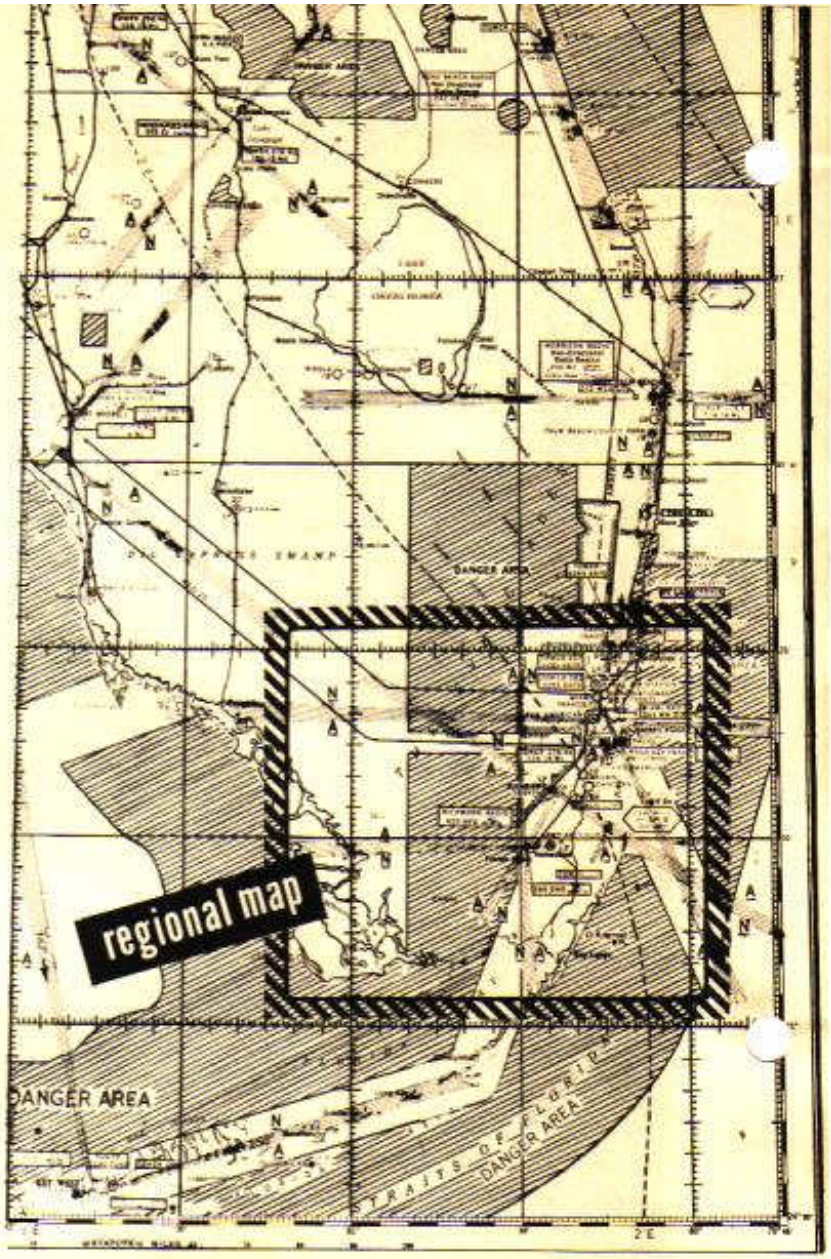
1. Mission Planning

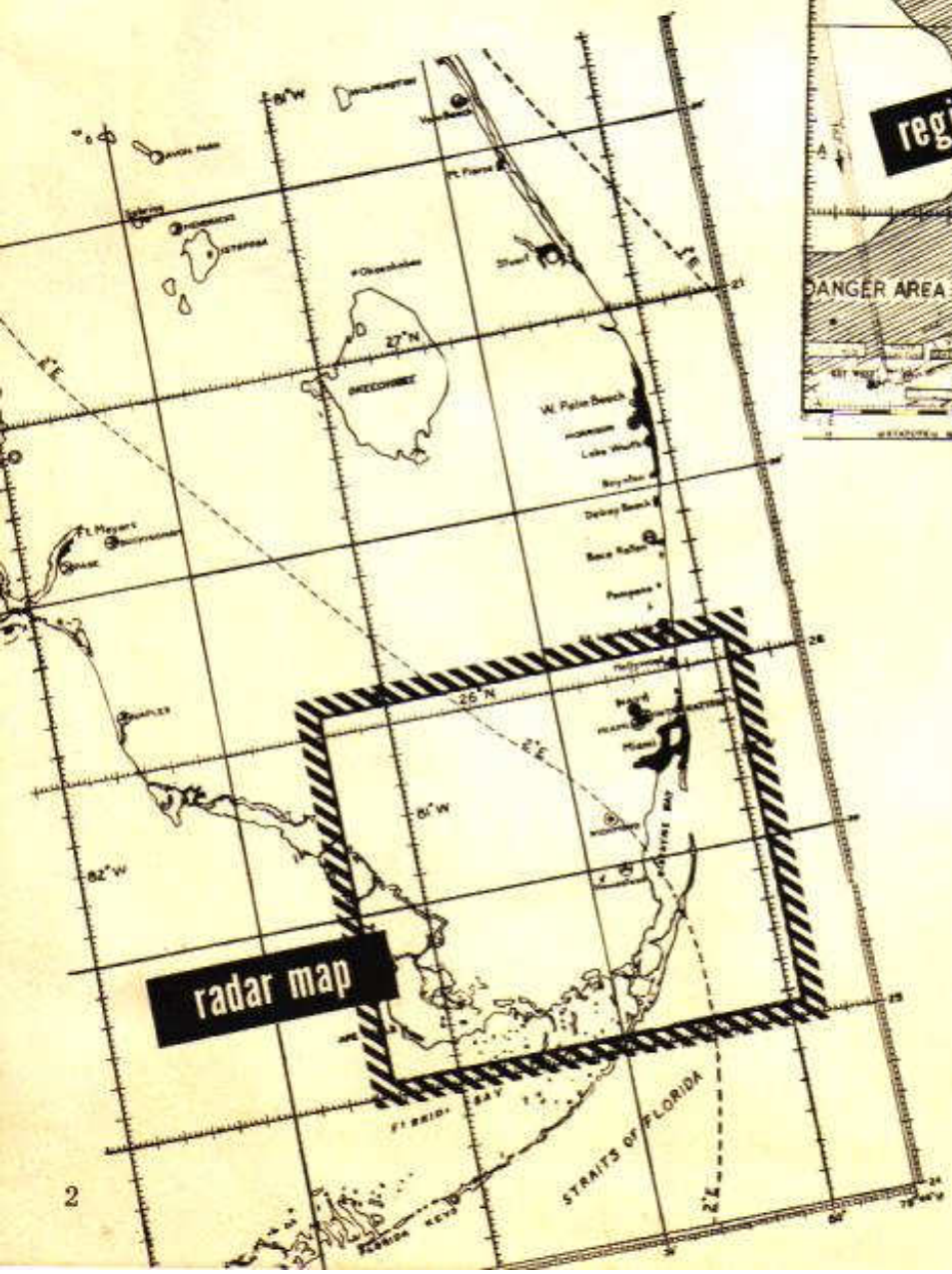
a. The planning of a radar mission is more complicated than that of a normal mission. Not only must the usual factors be considered, but in addition, attention must be given to the effect these factors will have on the radar scope. As a consequence, radar scope photographs have become a determining factor in the selection of any route over which a radar operator is expected to fly. Since the development of radar scope photography, the planning of a radar mission has taken on new aspects. No longer is it necessary to guess at the probable appearance of the terrain enroute to the target. Scope photographs taken on previous missions show exactly what may be expected. These photographs also make it possible to check the accuracy of the maps and charts in use and to correct errors in them.

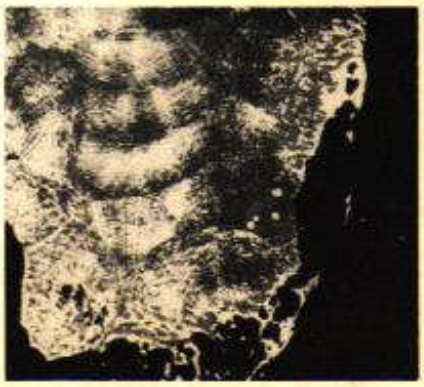


restricted

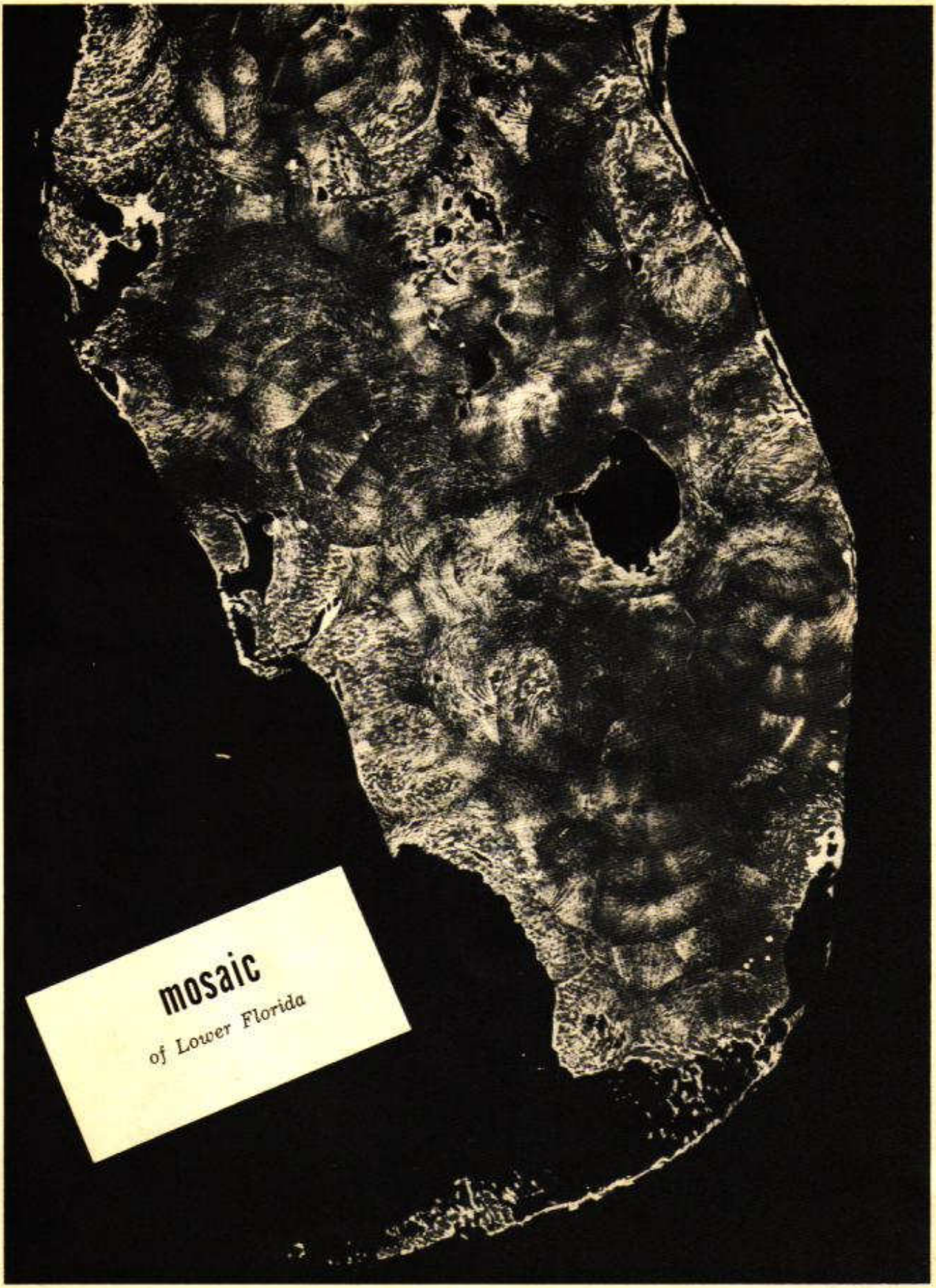
b. Many stations, both within the continental limits of the United States and in the theaters of operation, are therefore preparing maps and charts with information pertinent to radar navigational requirements. These maps and charts, which show the shape of potential radar scope targets as they will appear on the scope, are much more valuable for radar purposes than those which show them as they appear to the eye. Before long, mosaic maps made up of radar photographs will probably be prepared on a large scale and will provide complete radar navigational information.







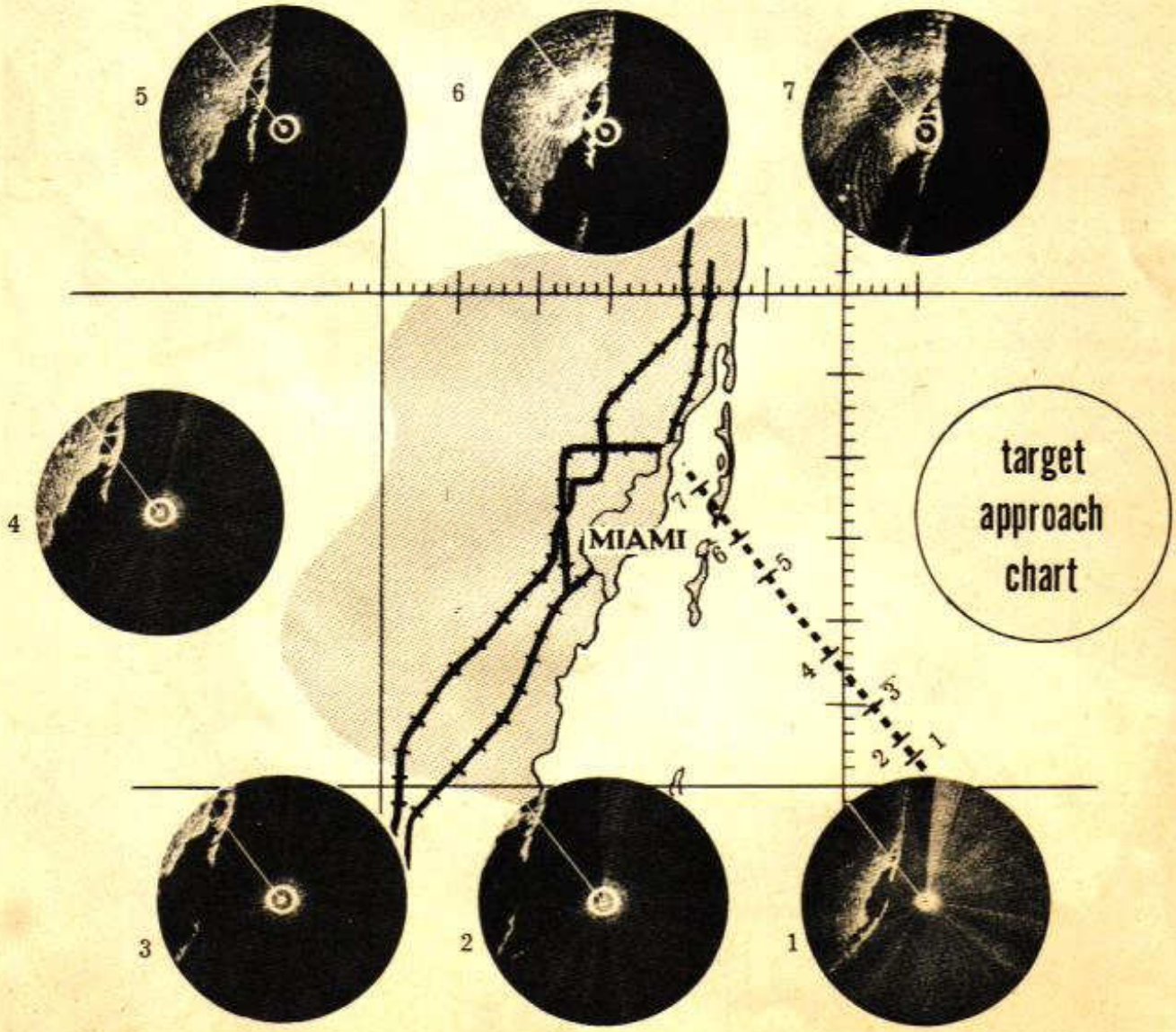
mosaic


mosaic
of Lower Florida

c. The same type of information can be used in bombing. Maps made by joining together radar scope photographs to form a complete coverage of an area are now being prepared for some bombing target areas. The file of scope pictures taken on previous missions shows how the target will appear on the scope, and in planning a bombing attack on any target, these pictures provide the basic information to be considered. Thorough study of these pictures reveals the best possible initial point (IP) from a scope presentation standpoint, and is a "must" for those planning such missions. The photographic records of previous missions also indicate what adjustments of the radar set will give the best results.

2. Briefing

The briefing officer can use the data provided by radar scope photographs to good advantage. By preparing motion pictures or slides of these photographs and projecting them onto a screen, he can help you develop your ability to interpret the scope. By using photographs taken over the same route on previous missions, he can show just how the terrain enroute to the IP will appear on the scope. He can prepare an overlay of scope pictures into a target-area mosaic, or he can mount pertinent individual pictures on existing maps of the target area and present highly useful target-approach charts. To emphasize specific areas of the target or to stress



target identification, he can use big enlargements of target scope pictures. All in all, radar scope photography makes it possible for the briefing officer to present a detailed and specific picture of the whole mission. In addition, radar technicians can study the past records and the critique of previous radar scope photographs and can tell the briefing officer the most desirable radar set adjustments for the particular mission.

3. Evaluation

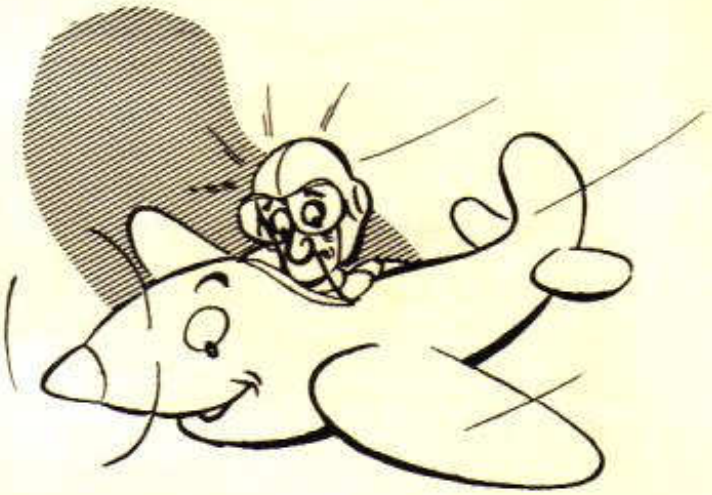
a. When a mission is over, radar scope photographs present a true picture of the displays on the scope through the entire course of the mission. The causes of errors that occur during the flight can be determined, and corrective suggestions can be offered. The operation of the radar set and the handling of its controls can be discussed. By comparing the photographic record with the logs and charts, errors in navigational procedure, scope interpretation, and position fixing can be determined and corrected.

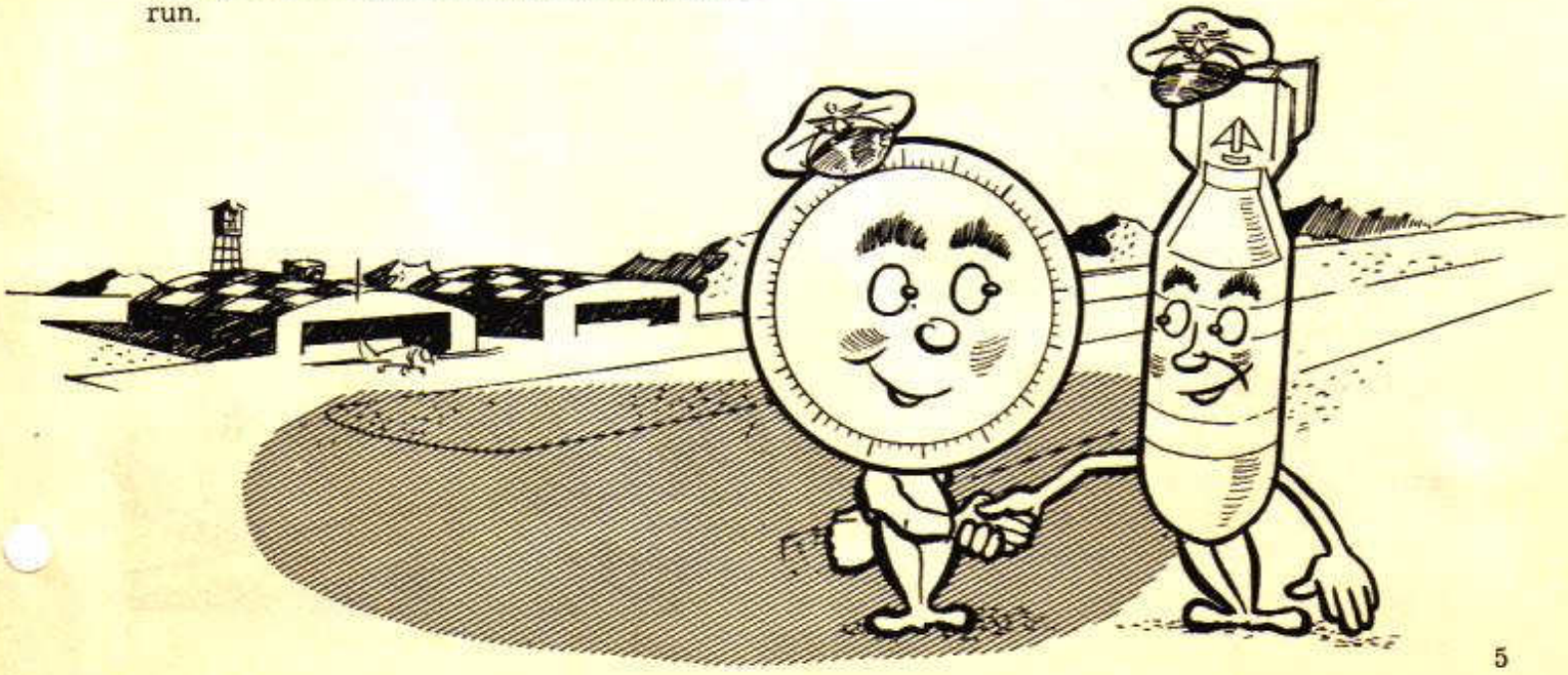
b. Scope photographs also make possible a dependable evaluation of bombing missions. Bomb impact points may be accurately determined, and errors may be expressed in range and azimuth. The causes of error can then be analyzed and can result in many corrective suggestions. The photographs of the scope displays can also show how efficiently the bombardier coordinates with you while you are synchronizing on the run.

4. Maintenance

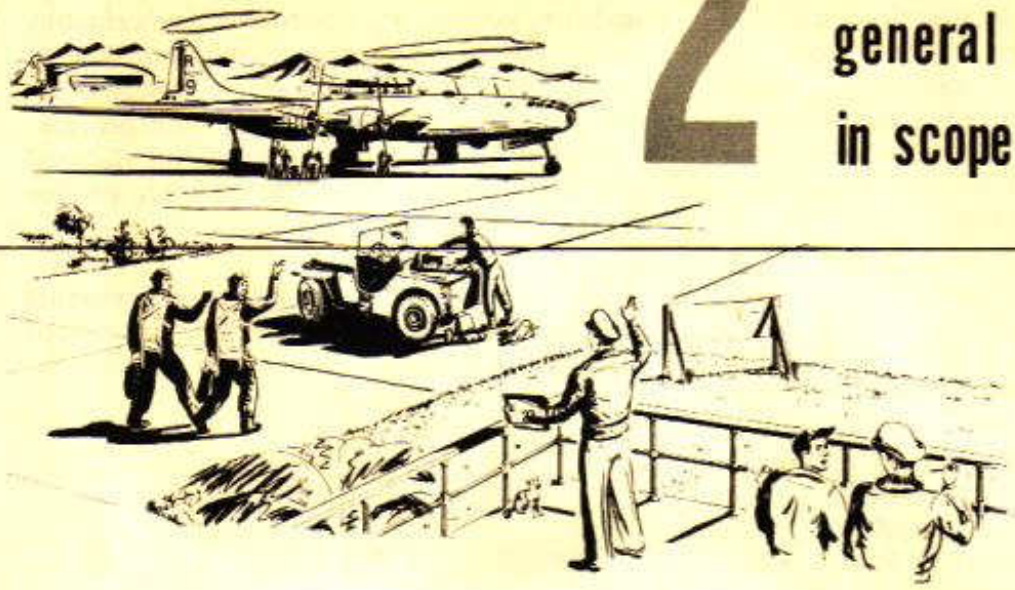
a. Even for maintenance of the equipment, radar scope photographs are valuable. Defects in the radar equipment as evidenced on the scope are often hard to describe accurately to members of the ground echelon. The photographs relieve you of this difficult job and allow you to show the maintenance personnel just what happened.

b. Ground beacon operating personnel can benefit from the pictures that record beacon operation as shown on the scope.





section 2 general considerations in scope photography



5. The Photographic Problem

a. The basic principles of scope photography are simple. The light from the display on the face of the scope passes through the lens, which focuses it on the film. Where the light strikes the film, the chemicals in the film are changed. The amount of change is proportional to the amount of light that strikes the film. Where no light strikes the film, there is no change. When the film is processed, chemical action brings out on the film an image that is similar in intensity and shape to the display on the scope.

b. The final picture is thus determined by the display on the face of the scope, the amount of light that passes through the lens, the accuracy with which the lens is focused, the sensitivity of the film, and the processing of the film. The problem of radar scope photography is to adjust each of these for the best results.

6. The Radar Set

a. GENERAL. Operate the radar set as you would normally. Keep the brilliance of the display close to normal at all times. Never turn it up or down excessively. Focus the display on the scope as accurately as possible. Tune in the target carefully by use of the tilt and gain adjustments on the set.

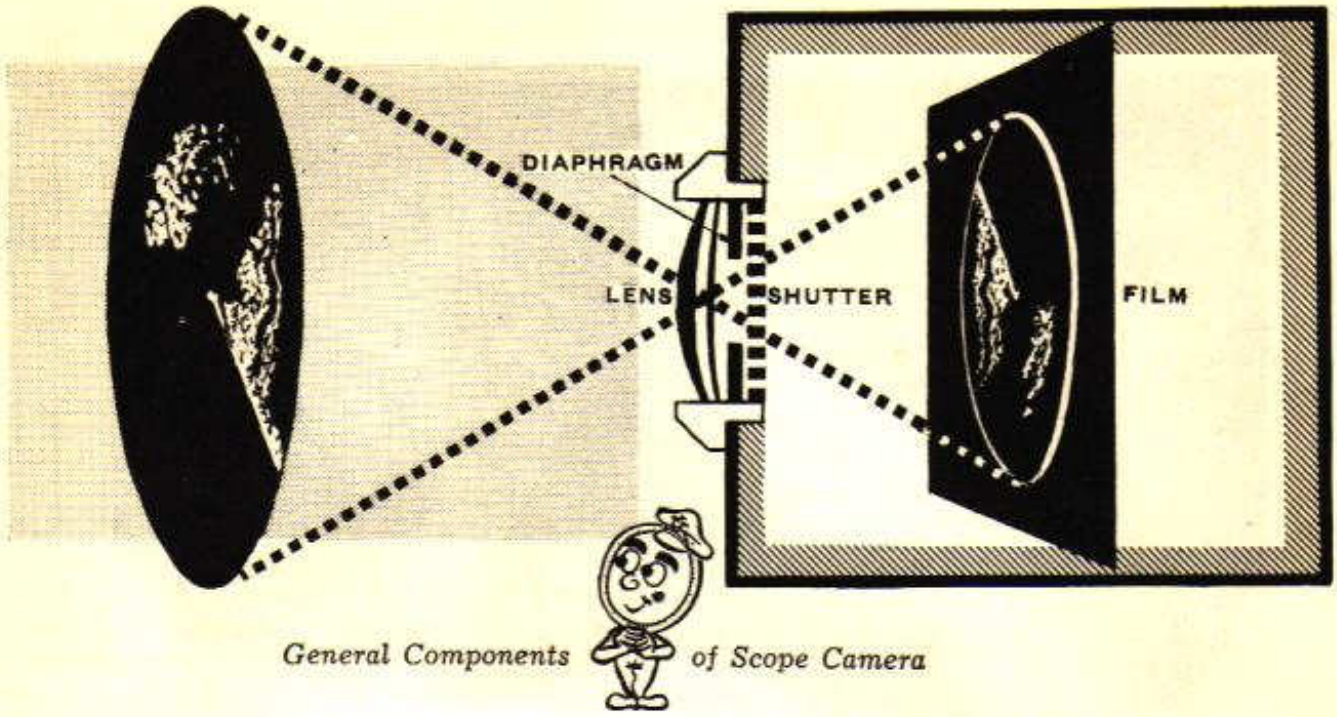
b. THE SWEEP-LINE. (1) To get a good picture it is necessary to record a complete cycle of the sweep-line. Less than a complete cycle may omit some important features of the image on the scope, and more than one cycle will put more than one image on the film and blur the picture. Of course, the scope face retains the impression of several previous revolutions of the sweep-line in diminishing degrees of intensity, and the picture will show these even though only one

cycle is recorded. Nevertheless, for all practical purposes, these fading images will produce less of a blurring effect in photographs than they do on the scope, and if a single complete cycle is exposed to the film, the result will be a clear picture.

(2) With radar sets on which the origin of the sweep-line is at the center of the scope (for example, on AN/APQ-13 and AN/APS-15 equipment) one cycle consists of 360° of sweep-line revolution. With these sets, therefore, 360° of sweep-line revolution must be exposed to sensitive film, no more, no less. With radar sets on which the origin of the sweep-line is at the bottom of the scope (for example, AN/APQ-7 equipment) 60° of sweep-line revolution comprises one cycle, and exactly 60° should be recorded in one exposure. On both types of equipment, the range markers, targets, heading marker, in fact, everything that appears on the scope will be recorded. Beacon operation can be recorded in much the same way as search.

7. The Camera

a. THE SHUTTER. The amount of sweep-line revolution recorded on the film can be controlled by means of the shutter. When the shutter is open, light from the face of the scope passes through the lens to the film. When the shutter is closed, the light is blocked. The shutter must therefore be open at the beginning of the cycle and closed at the end of the cycle. After the shutter is closed, the exposed film can be moved away, and unexposed film can be moved up in its place, ready for exposure. The operation of the shutter mechanism and the winding of the film can be handled either manually or electrically.



General Components of Scope Camera

b. THE LENS. (1) The intensity of the image on the film depends on the amount of light that passes through the lens. Assuming that the display on the face of the scope does not change in brilliance, the amount of light that passes through the lens depends on the size of the diaphragm opening. By changing the size of the diaphragm opening, the effective size of the lens is changed.

Diaphragm

(2) The diaphragm generally consists of a set of overlapping leaves. The leaves do not overlap at the center of the diaphragm, however, and the small opening there is called the aperture. The rotary, lever-like control that adjusts the size of the aperture by changing the amount of overlapping is calibrated numerically in "f" settings. The lower the setting number, the larger the aperture and the more light passes through the lens.

c. FOCUSING. When the image on the scope and the lens aperture are properly adjusted, the proper amount of light will pass through the lens opening. However, unless the light is focused sharply on the film, a blurred picture will still result. To focus the scope display on the film, it is necessary to adjust the distance between the lens and the film. The lens is usually set in a threaded mount. By rotating this mount, it is possible to adjust the distance between the lens and the film for sharp focus.

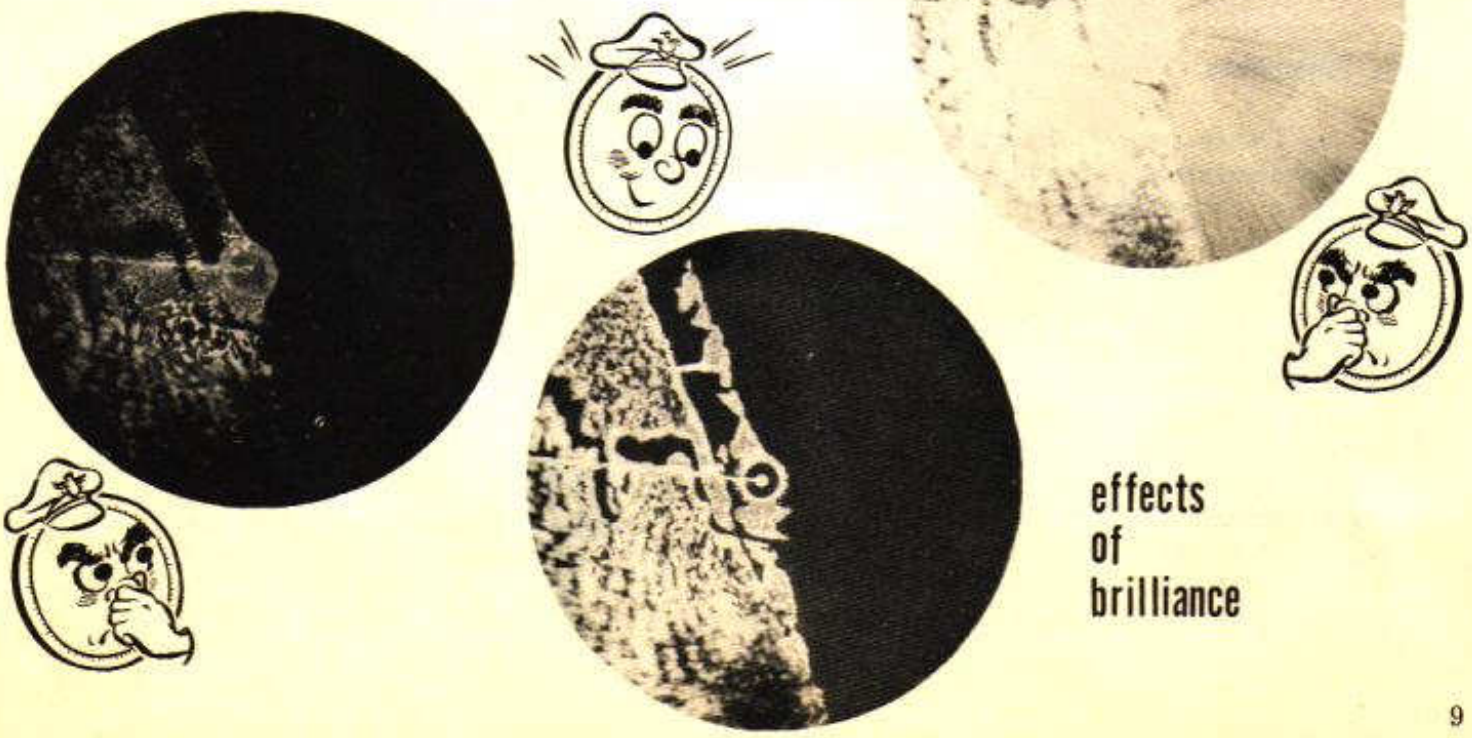
d. THE FILM. There are two classes of film which are generally used for scope photographic purposes. They differ in their sensitivity. Operating conditions will determine which is used.

8. Radar and Camera Adjustments

a. The job of setting the lens aperture, determining the film speed, and focusing the lens is a very complicated one. These adjustments will, therefore, always be made by photographic laboratory technicians trained for this job. Do not alter these settings unless you are specifically instructed in detail as to what to do. They are critical adjustments and are based on many hours of testing and experimentation. Your job is to operate the radar set and the camera properly, assuming that all the settings have been correctly made by the technical personnel.

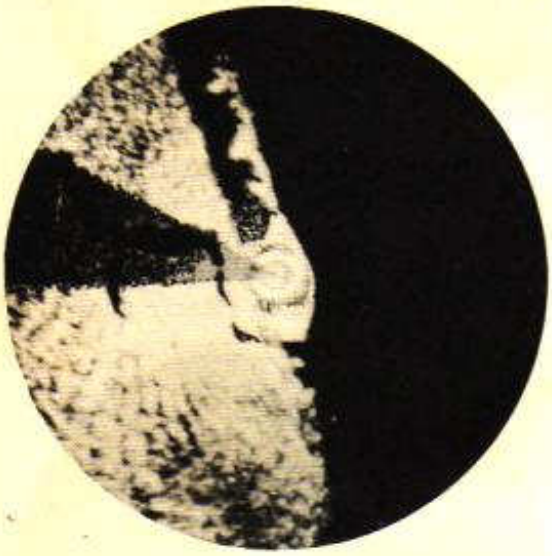
b. The correct operation of the radar set is of the utmost importance in getting good pictures. While taking scope photographs, therefore, keep your radar set adjusted accurately even when it is not necessary for bombing or navigation. If you require excessively high or low gain settings, accommodate the camera by making reciprocal adjustments of the brilliance controls and try to have an even intensity of light on the scope at all times. Make the centering adjustments accurately. In general, if you watch the brilliance and gain adjustments, you can proceed with radar operation as usual.

c. The brilliance and gain adjustments are important because they determine the kind of picture you get. If you turn the brilliance up to an unusually high point, an overexposed picture will result and the highlights of the picture will spread and lose definition. If you turn the brilliance down far below average, an underexposed picture will result. Most of the background features of the display will be eliminated, and only the brightest parts of the sweep-line revolution will be shown on the picture. With correct brilliance, both the highlights and the background display will be clearly shown.



d. With respect to the camera your main concern is with the operation of the shutter. In automatic cameras, all you will have to do is press buttons. In cameras with manually-controlled shutters, you will have to depress the trigger (which controls the shutter) at the beginning of the sweep-line revolution and release it at the end. If you close the shutter too late, more than one cycle of the sweep-line will show on the film. The over-run portion of the picture will be fuzzy, and definition will be extremely difficult in that segment. If you close the shutter too soon, a complete cycle of the sweep-line will not show on the film and one segment of the picture will be practically blank.

faulty shutter operation



(2) In radar scope photography, as in everything else, carelessness is the chief cause of difficulty, and thoughtfulness is the chief cure. If all those responsible for the production of scope photographic records are reasonably careful, the results will be more than satisfactory.

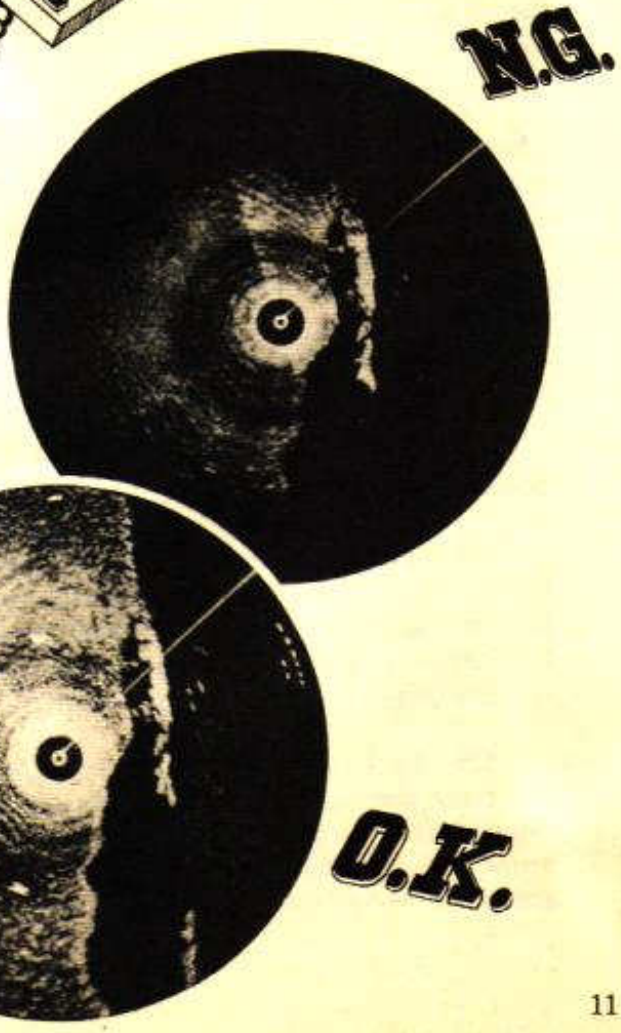
9. Precautions

a. GENERAL. (1) Radar scope photography depends on two complex instruments, the radar set and the camera, each with many critical adjustments. It depends also on the good judgment of a number of technicians. It even depends a little on luck. Occasional poor results should therefore be no surprise. Nevertheless, it is important that the causes of poor results be studied and eliminated. Poor radar photographs can be caused by defective radar or camera equipment, incorrect radar or camera procedure, and poor judgment in the selection of displays. Incomplete logs can render otherwise valuable pictures practically useless.

b. WITH THE RADAR SET. (1) *Scope Adjustment.* (a) Poor displays result in poor pictures. The fuzziness or lack of detail that results from the improper functioning or adjustment of the brilliance or gain controls has already been considered. Incorrect adjustments of the focus and tilt controls and defects in these controls give equally poor results.

incorrect and correct focus adjustment

(b) Be careful, therefore, to maintain the proper radar set adjustments as to brilliance, focus, tilt, gain, and other allied controls in order to insure a good scope display record. Try to keep a balance between the brilliance and gain adjustments in order to insure an even amount of light on the scope at all times. While taking a picture, try to establish a tilt adjustment that shows clearly the targets on the outer edge of the scope display.



incorrect and correct tilt adjustment

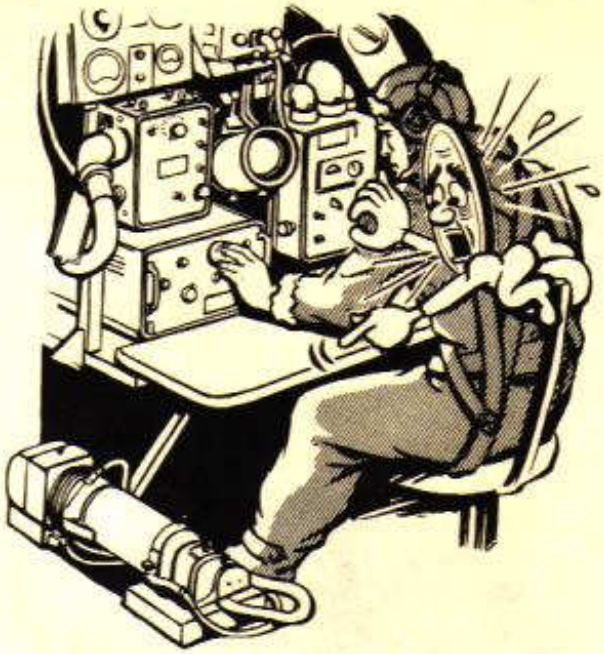
(2) *Remote Scope.* If your camera equipment is mounted on a remote scope remember that you are recording the remote scope display and adjust the controls accordingly. Many an operator has handled his main scope with a high degree of skill only to find that his photographs were practically useless because he had failed to consider the remote scope on which the camera equipment was mounted . Failure to perform a thorough check on the remote scope and synchronize its brilliance with that of the master scope will give results as poor as those obtained when the master scope is operated incorrectly.

c. WITH THE CAMERA. (1) *On the Ground.* (a) Defects in the camera equipment or incorrect use of it will result in a large percentage of poor pictures. Some camera deficiencies, for example, electrical malfunctions, may be the fault of the maintenance technicians. Some, such as incorrect selection of film and aperture settings, poor focusing, and defective film processing, are the fault of photographic laboratory technicians.

(b) To avoid errors, the photographic laboratory technicians must conduct tests to determine the best aperture setting. They must adjust the aperture of the equipment, focus the lens, and, in some cases, load the magazine. At the end of the mission, they must process the film correctly and deliver the completed record to the proper authorities.

(c) The maintenance personnel must remember that this equipment is critical and sensitive and must make reasonably sure that not only is it operating satisfactorily, but that vibrations in flight will not prevent its continued operation. In general, it is necessary that they conduct a careful preventive maintenance program for this equipment.

(2) *In the Air.* (a) As radar operator, you must assume that the photographic laboratory has done a good job. No matter how broad your knowledge of photography, do not attempt to re-set the adjustments. Remember



"Don't, please don't forget the Remote Scope!"

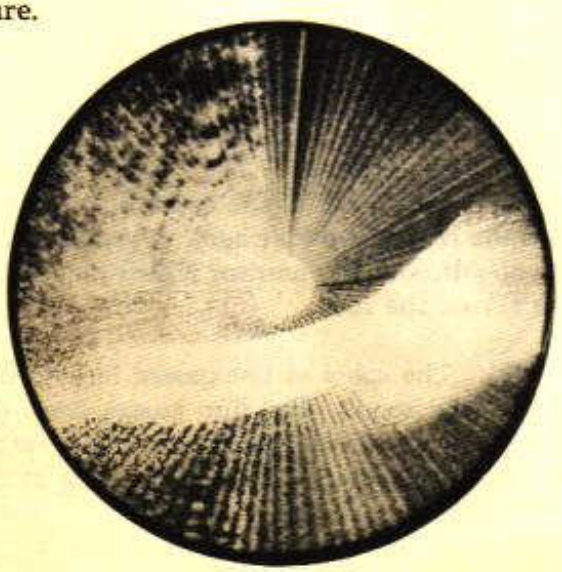
that these adjustments are based on numerous tests with the particular type of camera and film that you have. In your manipulation of the control switches, follow closely the directions outlined under the operating procedure. The electrical functions of certain types of these cameras are extremely critical. It is possible for you to work the relays out of synchronization and cause other malfunctions that, in some cases, cannot be corrected in flight.

(b) On cameras which do not have electrical provisions for timing, you will have to see to it that the exposure is correctly timed to cover one cycle of the sweep-line. This requires great care, and some operators have adopted the procedure of starting the exposure when the sweep-line is over a particular landmark on the outer extremity of the scope display. They stop the exposure when the sweep-line has completed its cycle and returned to the same point. This gives them a good reference position from which to time the sweep-line exactly. Other operators have set up the grid lines of the filter on the scope and have timed their operation from these lines, as described later. In view of the possibility of human error with manually-controlled cameras, be sure to start and stop the exposure when the sweep-line is

over an unimportant part of the scope display. This practice will insure the proper reproduction of the primary target on the display.

Good! Overlap is Over Unimportant Part of Scope Display

(c) The cone is often a source of trouble. The camera lens will pass any light that shines on it. Consequently, if light leaks in from the edge of the cone, there will be streaks on various sections of the negative. Cones that are not permanently fastened to the face of the scope must be fitted closely and held securely in place during the picture-taking operation; otherwise, there will be light leaks around the contact edges. Cones that are fitted to a remote scope have a door which may be opened for inspection and adjustment of this scope. If this door is not tightly closed while the camera is exposing, the resulting light leaks will spoil the picture.



d. In Getting the Correct Pictures. (1) The photographic laboratory technicians may have done a good job. You may have operated the radar and camera equipment in perfect fashion. The pictures may be perfectly clear. Yet, they will be practically useless if you neglect the displays you were briefed to record. When the operation or intelligence sections of a station request a photographic record of a specific scope display, they usually have a good reason for it.

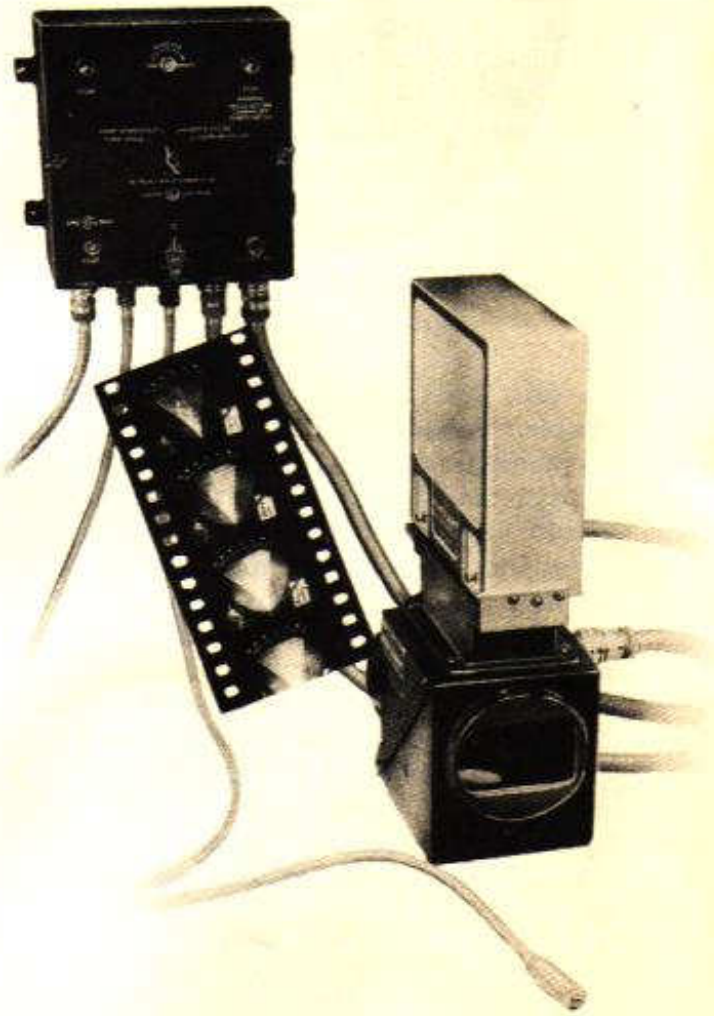
(2) At the end of the briefing period, you should know exactly what pictures are required. Make every effort to get a record of the required displays. Failure to do so will make the mission just a waste of time from a photographic standpoint.

e. In Keeping a Log. (1) The value of the radar scope photograph depends to a large extent on the data in your log. Your failure to keep a complete and accurate log will cause the expenditure of many hours in tedious review of your photographic record to determine the value of your pictures.

(2) Conduct your log work carefully, therefore, as described later in this manual. Make all entries accurately so that the briefing personnel will not be confronted with the difficulty of trying to determine what targets are shown on the pictures, when they were taken, on what mission, or by what airplane.

section 3

the 0-5 camera assembly



10. Description

a. GENERAL. (1) The 0-5 Automatic Recording Camera Assembly is now being used with the AN/APQ-7 Radar Set. Adapters will make it possible to use this camera assembly with other radar sets also. Each picture taken by the 0-5 is a photographic record of the scope display, and each shows the exact time it was taken, the number of the picture, and any other pertinent information you may wish to write on the data card.

(2) The 0-5 camera uses 35-mm motion picture film, but it is not a motion picture camera. It records 1600 single exposures on a 100-foot roll of film. When the negatives are contact printed, the resulting photographs are the same size as the negatives. If larger photographs are desired, good results can be obtained by enlarging the pictures to a 4x5-inch size. The 35-mm film also lends itself readily to projection onto a screen for viewing.

(3) The complete 0-5 camera assembly includes the camera proper, an adapter, a coupling unit, a control box, and connecting cables.

b. THE CAMERA. (1) The camera proper is at the top of the assembly. It contains the lens, the diaphragm, the shutter, the film spools, and mechanism which moves the film across the lens.

(2) The spool of unexposed film is called the feed spool. The film passes from the feed spool over a drive sprocket and across the aperture plate. It is held in place at the

drive sprocket by guide rollers and at the aperture plate by a gate and lock assembly. Between the aperture plate and the lens is a shutter which is synchronized with the radar sweep-line. The shutter times the exposure of the film automatically so that one complete cycle of the sweep-line is recorded at every exposure. The display passes from the radar scope through the lens to the film. The exposed film passes from the aperture plate over the drive sprocket and winds around the take-up spool.

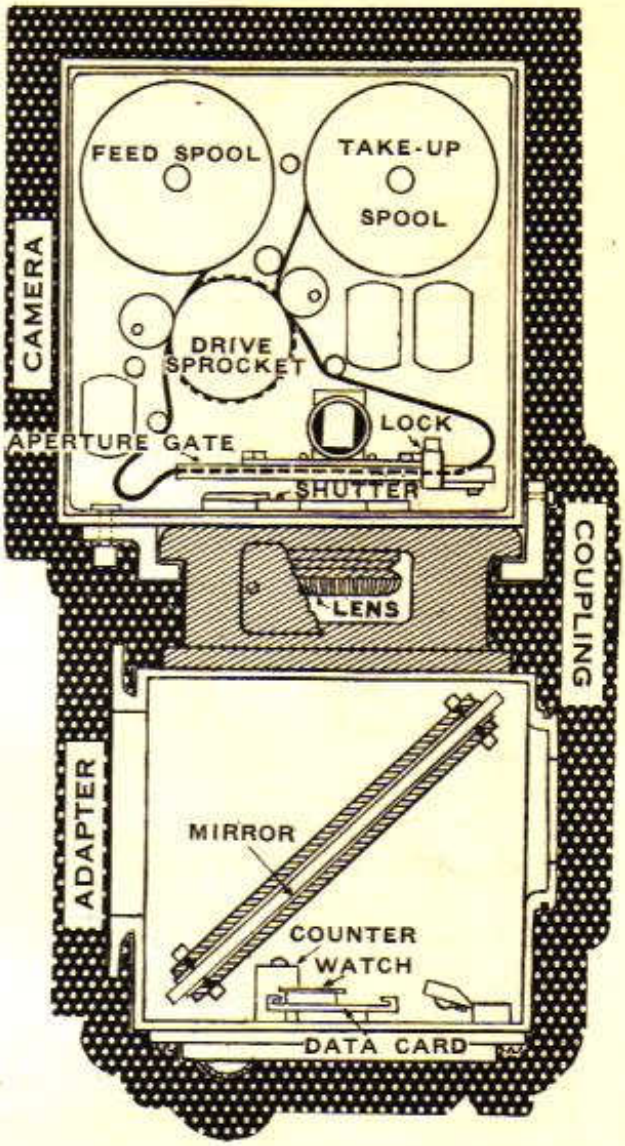
c. THE ADAPTER. (1) The adapter is attached to the AN/APQ-7 indicator panel. It replaces the cursor elbow on the panel and performs some of its functions. It acts as a photographic periscope and permits you to inspect the radar display and take a picture of it at the same time. A beam-splitting mirror in the adapter makes this type of operation possible. In the bottom part of the adapter there is a watch, a data card, an exposure counter, and lights to illuminate these items so that they may be photographed.

(2) The cursor plate is mounted in the adapter in much the same manner as it is in the AN/APQ-7 elbow, and the adapter is bolted to the AN/APQ-7 in the same place as the elbow which it replaces. The adapter serves as a camera mount as well as a photographic periscope.

d. THE COUPLING. A small metal coupling fastens the camera to the top of the adapter. The coupling has a door in it to permit adjustment of the camera lens, but the door should not be disturbed as all adjustments are made by the photographic laboratory technicians.

e. THE CONTROL BOX. (1) The control box is always located in a position that will give you easy access to it. In the control box are located the activating mechanism and the relays which enable the camera to function automatically.

(2) The control box comes in three different types, Type P-1M (or P-1), Type P-1R, and Type P-2.



P-2 Control Box

(a) Control Box Type P-1M (or P-1) includes the following items:

a sequence selector switch to select the interval between the pictures;

an ON-OFF switch to control power in the camera (a guard prevents this switch from being turned off accidentally);

a START button to start the operation of the camera;

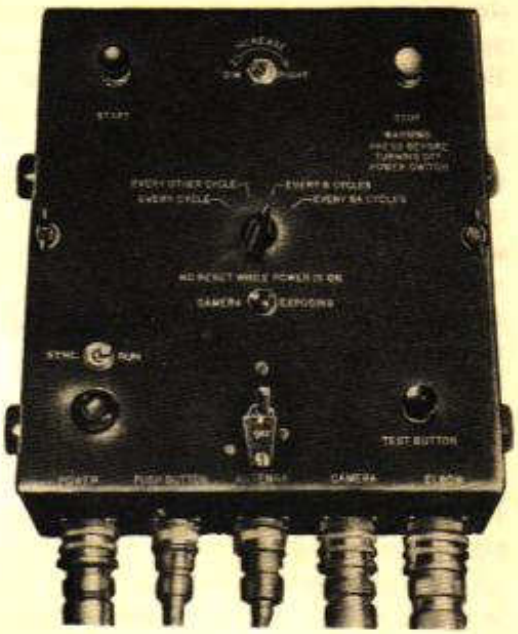
a STOP button to stop the operation of the camera;

a TEST button for tests;

a SYNCH-RUN switch for synchronizing the relays;

a 20-amp. fuse; and

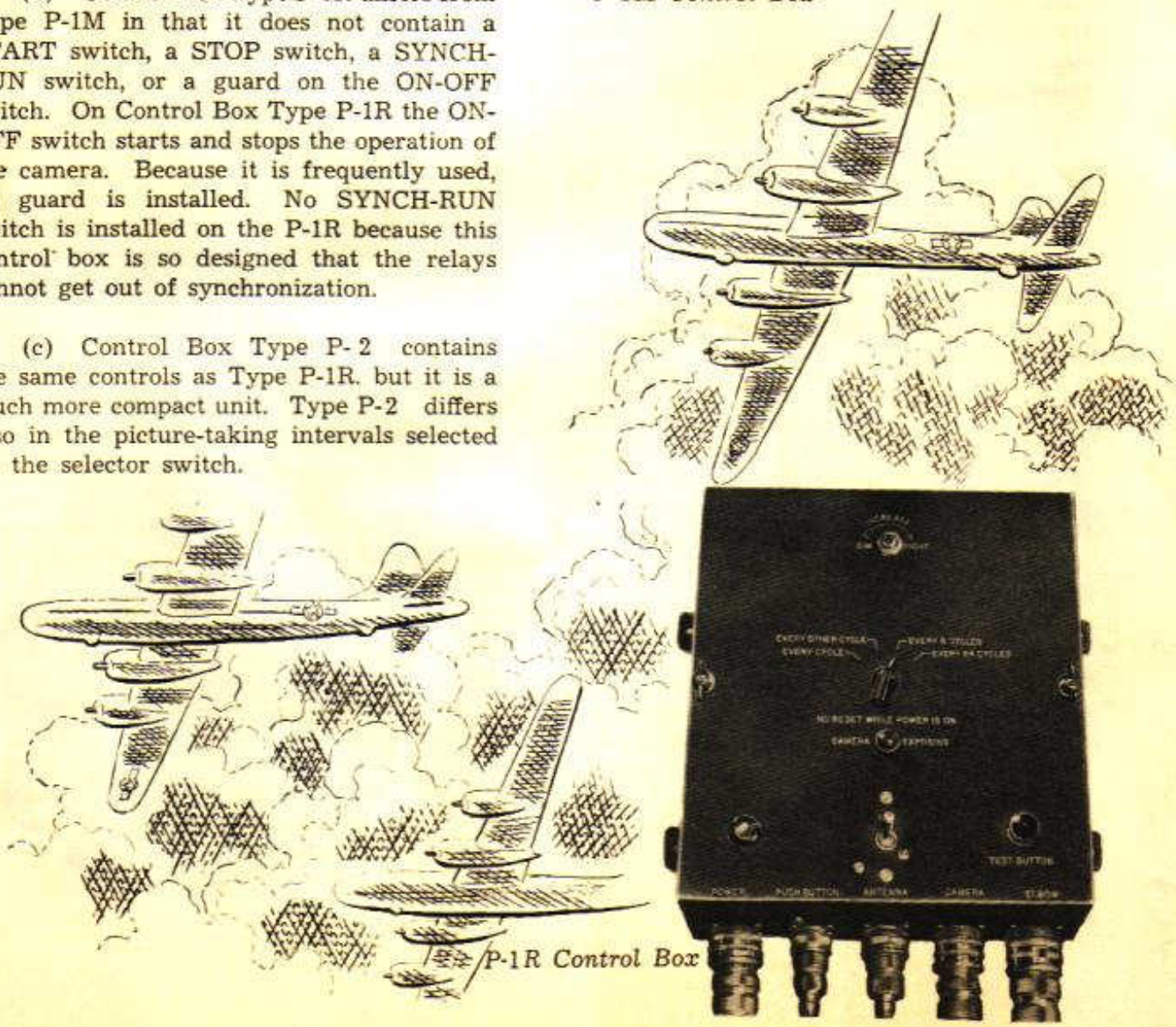
an intensity control to regulate the brilliance of the lights in the adapter.



P-1M Control Box

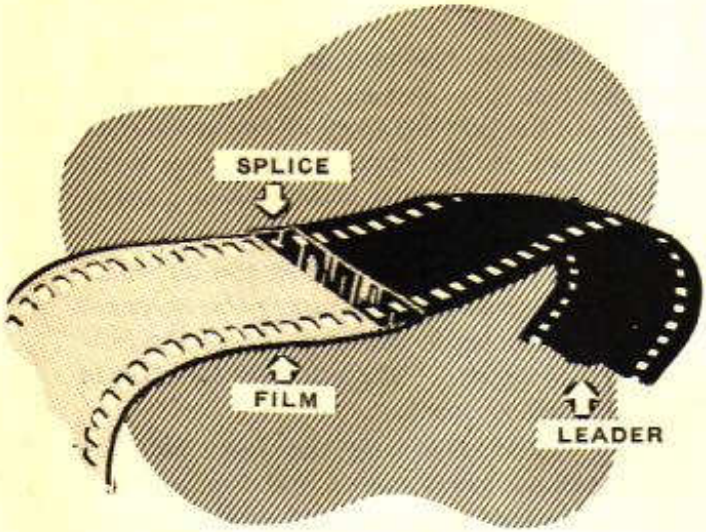
(b) Control Box Type P-1R differs from Type P-1M in that it does not contain a START switch, a STOP switch, a SYNCH-RUN switch, or a guard on the ON-OFF switch. On Control Box Type P-1R the ON-OFF switch starts and stops the operation of the camera. Because it is frequently used, no guard is installed. No SYNCH-RUN switch is installed on the P-1R because this control box is so designed that the relays cannot get out of synchronization.

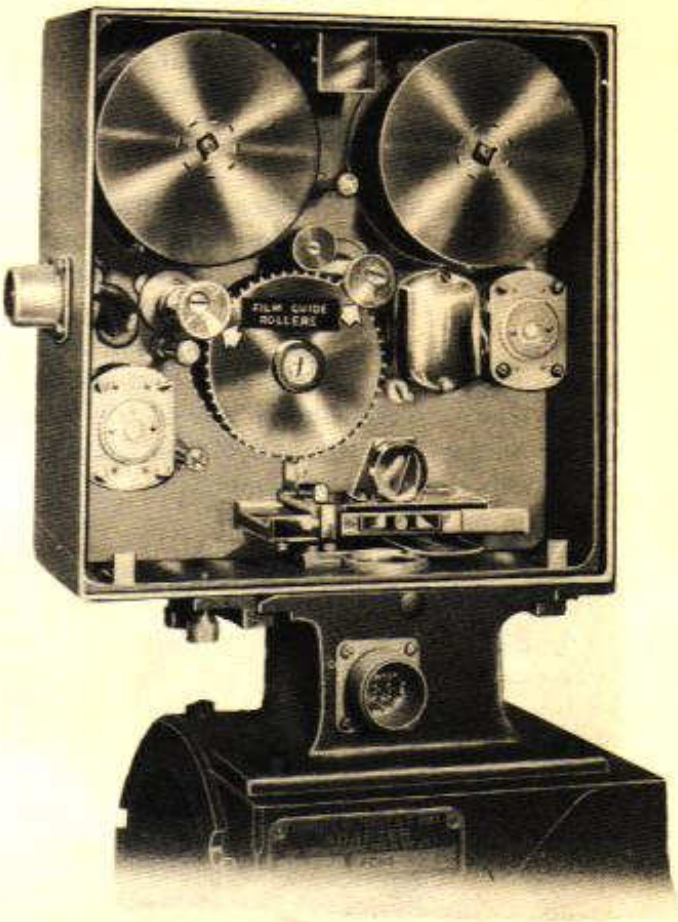
(c) Control Box Type P-2 contains the same controls as Type P-1R. but it is a much more compact unit. Type P-2 differs also in the picture-taking intervals selected by the selector switch.

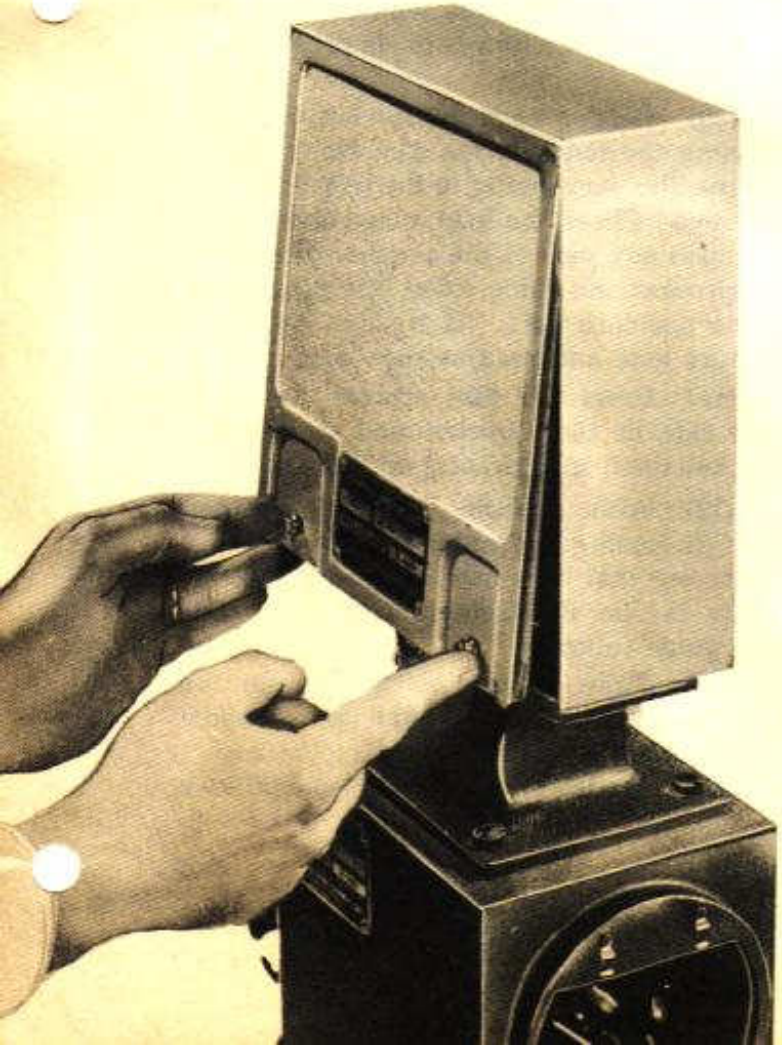


P-1R Control Box

f. THE FILM. The film supplied for this camera is 35-mm motion picture film, furnished in light-tight cans. The sensitive face of the film, called emulsion, faces the inside of the spool. Each spool contains 100 feet of film. A 6-foot, black, unsensitized "leader" is sometimes attached to the beginning of the film, and a similar strip is sometimes attached to the end of the film.







11. Loading the Camera

a. Remove the camera door. You can do this by operating two small corner latches.

b. If there is film in the camera, proceed as follows before loading the camera:

(1) Unlock the aperture gate and open it, then open the film guide rollers.

(2) Remove the take-up spool and wind all the remaining film on it.

(3) Remove the spool of unexposed film from its can and place the spool of exposed film in the can.

c. When there is no film in the camera proceed as follows:

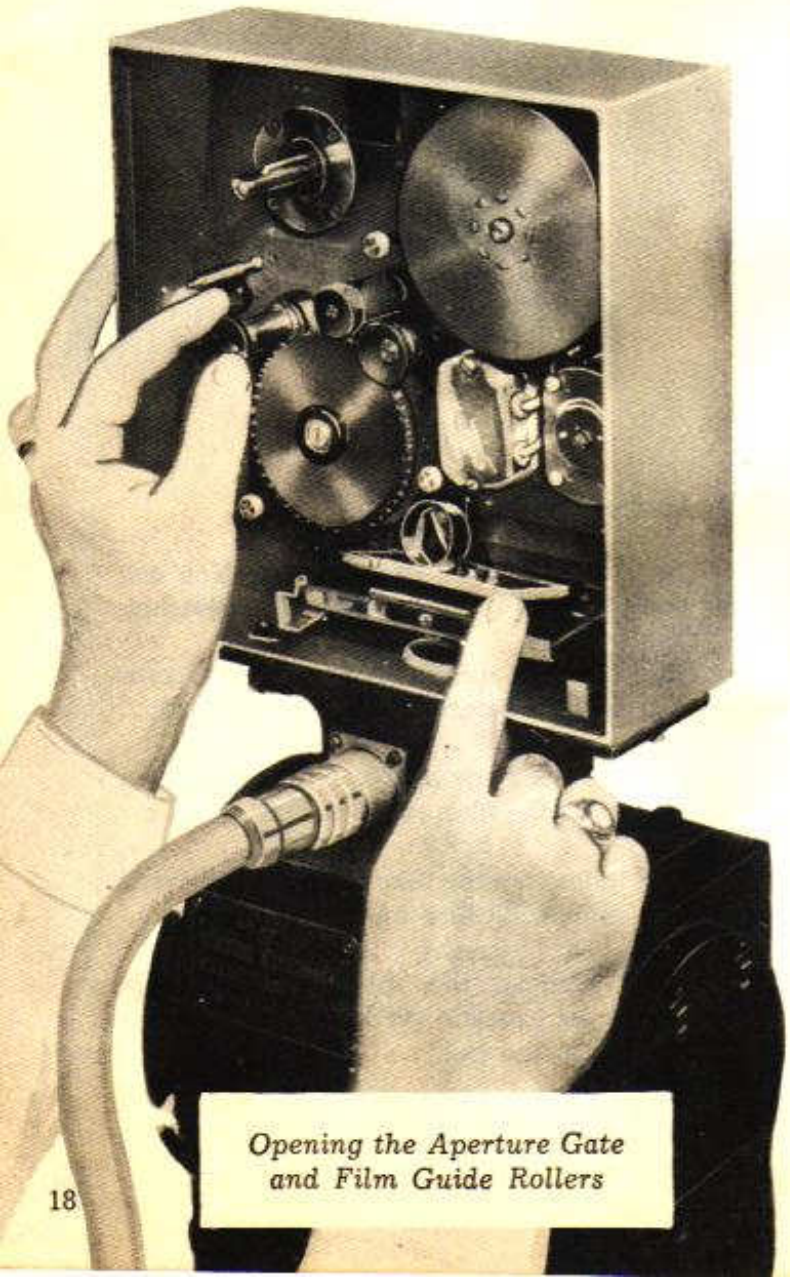
(1) Remove the empty feed spool from the left-hand spindle and push it into place on the right-hand spindle.

(2) Unlock the aperture gate and open it. Then open the film guide rollers.

(3) Remove the spool of unexposed film from the can.

(4) Unwind the leader and about 2 feet of film from the spool of unexposed film. If there is no leader, unwind about 4 feet of film.

(5) Push this spool into position on the left-hand spindle, making sure that the film hangs from the right-hand side of the spool. Check to see that the end of the spindle is flush with the spool surface.



Opening the Aperture Gate and Film Guide Rollers

(6) Pass the film between the left-hand guide roller and the sprocket, through the aperture gate, and between the sprocket and the right-hand guide roller. When passing the film through the aperture gate, make sure that the splice between the film and the leader is to the right of the aperture gate, for the splice will not pass through the gate. Also be careful to place the film on the proper side of the guide pins as indicated in the illustration.

(7) Fasten the end of the leader (or the film) in the slot on the take-up spool and rotate the take-up spool clockwise to pick up the slack in the film. Leave loops, however, that are about the same size and shape as indicated in the illustration.

(8) Press the film against the left-hand side of the sprocket and engage the sprocket teeth in the holes in the film. Close the left-hand guide roller. This will hold the film in place on the sprocket.

(9) After checking the loop between the left-hand guide roller and the aperture gate to see that its shape and position are as shown in the illustration, close the aperture gate and lock it. The gate should close without difficulty if the film is in its proper position.

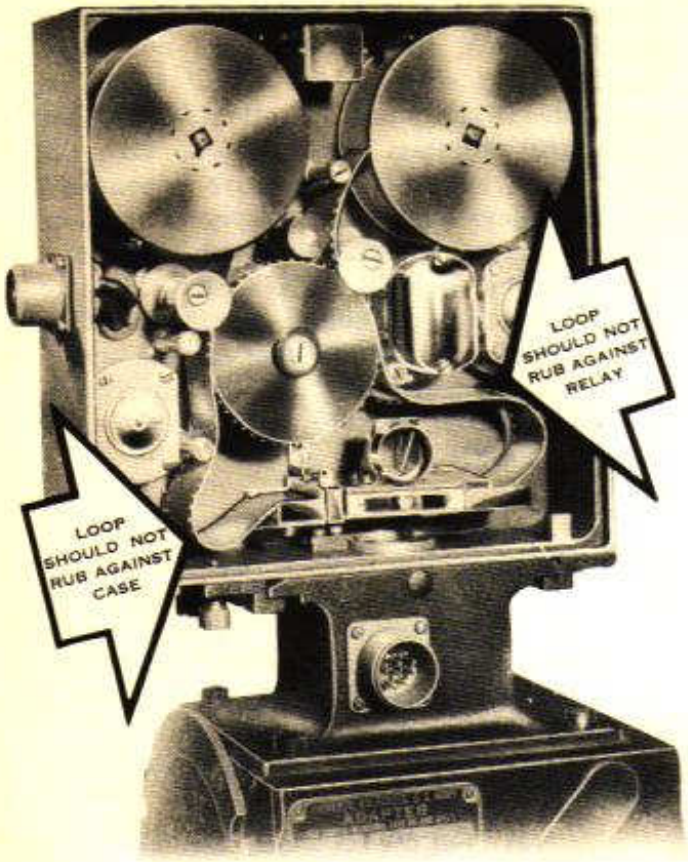
(10) Determine if the ratchet teeth are engaging the holes in the film by trying to pull the film very gently to the left. It should not move. Check the loop to see that it does not touch any part of the camera other than the sprocket, the guide roller, the guide pins, or the aperture gate. If it does, open the aperture gate and readjust the loop.

(11) Press the film against the right-hand side of the sprocket and engage the sprocket teeth in the holes in the film.

(12) After checking the loop between the right-hand guide roller and the aperture gate to see that its shape and position are as shown in the illustration, close the right-hand guide roller.

(13) Take up any slack between the right-hand guide roller and the take-up spool by rotating the take-up spool clockwise.

(14) Replace the camera door and lock it.



12. Pre-Flight Check

a. When you have performed the pre-flight check on your radar set, leave the set in operation and check your camera assembly. Be sure that your radar ANT ON-OFF switch is ON and your radar ANT SCAN switch is on F, while checking the camera.

b. Set the sequence selector switch on EVERY CYCLE, (on Type P-2, set the selector switch on 1).

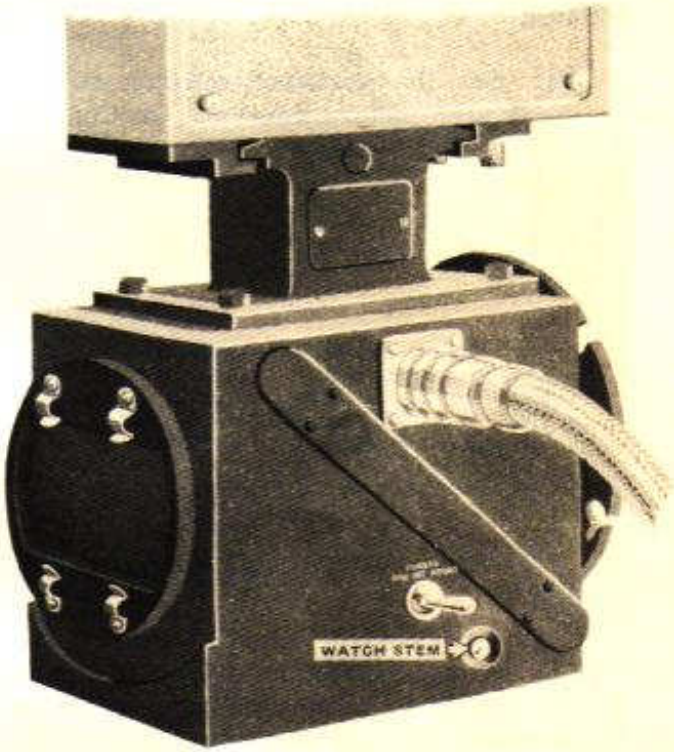
c. Turn the ON-OFF switch on the camera control box to ON.

d. If your control box has a START switch, press it.

e. Check the operation of the lights that illuminate the data card, watch, and exposure counter. They should go on and off at every cycle. Look through the hood and see if they are operative; if not, replace the bulbs. Do not change the setting of the DIM-BRIGHT intensity control. This is handled by the photographic laboratory technicians.

f. Record the exposure counter reading on the log. This will help you determine when to change film.

g. The watch stem is accessible through a hole in the right bottom corner on the right-hand side of the adapter. Wind the watch; then, looking at it through the hood, synchronize it with your own.



h. The exposure counter reading is reduced by one each time an exposure is made. Let the camera run until the exposure counter reading is at least 24 less than the reading you recorded. This is necessary to clear the film exposed during loading.

i. If your control box has a STOP button, press the STOP button, and wait for the CAMERA EXPOSING light to go on and then off.

j. Turn the ON-OFF switch to OFF.

k. Fill out the data card and insert it into the adapter. The data card is recorded with every exposure so that a record of everything written on its surface will appear on each picture. When filling out this card, include the information listed on page 39.

13. Operation

a. Operate the 0-5 camera only while the radar antenna is scanning the full 60°.

b. To operate the camera in synchronization with the radar sweep-line proceed as follows:

(1) Set the sequence selector switch for the desired picture interval. On Control Boxes Type P-1, P-1M, and P-1R, the settings are: EVERY CYCLE, EVERY OTHER CYCLE, EVERY 8 CYCLES, EVERY 64 CYCLES. On Type P-2, the settings are: 1, 2, 10, 60.

NOTE: On all control box types except the P-2, the camera takes a picture every 16 cycles when the sequence selector switch is on EVERY 8 CYCLES position and every 128 cycles when the sequence selector switch is on EVERY 64 CYCLES position. On the P-2, pictures are taken as indicated on the control box.

(2) Turn the ON-OFF switch to ON position.

(3) On control boxes with a START button press the START button. This will cause the camera to start taking pictures at the interval indicated by the sequence selector switch. On control boxes without a START button, the ON-OFF switch starts the operation of the camera.

c. To change the setting of the sequence selector switch on control boxes containing START and STOP switches, press the STOP switch, wait until the CAMERA EXPOSING light goes on and off, set the sequence selector switch on the desired position, and press the START button. On control boxes without START and STOP switches, you may reset the sequence selector switch without manipulating any other control.

d. With control boxes containing a STOP switch, the camera does not cease operating as soon as the STOP switch is pressed. It continues operation for another exposure and then stops. If you turn the camera off before this exposure is completed, the relays will be out of synchronization. After pressing the STOP switch, therefore, wait for the CAMERA EXPOSING light to go on and then off before turning the ON-OFF switch to OFF. To stop camera operation with control boxes that do not contain a STOP switch, merely turn the ON-OFF switch to OFF.

e. If the lights in the adapter flash on and off erratically, if they stay on continuously, or if pressing the STOP button does not halt the operation of the camera, the relays are out of synchronization. To re-synchronize them proceed as follows:

(1) Turn the ON-OFF switch to OFF.

(2) Set the sequence selector switch on EVERY OTHER CYCLE.

(3) Turn the ON-OFF switch to ON.

(4) Press the START button.

(5) When the CAMERA EXPOSING light goes on and then off, turn the ON-OFF switch to OFF.

(6) Set the sequence selector switch on EVERY 64 CYCLES.

(7) Put the SYNCH-RUN switch on SYNCH.

(8) Turn the ON-OFF switch to ON.

(9) Press the START button.

(10) As soon as the CAMERA EXPOSING light flashes, watch the scope. When the sweep-line passes the end of its cycle turn the ON-OFF switch to OFF.

(11) Put the SYNCH-RUN switch on RUN.

(12) Put the sequence selector switch on EVERY 8 CYCLES.

(13) Turn the ON-OFF switch to ON.

(14) Press the START button.

(15) Press the STOP button.

(16) Wait for the CAMERA EXPOSING light to go on and then off. The relays are now in synchronization.

f. If you do not have the time to re-synchronize the camera, you may still operate with the sequence selector switch on EVERY CYCLE or EVERY OTHER CYCLE position. To do this,

(1) Turn the ON-OFF switch to OFF.

(2) Put the sequence selector switch on EVERY CYCLE or EVERY OTHER CYCLE position.

(3) Turn the ON-OFF switch to ON.

(4) Press the START button.

(5) In this type of operation, ignore the STOP button. When you wish to turn the camera off, turn the ON-OFF switch to OFF.

g. The TEST button causes the camera equipment to cycle in the same way as the radar antenna. This button is used by the maintenance personnel.

h. The fuse protects the electrical circuits in the camera. If the camera becomes inoperative, check the fuse.

i. The exposure counter is a three-place counter. Its purpose is to indicate the number of exposures remaining on the film. The exposure counter reading is reduced by one every time the camera makes an exposure.

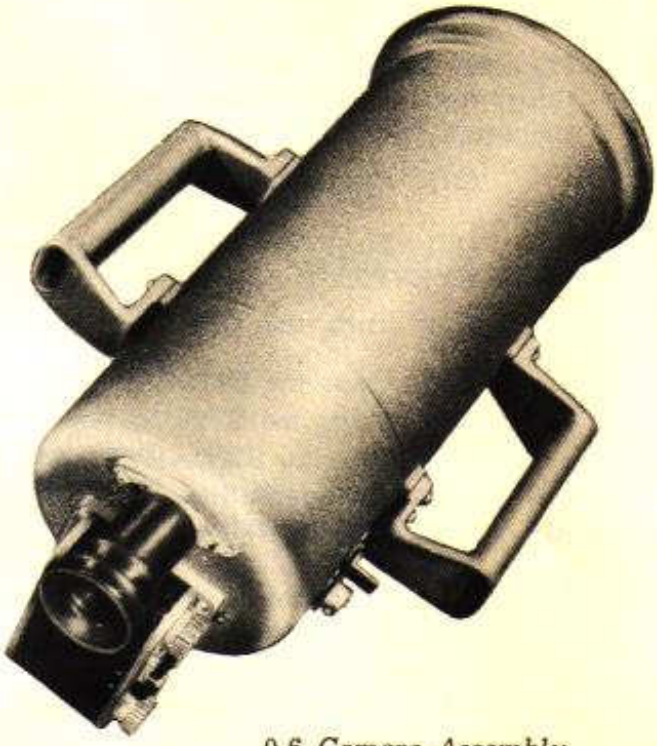
j. A new spool of film must be installed after approximately 1500 exposures. However, the counter cannot be re-set, and it is necessary to record the exposure counter reading when loading a roll of film. When the exposure counter reading returns to this recorded number, 1000 exposures have been made. Keeping in mind the fact that the reading reduces as the film is exposed, subtract 500 from this reading to determine the point at which to change film. Don't risk missing a picture in an effort to economize on film. When changing spools in flight, try to pick an advantageous time to perform the operation even if it means wasting the 5 or 10 feet of film still on the spool. Never run to the end of the spool if it can be avoided.

14. Turning Off the Equipment

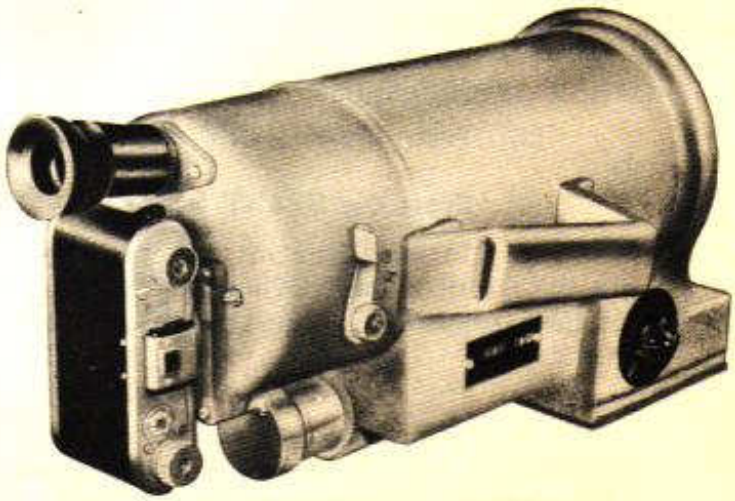
If the 0-5 camera assembly is left on after the radar antenna is stopped or put on sector scan, the camera solenoids may burn out. To avoid this, turn off the 0-5 before turning off the radar set. It is also necessary to move the exposed film from the body of the camera onto the take-up spool so that the personnel charged with unloading the spool will not fog the film while performing the unloading operation. At the end of the roll of film, therefore, set the selector switch on EVERY CYCLE position (on Type P-2, set the selector switch on 1) and turn ON-OFF switch to ON. On control boxes with a START switch, also press the START switch. Allow 25 exposures to be made. Then press the STOP switch, wait for the CAMERA EXPOSING light to go on and off, and put the ON-OFF switch in the OFF position; on control boxes without a STOP switch, merely turn the ON-OFF switch to OFF.. This switch disconnects all the power from the camera.

section 4

the 0-6, 0-7, and 0-8 camera assemblies



0-6 *Camera Assembly*



0-7 *Camera Assembly*

15. Description

a. GENERAL. (1) The 0-6, 0-7, and 0-8 camera assemblies all use the same camera, the K-35. They differ only in their cones. The 0-6 assembly is equipped with a Morse Model A Stovepipe cone for use with AN/-APQ-13 equipment. The 0-7 assembly is equipped with a Morse Model B Stovepipe cone for use with AN/APQ-13 equipment. The 0-8 assembly is equipped with a Morse Model A Stovepipe cone for use with AN/-APS-15 equipment. Various adapters permit the use of these assemblies with other types of radar equipment such as the SCR-717B.

(2) The Model B cone contains a watch and a radar range indicator. The Model A cone does not contain these items. All three assemblies record a picture of the scope. However, only the 0-7 assembly, which is equipped with the Morse Model B Stovepipe cone, records the time, and the radar range indicator setting on each photograph.

(3) All three assemblies use 35-mm film. Contact prints, of course, are the same size as the film. If larger pictures are required, each negative can be enlarged to produce

a 4x5-inch picture. The 35-mm film also lends itself readily to projection onto a screen for viewing.

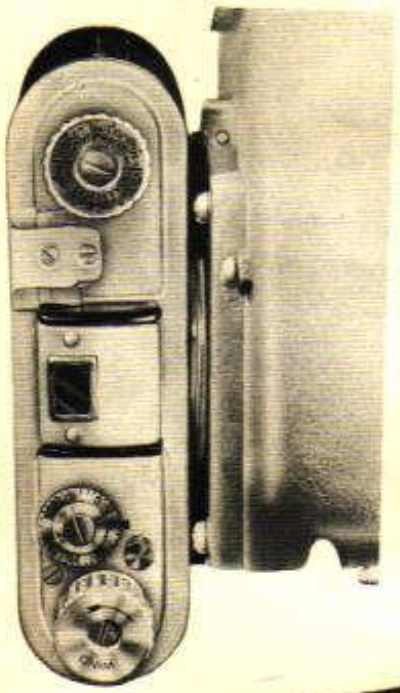
b. THE K-35 CAMERA. (1) The K-35 camera uses standard 35-mm cartridges, each of which contains enough film for 36 exposures. The cartridge is accommodated in a space at the bottom of the REWIND knob. The top of the knob protrudes through the top of the camera and has a knurled head on it for ease in winding.

(2) The film from the cartridge passes over the aperture plate. This plate has a rectangular opening in it to frame the light coming through the lens when the shutter is open. From the aperture plate, the film passes over a sprocket which is connected to the exposure counter on the outside of the camera. From the sprocket the film passes to the take-up spool.

(3) By means of a shutter, the period of time during which light can pass through the lens to the film can be controlled. The

shutter is manually activated by a trigger on the outside of the cone. When the film has been exposed, it is moved away from the aperture plate to the take-up spool by the WIND knob. A lock on the WIND knob is then activated preventing further rotation of the knob. This lock thus serves to space the film. It can be released by pressing the release button located alongside the WIND knob.

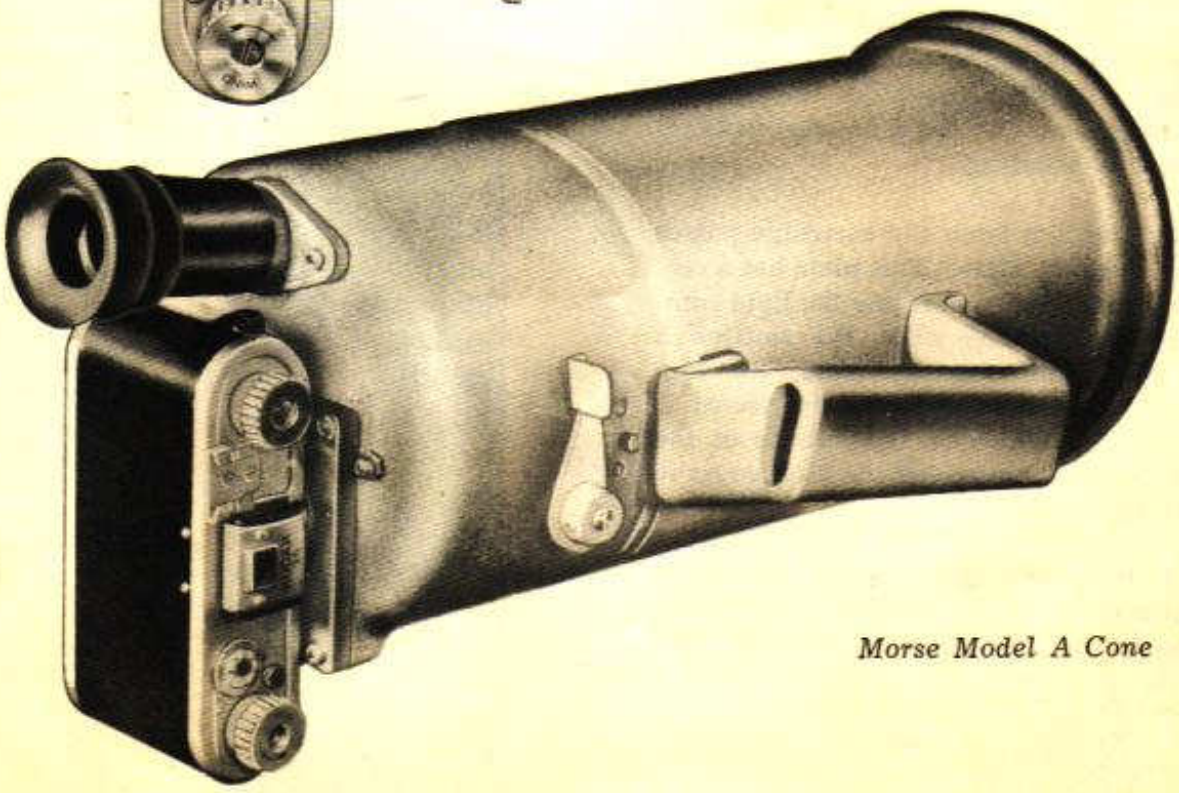
(4) The camera has a removable back to permit the loading of the film and inspection of the mechanism. The back is held in place by a lock on the bottom of the camera.



c. THE MORSE MODEL A CONE. (1) Both the 0-6 and 0-8 camera assemblies use a Morse Model A Stovepipe cone as a supporting unit. The cone acts as a light-tight adapter between the camera proper and the face of the scope.

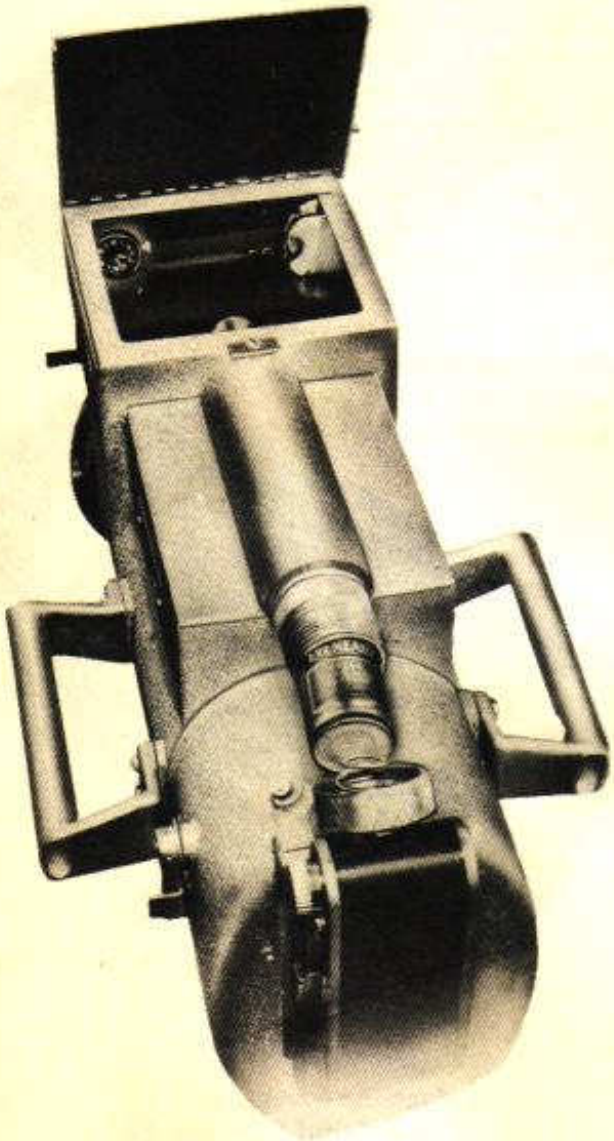
(2) The cone is made of metal. A ring on the scope end of the cone permits the cone to fit securely over the scope. A peepsight on the camera end of the cone permits you to view the scope while taking pictures. The two handles on the cone enable you to place the camera in position over the scope and to hold it securely while operating the shutter trigger with your thumb. The trigger is near the back of one of the handles in a convenient position for thumb operation.

(3) The entire cone unit is attached to the front of the camera, and the whole assembly may be located anywhere in the airplane convenient for you.



Morse Model A Cone

d. MORSE MODEL B CONE. (1) The Morse Model B Cone is the supporting unit for the 0-7 camera assembly. It acts as a light-tight adapter between the face of the scope and the camera lens. The cone houses a watch, a radar range indicator, and lighting facilities for them.



Morse Model B Cone

(2) The cone is made of metal. The scope end of the cone fits over the scope housing and makes a light-tight connection. A peep-sight on the camera end of the cone permits you to view the scope while taking pictures.

(3) There are two handles on the outside of the cone by means of which you can hold the camera firmly against the scope housing. The trigger is on the outside of the cone near the back of one of the handles. This makes it easy to trip the trigger with your thumb while holding the cone by the handles.

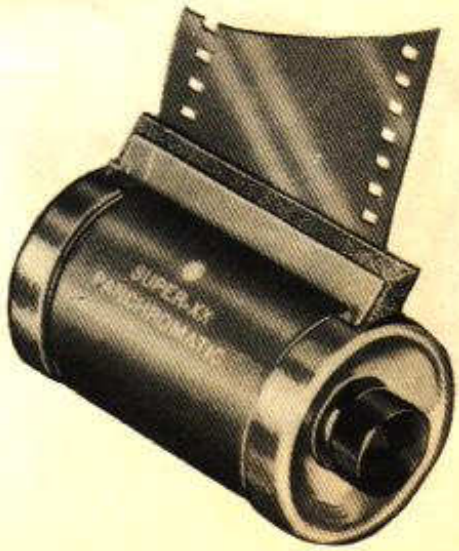
(4) When you press the trigger, the shutter is activated, and the light in the data housing goes on and illuminates the watch and the range indicator.

(5) The data housing is a square-shaped compartment, the inside of which is photographed along with the scope. The light in the data housing secures its power from dry cell batteries which are located in another housing in back of the data housing. The brilliance of the light is controlled by a rheostat knob on the data housing.

(6) The cone is attached to the front of the camera. You may place the entire unit at any convenient place in the airplane.

e. THE LENS. The aperture and focus of the lens are set by the photographic laboratory technicians. Do not disturb these adjustments.

f. THE FILM. The film used with these cameras is supplied in cartridges. Each cartridge contains a strip of 35-mm film, capable of recording 36 exposures. A leader is sometimes provided, but generally, the beginning of the film is used as the leader.



16. Loading the Camera

a. If you can't turn the WIND knob in a clockwise direction after pressing the release button, the film in the camera is fully exposed and must be removed. To do this,

(1) Pull up the WIND knob.

(2) Turn the REWIND knob at the opposite end of the camera in a clockwise direction until the exposure counter stops turning.

(3) Release the lock on the bottom of the camera and remove the camera back.

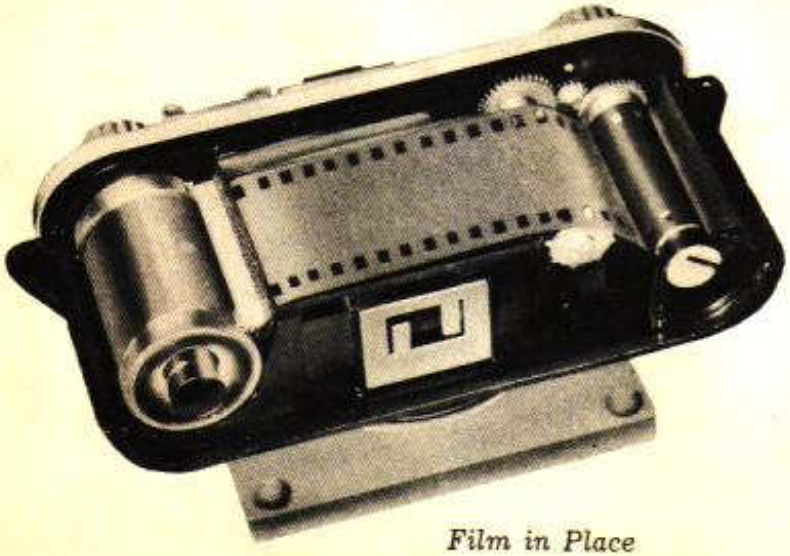
(4) Take out the cartridge of exposed film.

(5) Push in the WIND knob and engage the empty spool.

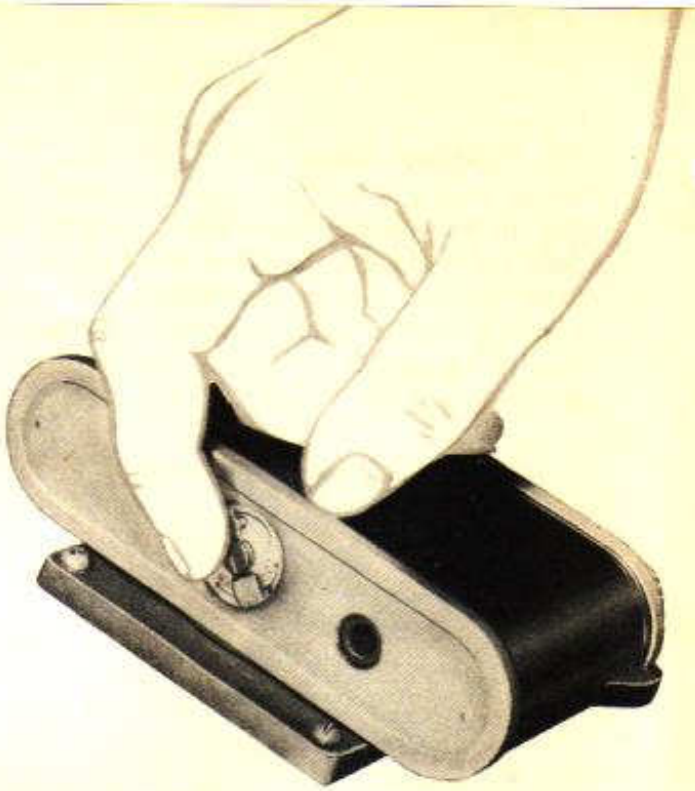
b. Insert a cartridge of unexposed film in the space provided at the base of the REWIND knob. The protruding end of the spool should face the bottom of the camera.

c. Thread the film on the sprocket and insert the end of the film in the slot of the WIND spool.

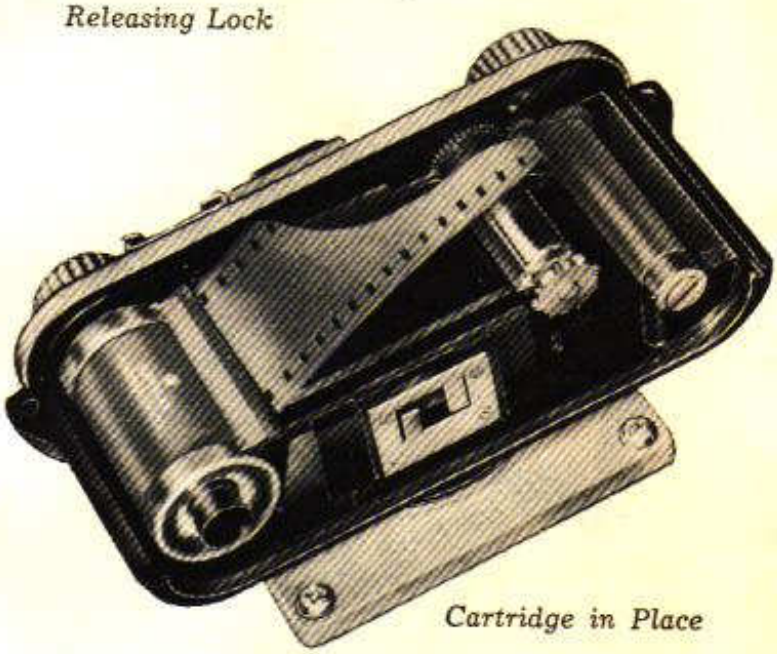
d. Wind two turns of film around this spool by turning the WIND knob in a clockwise direction.



Film in Place



Releasing Lock



Cartridge in Place

e. Replace the cover and lock it in place. The film is loaded, but it is now necessary to get unexposed film into place.

f. Press the release button, rotate the WIND knob until it stops, and then press the release button again.

g. Repeat the winding and releasing operation once more to make sure that unexposed film will be in position when you use the camera to record the display on the scope.

17. Pre-Flight Check

a. Assuming that the lens has been focused and the aperture setting has been made by the photographic laboratory technicians, load the film, if necessary. Then check and prepare the equipment before the airplane leaves the ground.

b. Set the exposure counter at zero.

c. Press the release button next to the WIND knob until it clicks.

d. Turn the WIND knob in a clockwise direction as far as it will go, watching the counter indicator. If it records an exposure, the equipment is operating properly. This completes the check on the 0-6 and the 0-8 camera assemblies.

e. When using the 0-7 camera assemblies, two additional steps are required. To perform these steps, open the door at the bottom of the data housing.

f. Wind the watch and synchronize it with your own.

g. Holding the trigger down, check whether the light in the data housing is lit. If it is not, replace the batteries or bulb, whichever is necessary. Do not change the rheostat setting.

18. Operation

a. Since the 0-6, 0-7, and 0-8 camera assemblies all use the same camera, all three are operated in the same way. The 0-7 camera assembly, however, uses the Model B cone which includes a picture of the range indicator on every photograph. With this assembly, therefore, you must adjust the range indicator before taking pictures. To do this, turn the indicator to the same number as the RANGE NAUTICAL MILE switch on the radar set.

b. The first step in using the 0-6, 0-7, or 0-8 camera assemblies is to put the cone over the scope to be photographed. Hold the camera securely in position against the scope face during the whole course of operation. This will keep the distance between the scope face and the camera lens constant and will prevent the leakage of light into the cone from outside sources.

c. (1) When you have selected the display to be recorded, pick an unimportant point on the display and use it as the reference point for starting your exposure. When the sweep-line coincides with the reference point, depress the trigger on the camera and hold it down while you watch the progress of the sweep-line through the peep-sight on the cone. Release the trigger when the sweep-line again coincides with the reference point. It is very important that you record exactly 360° of sweep-line rotation, and you need a reference point for that purpose. Pick an unimportant reference point so that if the sweep-line over-runs it a little, the picture will not be spoiled.

(2) You can also use the grid lines on the filter as the reference lines by rotating the filter so that the grid lines are away from the primary target. Then you can depress the trigger when the sweep-line coincides with the grid line and release the trigger when the sweep-line again reaches the grid line.

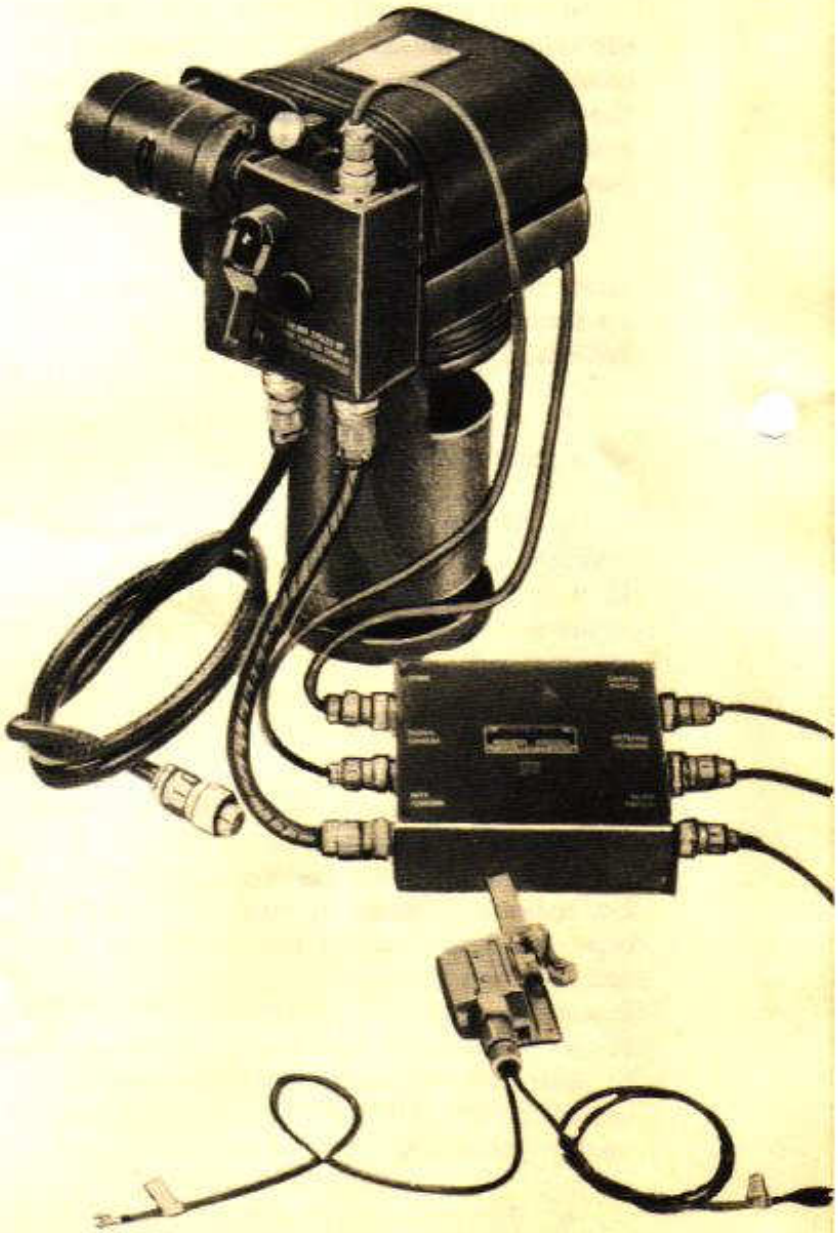
d. Immediately after you have made the exposure, press the release button next to the WIND knob until it clicks. Then turn the WIND knob in a clockwise direction until it stops.

e. If you set the exposure counter at zero after the film was loaded and the exposed film cleared, there will be enough film in the camera for 36 exposures. This number of exposures is normally not sufficient to cover a mission, and it will be necessary for you to reload the camera in flight. During the course of the mission, select the best time to perform this operation. If necessary, waste a few exposures in order to reload at an advantageous time.

f. The 0-6, 0-7, and 0-8 camera assemblies require no turn-off procedure.

section 5

the 0-9 and 0-10 camera assemblies



19. Description

a. GENERAL. (1) The 0-9 and 0-10 camera assemblies are each modifications of the standard K-24 aerial camera. The 0-9 assembly is designed to fit on the remote scope of the AN/APQ-13 equipment, and the 0-10 is designed to fit on the remote scope of the AN/APS-15 equipment. Both assemblies operate in the same way and produce pictures which show the scope display and the time each picture was taken. In addition, each "bombs away" picture shows a small, round spot in the corner to identify it.

(2) The film used with this camera is 5½-inch film. It is loaded into the magazine by photographic laboratory technicians. Contact prints of the negative are 5 inches square. Enlargements 20x24 inches made from the negatives will be clear enough for all purposes. It is possible to project the negatives or prints onto a screen for viewing.

(3) Complete 0-9 and 0-10 camera assemblies include a camera, a cone, a control box, an antenna switching unit, and connecting cables.

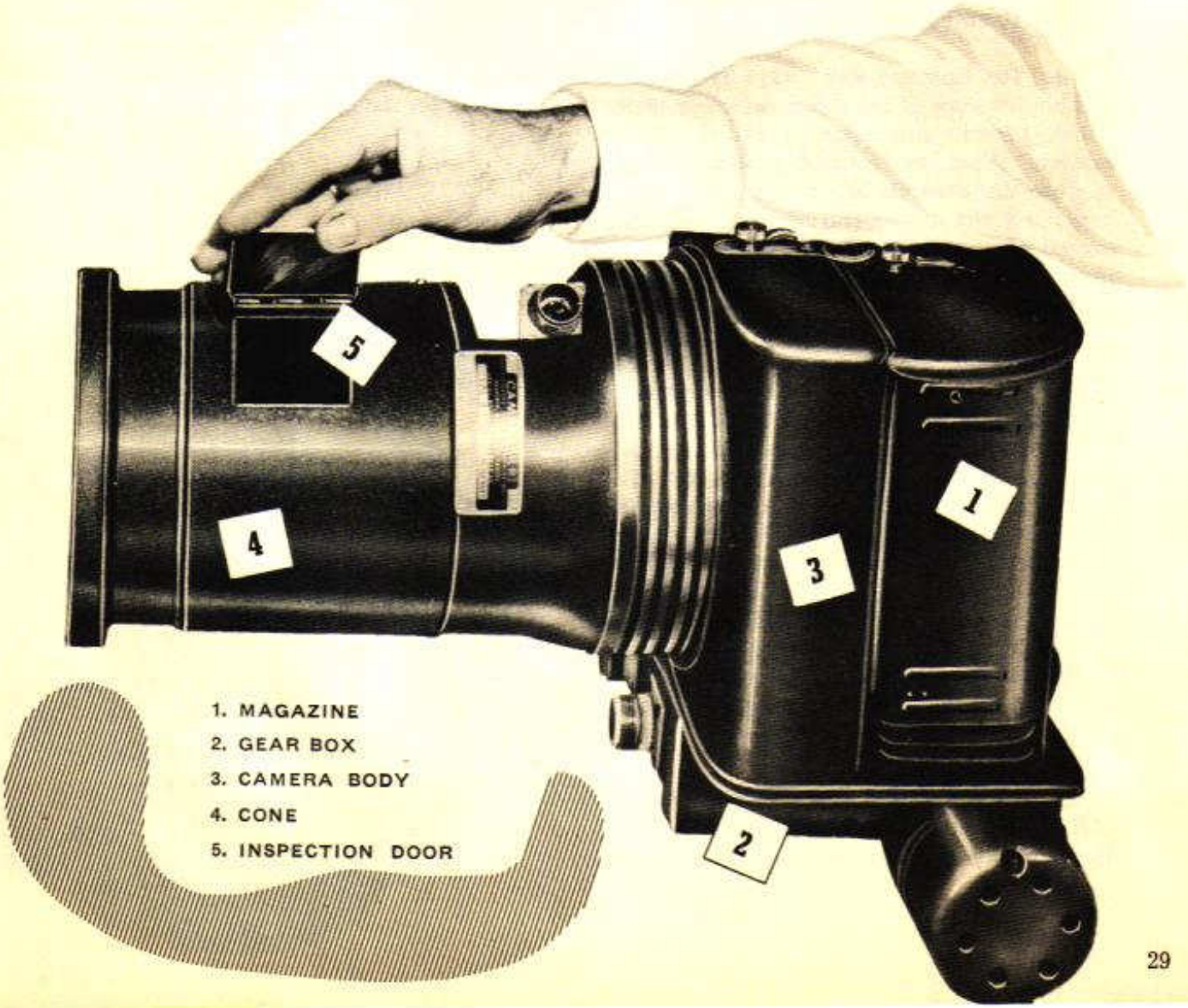
b. THE CAMERA. (1) *General.* The camera unit used with this equipment is composed of three parts: the magazine, the gear box, and the body.

(2) *The Magazine.* The magazine contains the two film spools. The mechanism in the magazine holds the film flat against the glass platen, moves the film at each exposure, counts the exposures, and shuts off the motor when a roll of film has been completely exposed.

(3) *The Gear Box.* (a) The gear box houses the bearings and gears of the camera. The camera motor and its drive shaft are attached to the gear box. The purpose of this unit is to activate the film-driving mechanism in the magazine and to operate the shutter. The gear box receives the impulses from the control box.

(b) The handle which protrudes through an opening in the corner of the gear box is used for winding the shutter when loading the film. When not in use, this handle should be folded against the side of the box.

(4) *The Camera Body.* The camera body houses the lens, the shutter, a watch, and an assembly for identifying the "bombs away" picture. The watch can be removed for winding and synchronization. The lights provided to illuminate the watch flash on at each exposure. When the BOMB SWITCH is pressed, an additional identification light flashes on. The identification light exposes a round spot on the corner of the negative which serves to mark the "bombs away" picture.



c. THE CONE. (1) The cone allows the light from the scope to pass through the lens without interference from outside light. It also serves to hold the camera securely to the remote scope. The cone is made of metal. An inspection door in the cone permits you to view the scope display.

(2) The end of the cone is so shaped that it may be fastened to the scope housing. The 0-9 and 0-10 cones differ in that on the 0-9 there are slots to fit the AN/APQ-13 scope and on the 0-10 there are holes to fit the AN/APS-15 scope.

(3) One end of the cone fastens to the remote scope and the other to the body of the camera. The location of the whole assembly (the camera, the cone, and the remote scope) varies with different installations, but, in general, it is located close to your position so that you may view and adjust the remote scope.

d. THE CONTROL BOX. (1) The control box houses some of the electrical mechanisms which permit automatic operation of the camera. The two control switches which operate the controls are not on the control box itself but at the end of the cables connected to the control box. These switches may be located at any place in the airplane convenient for you.

(2) Every time the CAMERA SWITCH is pressed and released, it causes a picture to be taken. If the CAMERA SWITCH is held down, the camera will continue to take pictures until the switch is released. The BOMB SWITCH also causes a picture to be taken every time it is pressed, but at the same time, it activates an identification light to mark the picture as a "bombs away" picture. The location of the CAMERA SWITCH and BOMB SWITCH will vary with the installation. In some cases, you may find that the "bombs away" switch is wired in with the bomb release switch.

e. THE ANTENNA SWITCHING ASSEMBLY. (1) The antenna switching assembly delivers electrical impulses to the control box with each cycle of radar antenna rotation. These impulses time the opening and closing of the shutter.

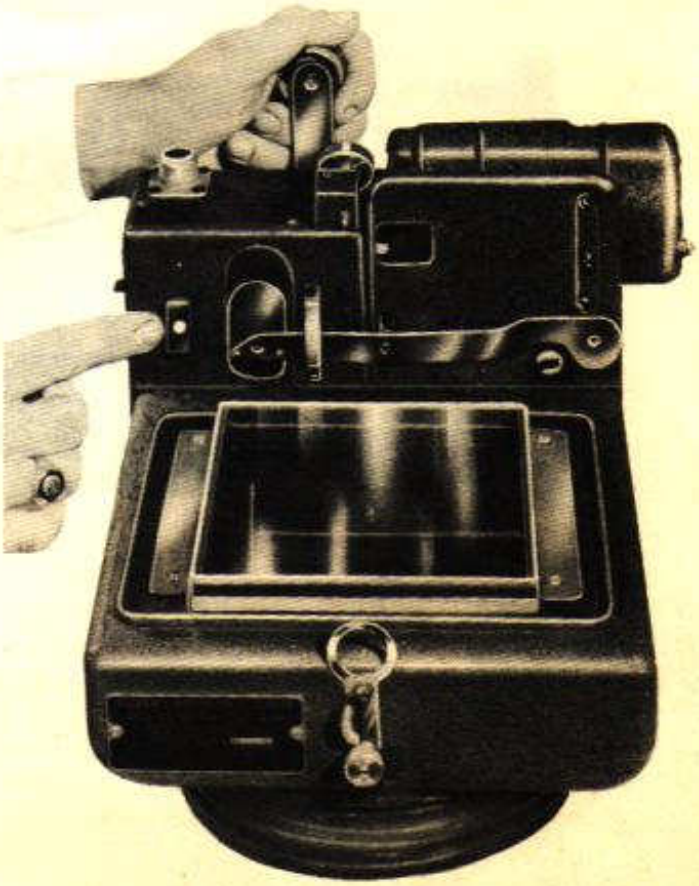
(2) The antenna switch itself is a stationary attachment mounted on the radar antenna unit in such a way that a cam on the rotating part of the antenna activates the switch each time the antenna rotates.

20. Loading the Camera

a. The magazine of the camera contains enough 5½-inch aerial photographic film to make 120 exposures. The photographic laboratory technicians load the magazine, and you will receive it fully loaded.

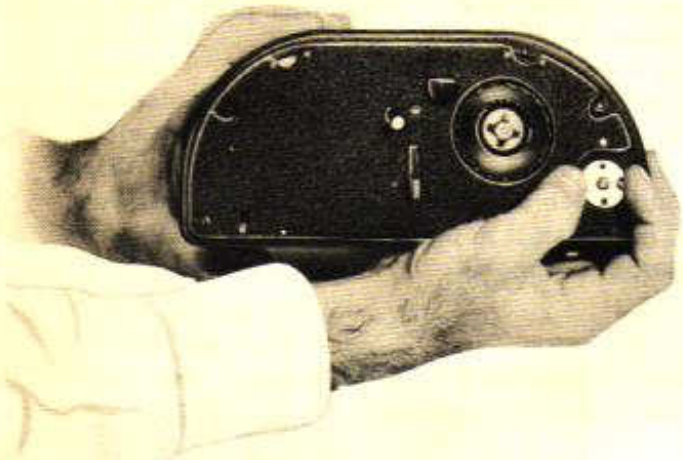
b. The magazine is held in place on the camera body by a knurled screw on the gear box and by a ring on the camera body into which the stud on the magazine fits. To remove the magazine, loosen the knurled screw on the gear box and lift the magazine so that the stud on the magazine is disengaged from the ring on the camera body.

Film Driver Adjusted



c. (1) To place a fresh magazine into position, turn the hand crank on the side of the gear box through five turns. The gears in the box will then be at rest and in their proper position. The film driver on the left wall of the gear box will then be in a vertical position.

(2) Turn the drive pins on the magazine until the red dots on the feed roller are in line with the red dot on the magazine.



(3) Using both thumbs turn the counter dial counter-clockwise to the "zero" point.

(4) If there is a cover on the glass platen, remove the cover and clean the glass platen with lens tissue or a soft, dry cloth.

(5) Insert the stud on the left-hand side of the film magazine into the large ring on the name-plate side of the camera body.

(6) Lower the magazine into position and pull it toward the gear box until it slips into position. Press down firmly to overcome the spring tension of the interlock pin on the right-hand side of the magazine.

(7) Tighten the large knurled screw on the top of the gear box firmly into place, being careful not to over-tighten it. When tightening the screw, make sure that it fits above the protrusion on the magazine.

21. Pre-Flight Check

a. When you have performed the pre-flight check on your radar set, leave your set in operation and check your camera assembly. Make sure the antenna is rotating while checking the camera.

b. The photographic laboratory technicians will load the film into the magazine. You may have to mount the magazine on the camera, however. If you do, follow all the steps of the following procedure, observing the lights and shutter through the glass platen.

c. If the magazine is already mounted on the camera, the photographic laboratory technicians have checked the lights and shutter. In this case start with step (4).

(1) Press the CAMERA SWITCH and release it. The following should occur in sequence:

(a) The camera shutter should open.

(b) The light bulbs should go on momentarily and illuminate the watch face.

(c) The shutter should close.

(2) Depress the BOMB SWITCH and release it.

WARNING: DEPRESS THE BOMB SWITCH ONLY IF IT IS NOT USED AS A BOMB RELEASE SWITCH OR IF YOU HAVE CHECKED PERSONALLY AND FOUND THAT THERE ARE NO BOMBS IN THE BOMB BAYS.

The following should occur in sequence:

(a) The bomb light should go on and then off.

(b) The shutter should open.

(c) The lights for the watch should go on momentarily.

(d) The shutter should close.

(3) If the magazine is not mounted on the camera, mount it at this point in your check.

(4) The knurled base of the watch protrudes from the camera body. Turn it clockwise as far as you can and pull it out. Wind the watch and synchronize it with your own. Then push it in and turn it counter-clockwise until it stops.

(5) Press the CAMERA SWITCH momentarily and check whether the red and white exposure indicator (next to the exposure counter) rotates.

(6) Check the operation of the remote scope. Remember that the 0-9 and 0-10 camera assemblies record the displays on the remote scope, not those on the main scope.

22. Operation

a. Both the 0-9 and 0-10 camera assemblies use a modified K-24 camera and both are operated in the same way. When using these camera assemblies, remember that it is the display on the remote scope that is being recorded and be sure that the remote scope is in synchronization with the master scope.

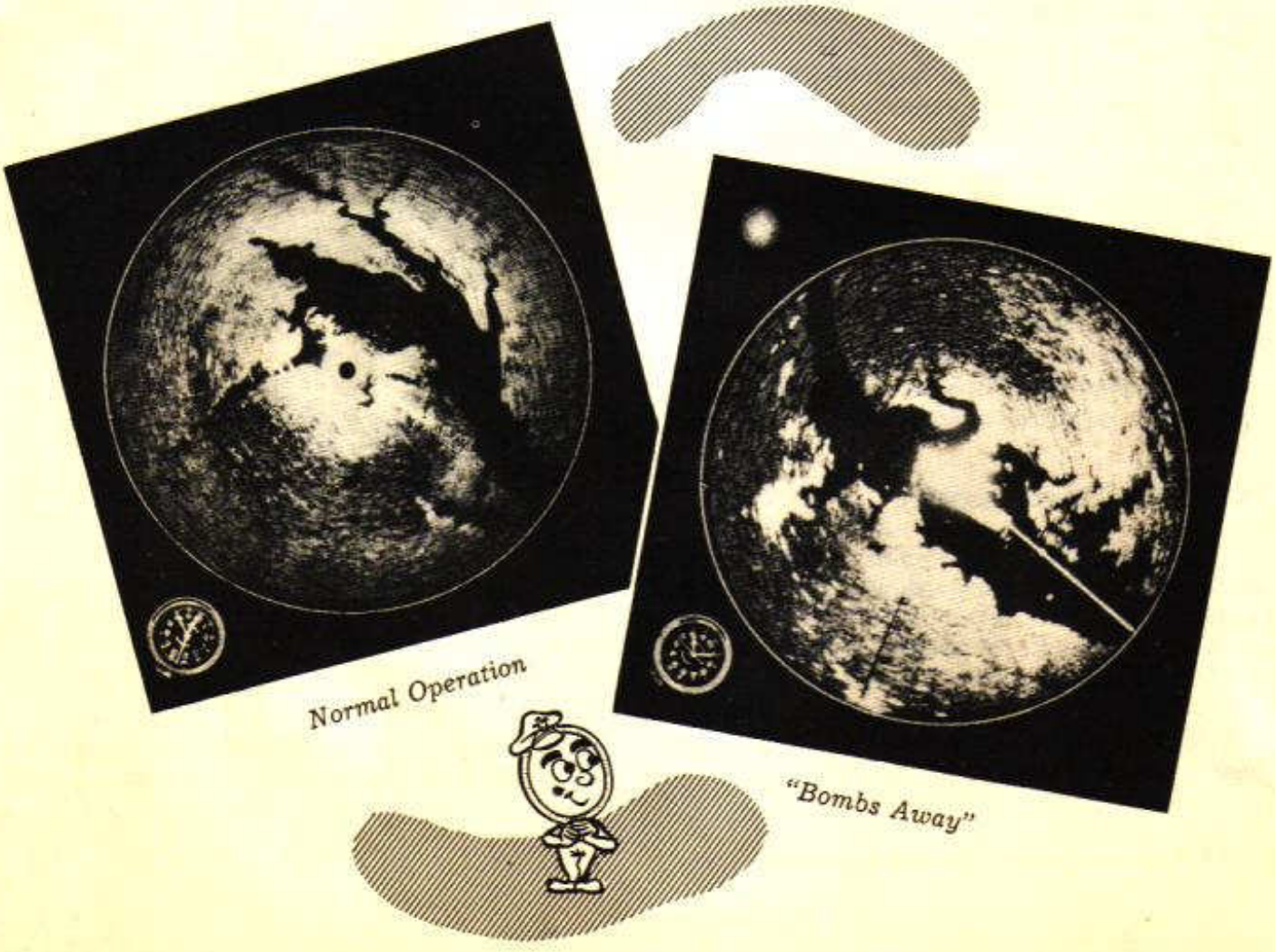
b. (1) The K-24 camera is very easy to operate. In most installations, an ON-OFF switch will be provided to control the power supply for this camera. All you have to do to operate the camera is to turn this switch on and press the CAMERA SWITCH. If you depress it momentarily, it will take one picture; if you continue to press it down, the camera will take pictures until you release the switch.

(2) The BOMB SWITCH operates the camera in the same way. In addition, however, it allows you to identify the "bombs away" picture by putting a round spot in the corner of the picture.

WARNING: At some stations, the actual bomb release switch and the camera BOMB SWITCH have been combined. Therefore, check the electrical connections of the BOMB SWITCH thoroughly before you use it. Where the bomb release switch and the BOMB SWITCH of the camera have been combined, use this switch only at the time of the bomb release unless you have personally checked the bomb bays and found that the ship is not loaded with bombs.

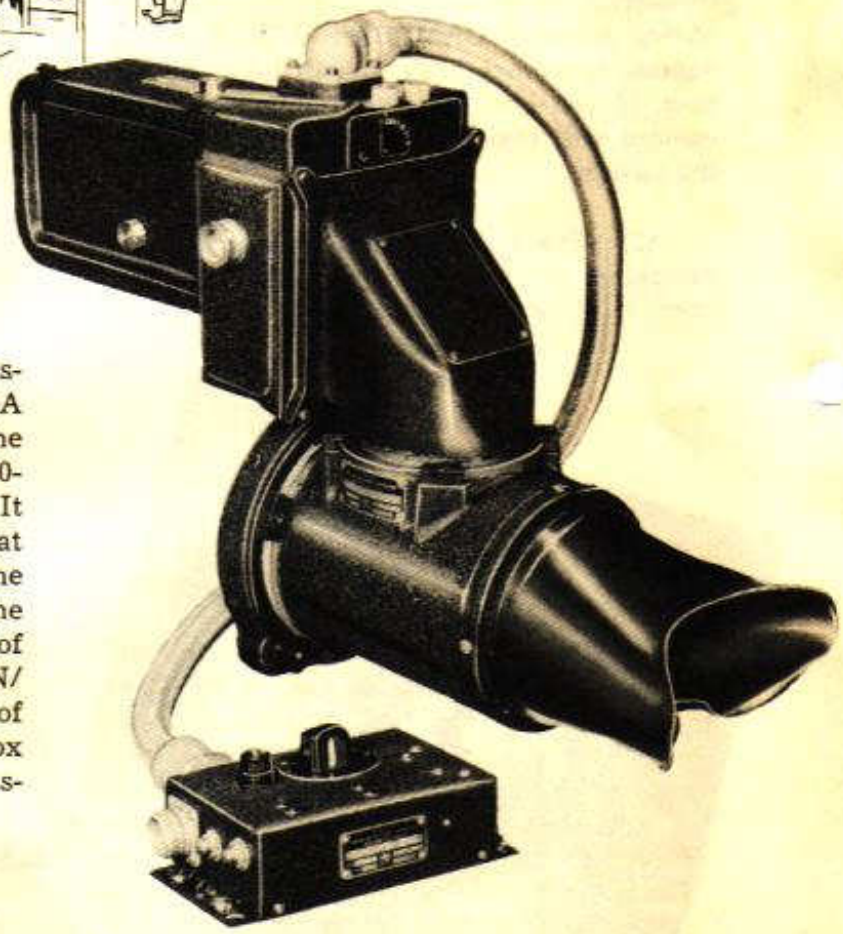
(3) When the exposure counter approaches the maximum number of exposures that the film can accommodate, namely, 120, prepare to change the magazine at an advantageous time.

c. The 0-9 and 0-10 camera assemblies are generally turned off by means of an ON-OFF switch installed with these cameras.



section 6

proposed camera assemblies



0-5A *Camera Assembly*

23. The 0-5A Camera Assembly

A new automatic 35-mm camera assembly soon to be in production is the 0-5A Camera Assembly. This assembly, like the 0-5, will produce 1600 exposures on a 100-foot roll of 35-mm motion picture film. It will, however, be magazine-loaded so that changing the film will be simplified. The 0-5A is designed to take pictures of the master scope. Adapters permit the use of the 0-5A Camera Assembly with the AN/APQ-13, the AN/APS-15, and other types of radar equipment. A simplified control box permits complete control of the camera assembly by means of a single switch.

24. The 0-11 Camera Assembly

Another improved 35-mm camera assembly now being designed will be known as the 0-11 camera assembly. It will probably be adapted to AN/APQ-7, AN/APQ-13, AN/APS-15, and other radar equipments. The 0-11 equipment will be similar in operation to the 0-5 equipment, but it will be more nearly trouble-free. Pictures taken with this equipment will be approximately 1x1½ inches in dimension. The 0-11 camera assembly will produce 800 exposures on a 100-foot spool of 35-mm motion picture film.

section 7 the mission

25. The Briefing

a. When it is necessary to make a photographic record of the radar scope displays on a mission, the briefing officer must cover the photographic aspects of the mission in his briefing. He must thoroughly acquaint you with the routine photographic requirements of the mission. He must list in detail the specific displays you will be required to record. In addition, he must become thoroughly familiar with the requirements of the particular mission, and he must review past records so that he will be able to offer suggestions as to the most desirable radar set adjustments for the mission.

b. At times, it is his responsibility to indicate to you the type of camera equipment that you are to use. He should brief you thoroughly on the operation of this equipment. In this connection, he should give general descriptions of the equipment and the peculiarities of each individual camera. He should let you know whether it will be necessary for you to change magazines or reload film in flight, and, if necessary, he should give you the general film-loading or magazine-mounting instructions. From the records of past missions, he should be familiar with the malfunctions common to the types of equipment that you will be using, and he should be able to suggest to you the way to overcome these malfunctions while participating in the mission.

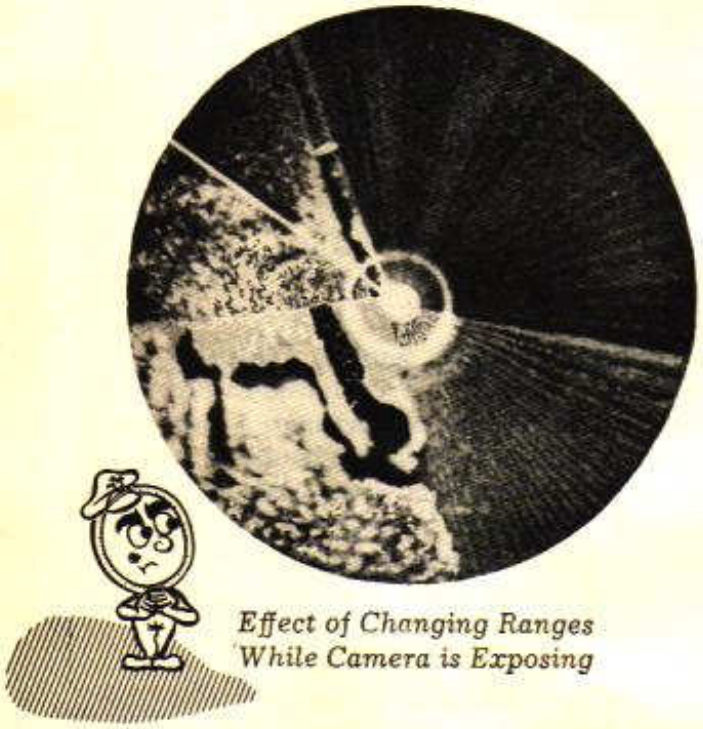
c. The briefing officer should also inform you whether the ground personnel will unload the camera, or whether you will have to do this yourself. He should also designate the officer to whom you will turn in your log.

26. The Radar Scope

a. Before you can take pictures of the radar scope, you must, of course, turn on the radar set. If you are working with the 0-9 and 0-10 cameras which use the remote scope, be sure to operate that scope in synchronization with the master scope. Whichever scope

you use, it is important that the display on that scope be the best possible.

b. Be very careful in centering the sweep. Keep the display at about average brilliance. Maintain accurate focus. After you tune in the target on the scope display and you turn up the gain to the point necessary for proper radar operation, try to keep the scope illumination at an average point by a reciprocal adjustment of the brilliance and gain controls. While taking pictures, keep the tilt in a position that will give a clear display of the targets on the edge of the scope. When it becomes necessary to change from one range to another or to expand the range, try to do it while the camera is not recording.



Effect of Changing Ranges While Camera is Exposing

c. You may use range markers at your discretion providing that they do not obscure the principal targets on the display. Generally speaking, sector scan operation does not produce good photographic results. If possible, limit its use to the interval between exposures of the film. You may conduct beacon operation as usual, but to get good pictures, it will be necessary for you to increase the brilliance and gain of the set to a point above average in order to assure the proper exposure of film.

d. When using the 0-6, 0-7, or 0-8 camera assemblies on the main scope do not remove the filter. Photograph the display through the filter.

e. When you are on a bombing run, you will, of course, have to give primary consideration to tuning the set in order to fulfill the bombing requirements. Even so, try to maintain an even degree of scope illumination by reciprocal adjustment of the brilliance and gain controls. If you have to turn the gain up excessively, turn the brilliance down, and vice versa. Do not adjust the brilliance every time you make a minor gain adjustment. You may use sector scan if you desire. After the bombs are released, be sure to tune for the best definition of the target being bombed. In all cases, pictures of this display will have a high priority, and your duties immediately after the bombs are released should allow you the time necessary to adjust the radar set to accommodate the camera.

27. When to Take Pictures

a. When you are navigating on a routine mission from the take-off point to the initial point (IP) of the bombing run, you will generally have to secure pictures at the following intervals.

(1) On the 50- or 100-mile range, one picture every 25 miles.

(2) On the 20-mile range, one picture every 10 miles.

(3) On any range below the 20-mile range, one picture every 3 miles. This is the procedure adopted by the tactical air forces. When you are in doubt as to which of two positions of the sequence selector switch to use, set the switch on the position that will give the more pictures.

Clouds on Scope

b. You are responsible for recording all peculiarities in the scope display, whether caused by the terrain over which you are flying or by some function of the radar set operation. To increase your proficiency, take fixes throughout the course of the mission and take pictures of them at the same time. Then enter them in your log. After the mission, you can check the fixes by means of the photographic record. You will then be able to see what mistakes you have made, if any, and learn how to correct them.

c. Always keep in mind the specific instructions given by the briefing officer with regard to the pictures that should be taken on your particular mission. Do everything in your power to get these pictures. As the initial point of the bomb run comes into view on the scope, record the image as often as possible. If you are using the 0-5 camera assembly, turn the sequence selector switch to EVERY OTHER CYCLE position (on Type P-2, turn the switch to 2). If you are using an 0-6, 0-7, or 0-8 camera assembly, you will probably not have time to record the run on the target. If possible, ask another crew member to operate the camera on the remote scope. Of course, if you do this, you will have to adjust the remote scope so that the displays on it will coincide with those on the master scope. If you are using an 0-9 or 0-10 camera assembly, arrange to change magazines shortly before the bomb run, and keep the CAMERA SWITCH depressed until the bombs are released. At "bombs away", press the BOMB SWITCH momentarily. Then press the CAMERA SWITCH again and keep it pressed until you have passed over the target area.

d. Continue to make a photographic record of the run from the IP to the target even after the bombs have been released. After the bombs have been released, re-tune your radar set carefully so that you can obtain the best scope pictures possible.

e. On the withdrawal run from the target while the pilot is engaged in evasive action, it is usually impossible to secure good terrain detail in scope pictures. Nevertheless, do your best to get as many good pictures as possible. Continue to take a picture on every cycle. In general, you must try to get as many pictures as possible while in the target area.

Evasive Action

28. Keeping a Log

a. GENERAL. (1) You will have to keep either a dual purpose log (radar and photographic) or a log specifically for photographic purposes, depending on the requirements of the mission.

(2) In either case you must include the following information:

AIRPLANE NO.	B-17 #41-1520	EXPOSURE NOS.	31 to 394
ORGANIZATION	23rd Bomb. Sqdn.	ROLL NO.	5
TYPE OF MISSION	Bomb. of Kahili	MISSION NO.	72
OPERATOR	Burton H. Burns	DATE	27 June

(a) The airplane number.

(b) The name of the organization.

(c) The type of mission and the mission number.

(d) Your name.

(e) The roll number, the exposure numbers, or both.

(f) The date.

(3) Individual stations may require other information in the general section of the log. If so, the briefing officer should let you know just what information is required.

RANGE	AZIMUTH STAB ON	AZIMUTH STAB OFF	SWEEP DELAY MILES	ALT. DELAY FEET	TIME	REMARKS: PECULIARITIES NOTED AND GENERAL REMARKS
20		✓	100	15000	watch working	Beacon coded wrong
50		✓	0	"	✓	
20	✓		0	"	✓	
Expanded	✓		0	"	watch out 15:20	clouds over Munda
5	✓		0	"	1525	Skipping ff Vela

b. DUAL PURPOSE LOG. (1) You can keep a dual purpose log by making the standard radar entries on a radar log and indicating in the REMARKS column the necessary photographic information.

(2) In the REMARKS column, keep a running account of the range at which the radar set is operated, indicate whether the azimuth stabilization is on, and record the amount of altitude and sweep delay. Whenever possible, record outstanding or peculiar scope displays and the time each occurs.

(3) If your camera assembly is equipped with a watch, you will need to make no other entries. If your camera assembly is not equipped with a watch, or if the watch in the camera assembly is not operating properly, indicate the time each picture was taken in the REMARKS column on your log.

TIME	TARGET	TRUE HEAD.	TRUE ALT.	RADAR RANGE	AZ. STAB ON	AZ. STAB OFF	ALT. DELAY FEET	SWEEP DELAY MILES	REMARKS
1520	Russell Islands	300°	12500	50	✓		0	100	
15:25	E. tip New Georgia	297°	13000	50	✓		0	0	set spoking
15:30	"	295°	13500	20		✓	0	0	"
15:35	Munda	295°	14300	Expanded	✓		0	0	set O.K. again
15:38	"	305°	15000	10	✓		15000	0	
15:41	Borauken Harbor	310°	15000	20	✓		15000	0	

c. PHOTOGRAPHIC LOGS. When keeping a log specifically for photographic purposes, make the general entries required on all logs. In addition, record the time each picture was taken, the outstanding target on the scope display, the true heading and altitude of the airplane, and the range setting of the set. For each picture, also indicate whether the azimuth stabilization is on and note the amount of altitude and sweep delay. Include in the log the time the bombs were released and any other pertinent information that is of value.

29. Filling Out the Data Card

a. The following information is required on all data cards: the airplane number; the mission number; the date; and the film roll number, exposure number, or both. To mark individual exposures, you should make additional entries to indicate peculiarities on the scope display caused by the set, the terrain, or the weather conditions. You may also enter pertinent navigational information. Always use the card to indicate the "bombs away" picture.

b. Be sure to change the information on the data card when the conditions of flight change. Neglect of this duty is the most frequent source of errors on data cards. Make a point of recording all changes in flight conditions at the time the changes are made, and you will save many hours of work on the ground.

AIRPLANE NO.	B-17"52C	EXP. NO.	17
MISSION NO.	9	DATE	6/7	ROLL NO.	4

REMARKS

Target overcast
Bombs away picture

section 8 mission evaluation and critique

30. General

All the possibilities offered by radar scope photography for the evaluation of a mission have still not been fully explored. One thing, however, is certain. When a complete photographic record of a mission is available, there are a great many ways in which errors in operation and procedure can be determined and their causes found.

31. Operation of the Radar Set

Radar scope photography makes it possible for the reviewing personnel to find out exactly what errors you have made and to suggest methods for correcting them. The photographs will show whether you have operated the gain and brilliance controls improperly. The reviewer can call this fact to your attention and offer corrective suggestions. If you have not focused or centered the sweep-line on the scope, the pictures will show it, and the reviewer can point out to you where you should be careful. Your effective use of the tilt, gain, and range adjustments will show up clearly when pictures of your displays are compared with those of past displays obtained over the same point. Beacon operation can be reviewed in the same manner as search, and a critique of the mission can be developed.

32. Navigation and Bombing Procedure

a. Where conditions permit, you or the reviewer can check the photographic record and analyze the mission completely. The review may be handled in a general manner, or an accurate re-flight of the mission may be conducted and the position of the airplane at any time during the mission may be determined. This review can help you by calling your attention to the errors you have made in navigating or bombing procedure.

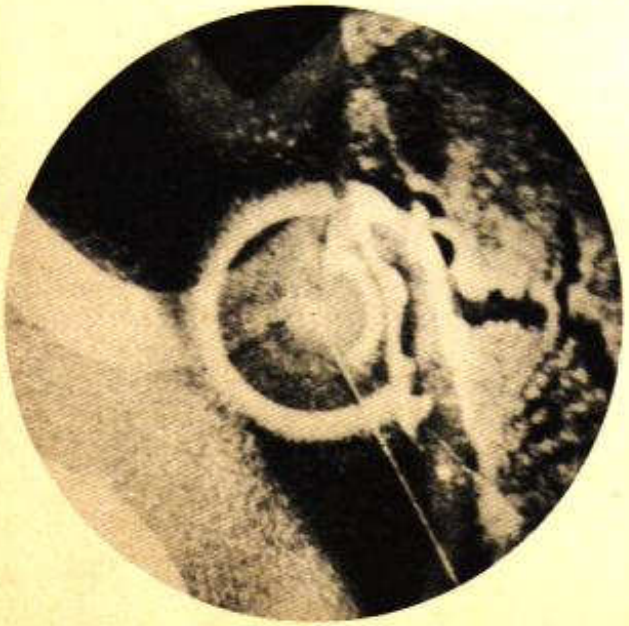
b. From the reconstruction of the courses of flight, incomplete log entries, in-

accurate fixes, errors in calculating ground speed, determining wind data, and inefficiency in almost any navigational procedure can be determined. The scope record can be analyzed and your weak points discussed.

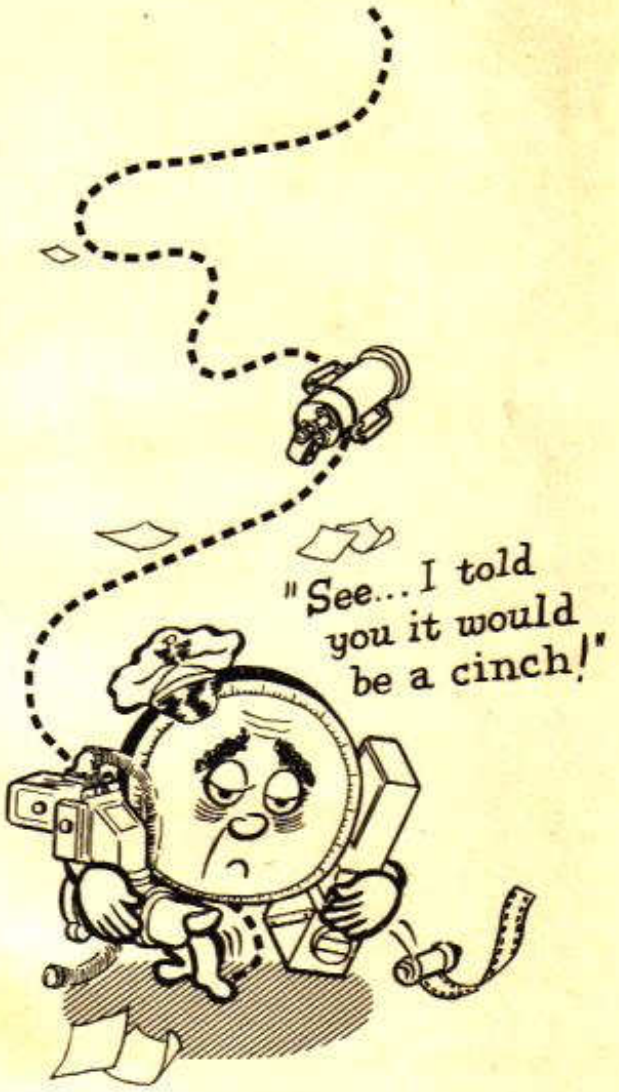
c. Several methods of bomb scoring by means of radar scope photography are in use at present. All of them are effective. No matter which you use, you can determine the impact point of the bombs and the course of the run from the IP to the target by means of the scope photographs. With this information, a complete bombing analysis is possible. This bombing analysis will show errors in range and azimuth and will indicate their cause. When synchronous bombing procedure has been followed, the errors may be further analyzed to determine any lack of coordination between you and the bombardier.

33. Picture-Taking Technique

Picture-taking technique can also be checked during the evaluation. Poor pictures due to improper aperture or focus settings, incorrect processing, or malfunctions of the equipment can be analyzed and the technicians informed. If you were working with an 0-6, 0-7, or 0-8 camera assembly and you failed to record one complete cycle of the sweep-line, the pictures will show it. Light leaks that result from leaving the door on the cone open or from not holding the cone firmly against the scope face can be easily identified. If you have not taken the pictures required by the mission, it will be obvious.



Incorrect Processing



34. Conclusion

The photographic record of a mission provides an excellent opportunity for the analysis of your technique and procedure. In the evaluation and critique of a mission, your errors are pointed out to you and suggestions are made to you for the purpose of helping you improve your results. Seek these suggestions and accept them without chagrin.

notes and additions

notes and additions

notes and additions

New Era Litho 20,000—6-45