

H A S S E L B L A D[®]



AERIAL
PHOTOGRAPHY

INTRODUCTION

It's difficult to find an author who is master of every field of aerial photography, from work done at the exalted heights attained by satellites taken from more down-to-earth helicopters and airplanes. Specialization has left its mark here as in other fields of photography. That's why we gave the word to a number of different experts in this special bulletin on aerial photography, something we've never done in any of the other Hasselblad bulletins.

Aerial photography is usually a very advanced procedure technically speaking, calling for special-purpose cameras, accessories, films and developing technics. Aerial photography is mainly used for surveying and in fields such as environmental conservation, town planning, archeology and geology. The aerial photograph is the only solution in many cases and contains considerable information for people skilled in photo interpretation.

But there is another side to aerial photography. You don't always need absolutely vertical, large-format pictures. You can often get by with the simpler equipment found in almost any photo studio.

Some common assignments for aerial photography are surveys of prospective business sites, determination of population density for prospective shopping centers, advertising shots for airlines, nature studies, postcards etc. A small-format camera is sufficient here and is both cheaper and simpler to use. This means that any photographer can practice these types of aerial photography with the equipment he already has.

Aerial perspective provides new opportunities. You are not as restricted as you are on the ground and can put a "bird's-eye view" to real advantage if needed. An aerial view can also provide the answer to many questions and problems.

This little booklet doesn't cover every aspect of the use of the Hasselblad system in aerial photography. Its purpose is just to provide a few tips. Cartographic photog-

raphy, for example, is not even mentioned since it is a very specialized field and requires specialized equipment.

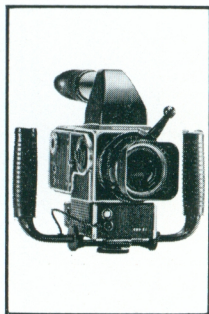
We've let different aerial photographers in different fields write about their experiences with Hasselblad in the air.

Don Blessing, who has many clients in many different businesses, deals with the difficulties encountered by an aerial photographer in getting good, marketable pictures. The aerial photographic requirements of the police are discussed by Evald Karlsten. The camera's air-borne use as a monitoring instrument and the role of the aerial photograph in environmental conservation are discussed by Dr. Wesley P. James. According to various forecasts, this field of aerial photography is likely to expand enormously in coming years when conservation of the environment will have a central role in our society.

In addition to the Hasselblad system's ordinary accessories, which are just as practical for the aerial photographer, there are several important items especially designed for the air-borne photographer. The most important of these are the Hasselblad Multi-camera Bracket for four Hasselblad cameras and the Hasselblad MK 70 photogrammetric camera, which also has its own accessory program. The MK 70 can be used on the ground as well as in the air, of course.

Cover photo: Peter Eckel, at right: Jens Karlsson

With the motordriven Hasselblad 500EL/70M equipped with double handgrip, prism viewfinder designed for the magazine 70 and the quick-focusing handle, aerial photographers have a camera capable of one frame/sec. and more than 70 exposures.







GENERAL AERIAL PHOTOGRAPHY

by Don Blessing Jr.

In writing this article I have tried to keep in mind that most of the readers of this booklet are more interested in photography than in aircraft. However, as an aviator turned photographer I do tend to get carried away.

I believe the key element to good aerial photography is a thorough understanding of what *both* the camera and aircraft can and cannot do. The second most important factor is "stick-to-it-iveness". Although the additional cost of the aircraft is somewhat high, the resultant aerial perspective is well worth the extra effort and cost.

When taking aerial pictures you must keep in mind that you are operating under difficult photographic conditions. You have the speed of the airplane across the ground, the vibration of the engine and airframe, the airflow around you and your camera, the turbulence of the air in which you are flying and the steadiness/unsteadiness of the photographer to consider. In other words, good aerial photography involves not only patience, ability and experience but an element of luck too. Help yourself to get good results by eliminating whatever detrimental factors you can. This involves planning and thought before the flight. Once in the air, you will be surprised at how difficult it is to get in the exact position desired. Know what and where your targets are and how they will look from the air. This may entail a drive to the location to firmly fix both the target and aides for finding it at low altitudes. A landmark, intersection, vacant lot or body of water can be extremely helpful for positioning. Since the photographer is the person doing the composing and also the individual looking through the viewfinder, he is naturally the one to position the aircraft. Here we have two factors to consider: first, is the photographer a pilot?

If so, fine. The problem is solved. Second, is the pilot an advanced photographer? Not likely. If this is the case, the photographer has three choices open to him: live with the way the pilot positions the aircraft (usually poorly), train him (slow), or learn to fly oneself (expensive). Because of these factors, one will find that most photographers will fly with no one else once they find a pilot that has the ability to "work with" the photographer.

Always get close enough for the image to fill the finder so you will not have to enlarge your negative excessively to get the print you want. You often find upon development that you were too far away. Refrain from shooting through the aircraft windows, and try to shoot at least at 1/500 sec.

Try to make sure to get the shot you want on your first pass. The main reason for this is that when in position for a really detailed shot, the airplane is often relatively close to habitation, and repeated visits can create hostility and bad relations by the property owners toward aviation in general, and you in particular. Enough civic hostility directed toward "you in particular" can in no way enhance the longevity of your aerial photography career.

Try to shoot immediately after the passage of a cold front (rain) when the air is clean and clear. For even lighting, try to shoot between 10 am and 2 pm, depending upon the direction the building (target) faces. However, early morning or late afternoon will provide beautiful long shadowing and direct lighting of certain objects. As with most areas of professional photography, it is a good idea to take a lot of pictures; but don't be lulled into taking so many shots one pass that you hurry and blur them all. High-wing aircraft are probably the most convenient for aerial photography. Low-wing aircraft can be used, but apart from the fact that you usually must shoot through a window and can't see directly below, they must be banked to get the wing out of the way of the camera. This makes them a less

stable platform and, thus, adds to the difficulty. Some of the newer high-wing aircraft have no wing struts, giving you much more open viewing space. The latter are almost ideal for the aerial photographer.

Helicopters are a superb photo platform, but they are usually prohibitively expensive. Although they have a tendency toward vibration and turbulence around the open door, these factors are easily overcome, and I recommend the use of helicopters whenever the budget allows it.

I make three modifications to the aircraft. I adjust the mechanism of the window so that it will open 90°; I modify the door hinges so that the door is removable, if necessary; and I locate an area in the floor where a hole with removable covers can be located (two openings, one at your feet for viewing, and one elsewhere for a remote camera, such as the 500EL, are also highly satisfactory). This allows you to shoot straight down. This hole must be large enough so as not to interfere with the angle of view of the lens and also permit the photographer to view ahead on the ground. An object suddenly appearing in the viewfinder is usually long gone before the photographer can react.

As far as actually flying the aircraft is concerned, good aerial photography depends on getting into the proper position with the aircraft slowed down. The run is made to the target with the airplane passing the target as closely as safety and regulations allow. Select the proper focal length lens to fill the negative with your subject. The target should be shot while approaching it, and not while passing it.

The slower the aircraft can safely fly the better, since the slower you fly, the slower your passage over the target. Your chances of getting a crisp photo will correspondingly improve. For my photos the airplane is set up to fly "hands off", i.e., straight and level for the photo approach. I then steer the aircraft with the rudder pedals while sighting through the lens via the eye-level viewfinder.

Naturally, when terrain, low altitude, and other hazards are involved, a safety pilot is mandatory. I have a built-in solution since my spouse is not only an accomplished photographer but a commercial pilot as well. For air-to-air work, my wife flies our camera aircraft very accurately over a predetermined course at a predetermined altitude. The pilot of the airplane to be photographed, knowing the camera ship will not deviate, maneuvers his aircraft through various angles at a very slow closure rate. I use the 150 mm or 250 mm lens and focus on the cockpit framework. This is a simple way of getting good sharp close-ups (one can also use hand signals when in close proximity), and with a little practice you can also select the background with care. Let me emphasize, however, that while the photography is relatively simple, the flying is not, and two skilled pilots are mandatory (unless you choose to wear a parachute, and perhaps use it).

I use the A12 magazines for the following reasons:

- A. Ease of keeping jobs and sites separated.
- B. Provides a contact sheet for each site.
- C. Ease of film classification (B&W or color):
- D. Ease of processing 120 film.
- E. Rapid and easy reloading (if I complete a site with 8 to 10 shots, I remove the roll, identify it, and insert a new one during the flight to the next site).

For serious aeriels the camera should be equipped with an eye-level prism viewfinder. Having a laterally correct picture helps with precision framing and alignment of the subject and horizon. A double handgrip is essential. It allows much steadier and easier handling of the camera and also enables the user to keep horizon straight and level while selecting background and foreground. When using the 500C the rapid-winding handle is very useful, but it is a little too long when the handgrips are used with the 500C, so I fabricated a short one by trimming down a standard transport knob and attaching an



Photo: United Air Lines

Photographing airplanes from the air can be a complicated business. The pilot in the camera ship has to know in advance the course and speed of the subject aircraft in order to maneu-

ver his own plane into the right photographic position. Aerial photography, whose lighting conditions are often more complicated than in other types of photography, demands the use of filters.

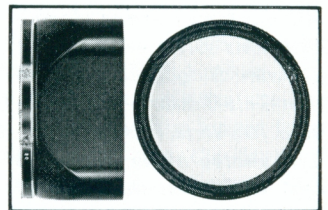
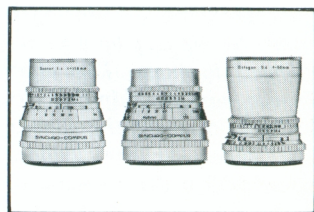




Photo: Don Blessing

All the lenses in the Hasselblad lens series — from the 38 mm Biogon to the 500 mm Tele-Tessar — are suitable for aerial photography. The photographer makes his lens choice on the basis of

factors such as working altitude and desired image size.



aluminum plate for a handle. The double handgrips are easily modified for use with the 500C by taping a cable release alongside one handle. On mine, I removed the flash shoe and installed a cable release within the grip. Other useful accessories are the checked screen, extra magazines, spare magazine slides (which have a habit of hiding when you need them most), a sports viewfinder and an extra body. While these all make one's job easier, it must be kept in mind that a 500C/80 mm with a sports viewfinder and any handgrip is capable of taking the finest of aerials. I use filters both to cut haze and for effect. My filter selection for B&W is usually governed by the lens used and available light. Simply stated, under normal conditions use a red filter if possible, then orange, and finally yellow. With Plus-X or Tri-X I normally underexpose from 1/2 to 1 1/2 f/stops (depending upon the brightness of the subject). I then slightly overdevelop (10%) the negative for added contrast. I occasionally use a yellow-green or green filter to lighten foliage.

For color film use the haze filter and underexpose 1/2 to 1 f/stop to reduce glare. Include a lens shade when shooting color to exclude all extraneous light. On all but the clearest days take a few shots with the polarizing filter. However, I find there are so many variables that for aerials the polarizing filter is unpredictable and may save or ruin a shot. I have installed a *locator* pin as a position reminder and find it helps.

B&W may be shot in haze, but color needs crystal clear air. Early morning and late afternoon shots can be striking in color. There are two problems with color enlargements. Lack of sharpness and overall haziness. There is no question that a color 16" × 20" enlargement viewed from a slight distance is highly impressive, but when detail is the thing, color cannot compare with black & white. Even on one of those sparkling, clear days following the passing of a storm, some haziness will persist in your pictures, regardless of film or filtering used.

For color, I favor the use of CPS and EH. I have them processed and enlarged by specialty labs. Of course, this is very expensive compared to black & white, but the results are worthwhile. For B&W, use Plus-X or Tri-X. For me, Plus-X seems to be the best. For air-to-air work Plus-X and CPS or Plus-X and High Speed Ektachrome can be interchanged and shot at the ASA value of the color film. Use a haze filter only, as this saves foul-ups when changing magazines in flight.

A note on haze from "Aviation Weather", U.S. Government Printing Office, Washington, D.C. 20402, Pages 3 & 136. "The atmosphere, even when apparently clear, contains an enormous number of impurities, such as dust particles. When these particles are relatively numerous, they appear as haze and reduce visibility. Distant objects lose their detail when seen through haze and if they are dark, appear to be viewed through a thin veil of blue. Visibility through the haze varies greatly, depending largely on whether the pilot is facing into or away from the sun."

The useful range of Hasselblad lenses for aerial photography is from 50 mm to 150 mm. The 250 mm can certainly be used (and I do use it from time to time), but it is extremely difficult to hold a 250 mm steady enough to get a really sharp picture. A 50 to 60 mm is ideal for subject matter encompassing a large area. An 80 to 100 mm lens is an ideal all-round lens, and a 120—150 mm is best for concentrating on particular subjects, such as a building where you wish to read the signs, or over a populated area where you must remain at a higher altitude. In an aerial photo, where the foreground is much closer than the background, maximum depth of field is important for two reasons. First, it is nearly impossible to fine-focus on a distant object (over 100 ft.) while in a moving vehicle. Therefore, always use the infinity setting. Second, with a longer focal length lens such as a 150 mm, the depth of field at f/4 is from 630' to infinity, and I

may be flying 500' from the target. Since I can't focus, if I shoot at f/4 there would be little usable depth of field. Therefore, use the minimum filter and minimum aperture setting to insure that the target will be within the zone of sharpness.

In conclusion, let me suggest that any photographer who has a favorite outdoor site try at least once to photograph the same site from the air, regardless of cost, regardless of weather (I even shoot in the rain), as the perspective he will obtain on an otherwise familiar area will probably capture his imagination and always cause him to consider the aerial view in the future.

SWEDISH POLICE RECORDS — WITH THE HASSELBLAD 500EL *by Evald Karlsten*

The police use helicopters a lot in their work. To supervise traffic and to record traffic accidents, to photograph the scenes of crime, arson and forest fires, to report on disasters, the dumping of oil in the sea and other forms of water pollution, to check on the ice situation in the northern channels, and in many other kinds of important, urgent work. From a modest start by the police, helicopters have become an invaluable aid in serving the public.

During the summer of 1971 the police in Sweden had about 30 helicopter pilots at their disposal. Their helicopters are fitted with Hasselblad 500EL cameras. The idea of using the Hasselblad camera is not a new one, as the 2 1/4" x 2 1/4" size is considered sufficiently large for enlargements to be made from parts of a negative and, at the same time, the camera is small and does not require much space.

In 1964, the police department bought a Hasselblad 500C and had it fitted with an optical finder. They fixed the camera above a hole cut in the helicopter hood and began to take vertical shots straight down. The results were encouraging so the police continued to experiment. During fall, 1967, they

had worked out a special stand to be used with the Hasselblad 500EL. The stand is permanently attached to the helicopter. Although the fuselage vibrates, the idea is extremely practical and nearly 100% of all pictures taken are sharp.

The Hasselblad 500EL/70 is operated by an electric built in motor within the camera body. The motor is powered by one or two rechargeable nickel cadmium batteries, each sufficient for 1,000 exposures on a single charge. The camera's selector knob permits five different ways of making an exposure, but the helicopter squad makes use of one exclusively — the A or automatic setting. At this setting, the camera exposes frame after frame at one second intervals as long as an exposure signal is given.

An Ikophot CD exposure meter is included in the helicopter's camera equipment. A light value is usually taken at the start of a patrol to determine the proper exposure to use.

Kodak Tri-X has been chosen as the black-white film for both the 70 mm magazine, which gives over 70 pictures per roll, and the magazine for 24 pictures. Both film rolls allow a wide latitude in exposure, and these large-capacity magazines were chosen because it is inconvenient to change magazines while flying solo. When color film is wanted the film used is Kodak Ektacolor Professional, Type S.

Collecting Evidence from the Air

The helicopter police is not only figuratively but literally the "flying squad"! Taking pictures of scenes where crimes have been committed is undoubtedly the most important part of the squad's work. Police helicopters are stationed in different parts of Sweden and they can hover above the scene of a crime very quickly when they are alerted by their colleagues in the crime squad. The escape route and other evidence left on the scene by criminals can often be revealed from photos taken by helicopters which land as soon as possible after completing their task. Exposed film rolls from the

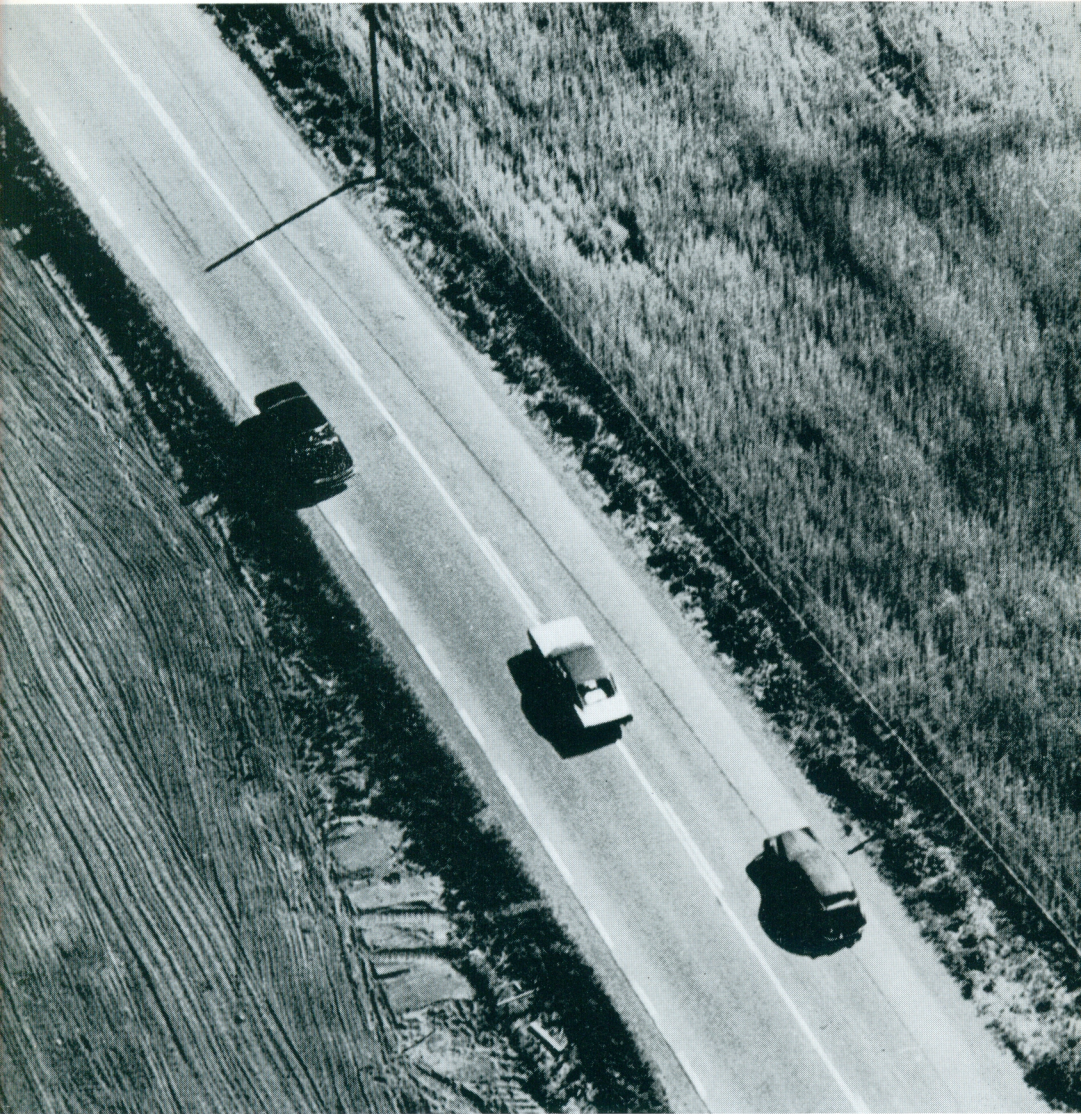
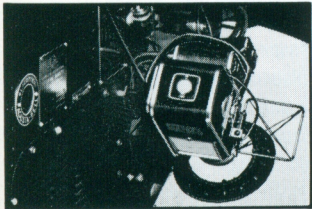


Photo: Helicopter squad of the Swedish police



A speeding car overtaking in a reckless manner has been spotted and photographed by an alert member of the helicopter squad. The nearest of the three cars is within a 50-foot distance of the

front bumper of the oncoming car. The helicopter's altitude was about 500 ft and its speed was about 95 m.p.h. Despite these conditions, the sharpness of the photo is quite good.

scenes of crime, and from serious traffic accidents, are then rushed over to the police's ground staff for processing.

Police helicopters also supervise traffic. Reckless and dangerous driving can be spotted and reported by radio to patrol cars. The two-way conversation held between helicopter and patrol cars when traffic violations are reported and photographed from the air is also tape-recorded in the helicopter.

Special Duties

Police helicopters have also been used very effectively to photograph disasters, such as landslides and forest fires. The photographic evidence produced is usually turned over to the authorities, such as the Swedish Geotechnical Institute. The helicopter squad is also asked to help when navigation routes begin to freeze in winter, and to report on the position of ice-breakers, etc. Unfortunately, water pollution and the dumping of oil into the sea have also become major problems today. When it is necessary to photograph such disasters, the shots are taken on negative color film.

Mounting the Hasselblad 500EL

The Hasselblad 500EL is attached to permanent stands in the police helicopters of which the fastest type, incidentally, is the Bell 206A with a maximum speed of 150 m.p.h. A company in Sweden has designed a support which is fastened to the helicopter's instrument console by three bolts. This support consists of a vertical metal plate to which an angle iron is affixed, and the camera is suspended from the bracket, tilted at an angle of 45° in normal flight. If necessary, the camera angle can be altered a few degrees by adjusting the frame at the bolts so that the optical axis coincides with the pilot's (photographer's) line of sight (he need not move his head to see through the viewfinder).

The camera's release button is situated on the helicopter's control lever, and the cam-

era's viewfinder is fitted with a green signal lamp, parallel-connected to the camera motor, which lights up when the film is exposed. This is a convenient visual aid as the pilot certainly cannot hear the soft whirr of the camera mechanism above the noise of the helicopter. The camera is permanently set at the A or automatic setting, and the lens generally used is the Zeiss Sonnar f. 4/150 mm.

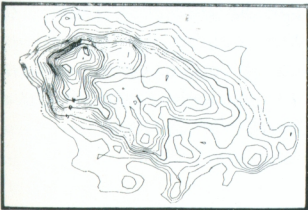
HASSELBLAD CAMERAS AID IN COASTAL POLLUTION STUDY

by Dr. Wesley P. James

Airphoto interpretation can be defined as the examination of photographs for the purpose of identifying objects and evaluating their significance. The interpreter is able to reconstruct the processes that created the airphoto patterns and make inferences regarding important properties of the natural system under study. Infra-red color photography is sometimes called "false" color as the colors recorded on the photograph are not the same as those seen by the eye in the natural setting. Blue colors in Nature are not recorded on this film, but green, red and infra-red light are recorded as blue, green and red colors respectively.

Aerial photography has supplemented ground surveys in the mapping of the earth's topography for the last 30 years. Photogrammetric uses for aerial photography are generally limited to the measurement of the spatial relationships of objects. However, photography can also be used as an energy sensor. Tonal differences or variation in image density in the photograph can indicate variation in energy radiation reflected from the object. Within the range of photographic sensitivity, variations in energy reflected from water, for example, as measured with the photo densitometer, can be related to water quality. The following ocean outfall dispersion study is an example of how quantitative image analysis can be applied to water pollution studies.

Photo: Wesley P. James



The infra-red color photograph of the waste field was taken from 6,000 ft. The outfall is located in the upper left; the plume extends downward and to the right. The head of the plume is

parabolic in shape. The black and white picture is an isoconcentration plot of the waste field. Concentrations were computed from the film densities measured from the color photograph.

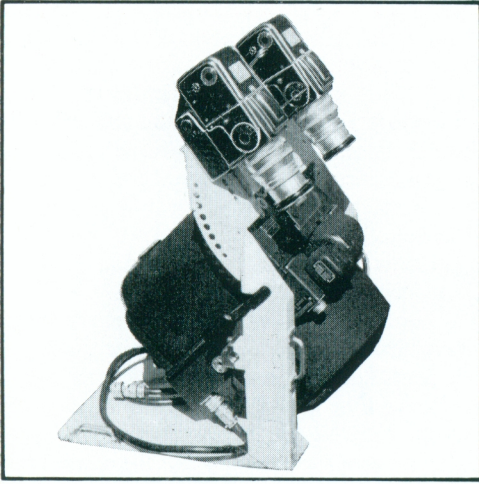


Photo: Wesley P. James

The infra-red color photo of the sewage treatment ponds show surface foam, algae, turbidity of the water and plant growth about the primary treatment ponds. The water color in the various

ponds can be quantitatively measured with a photo densitometer and is related to the number and size of the suspended particles and their light scattering and absorption properties. The color

can be indirectly related to the degree of treatment, dissolved oxygen content and biological oxygen for a particular system.



Ocean outfalls

An ocean outfall is a pipeline used for discharging industrial or municipal sewage into the ocean. The outfall design, along with adequate treatment and proper operational procedures, protects the water quality of the near shore area. Aerial photography is a valuable tool for studying the dispersion of wastes in the ocean and for monitoring waste disposal outfall.

Conventional boat sampling of outfall waste in order to obtain design information or to develop operational procedures is limited to calm sea conditions which only occur during a short period of the year. A detailed survey of the waste field by conventional procedures would require considerable time to conduct. Since the tide, wind, and currents are continuously changing in the outfall area, boat survey conducted over an extended period of time does not represent the waste field at any given instant, but is a composite of the plume patterns that occurred during the sampling period. Aerial photography provides a method of studying waste dispersion throughout the year in any sea conditions. Data collected in a fraction of a second with aerial photography would require several days of continuous boat

sampling in order to cover the area in the same detail.

Aerial photography techniques

Aerial photographs are made of the waste disposal area with a three-camera unit mounted in the baggage compartment of a small high-wing aircraft. The camera package consists of a mapping camera and two 70 mm Hasselblad cameras. Multiple cameras allow the selection of optimum film, filter and exposure combinations for several photographic bands. An oblique camera mounting is used to reduce direct sunlight reflections from the water surface. Polarizing filters on the 70 mm cameras also reduce reflections from the water. Because of its large angular coverage, the mapping camera provides data for the photographic orientation of the two smaller cameras. Film from the two 70 mm cameras are used for detailed analyses and measurements of the waste field.

The three cameras are not bore sighted since the angular relationship between cameras is determined in the processing of data. The mapping camera is oriented about 45 degrees from the vertical while the two Hasselblads are oriented about 35 degrees from the vertical.

Simultaneous exposures of the outfall area are made with the three cameras at ten- to thirty-second intervals along the flight line, depending upon the altitude which ranges from 3,000 to 10,000 ft. Because a large number of photographs are taken in a short time it is essential that cameras have automatic film advance. Matching of images between cameras in the computerized data processing procedure requires that cameras be synchronized and exposures be made at the same instant. The timing of the cameras to 1/100 sec. is accomplished with a relay-capacitor device and an adjustable resistor circuit for each camera.

A camera with film size larger than 70 mm would require fewer frames to cover the area, or pictures could be taken from a

lower altitude, thereby reducing the effect of contrast attenuation due to light path radiance in the atmosphere. However, as the camera size increases, the aircraft size and modifications required for camera mounting may change. Quality control problems in the chemical processing of the aerial film also increases with the film size. For consistent results it is essential that the project process the film. 70 mm film is considered to be the largest film that could be processed without elaborate film processing equipment and yet meet the required quality standards for image analyses.

Six-inch focal length lenses are selected for the 70 mm cameras to reduce the variation in light return across the photograph. For the quantitative measurement of water quality parameters from aerial photography, it is desirable that the angle between the camera axis and object vector be kept to a minimum. Not only does light reflected from within the water mass vary with this angle, according to the volume scattering function of the waste, but the light fall-off on the image plane of the camera also varies inversely with the fourth power of the cosine of this angle due to the geometry of the exposure. In addition, the peak spectral transmittance of the narrow band reflectance filters changes with this angle.

Photo analysis

Field work is carried out by conducting simultaneous studies of the waste plumes by aerial photographic methods and by conventional boat sampling. So that the results of the two methods (boat survey and aerial photography) can be compared, the horizontal control datum is the state plane coordinate system for the area.

Photographic film is converted into digital data with the aid of the photo densitometer. The densitometer aerial film holder is attached to an x-y coordinatograph which in turn is connected to a digitizer and standard card punch to produce data for computer processing. By using the method of analysis

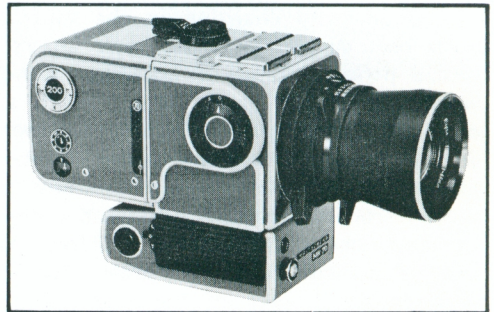
described by James and Burgess (1970), the photographic images are reduced to waste concentrations, the diffusion coefficients determined and water currents computed. In order to present the data in the most visually useful form, a computerized method of topographic mapping is adopted for concentration display. The result of this application is a map of the waste field which gives iso-concentration lines and variation in concentration throughout the plume.

In sampling the waste plume from a boat, there are several locations within the waste field where the concentrations are measured twice at one point. Computing the mean square residual for these points gives a measure of the repeatability of the concentrations by boat sampling. By matching ground coordinates, the concentrations measured by boat sampling can also be compared to those determined from aerial photography. The mean square residual for these two comparisons have been the same. Discrepancies between photo waste concentrations and waste concentrations determined by boat sampling appear to be due primarily to actual changes in concentration within the waste field which are not adequately measured by conventional boat sampling.

HASSELBLAD MK 70

The Hasselblad MK 70 is designed for photogrammetric applications. Like the Hasselblad 500EL Data Camera, which has been used by NASA since the first moon landing

Photo: Ray Halin





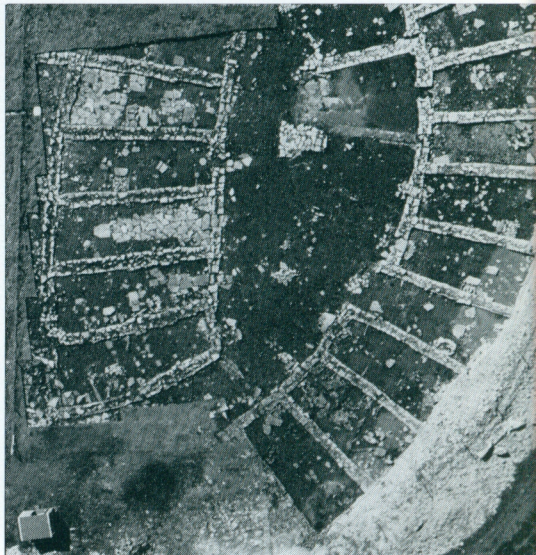
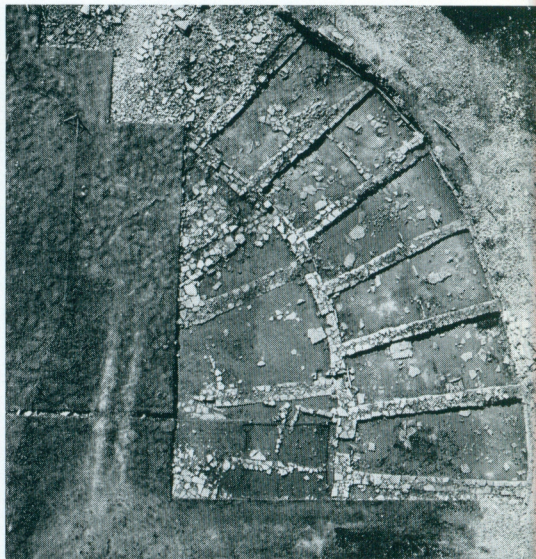
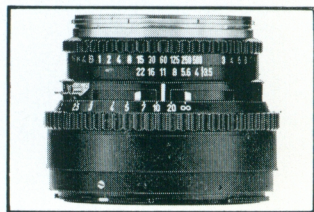


Photo: Rune Hedgren

The helicopter photographs above show the excavation of Eketorp Fort on Öland island, Sweden. The pair left shows an overview of the area, a closeup to the right. The lower pair shows the

progress of the work. The Planar 100 mm lens is specially suitable for this type of photography because of its outstanding even resolution across the entire field and high correction.



in 1969, the MK 70 uses the same basic frame as an ordinary, standard 500EL.

Experience gained from the Data Camera was put to use in the design of the MK 70. The MK 70, a small, easy-to-use photogrammetric camera, is equipped with a Reseau plate located in the camera body at the opening immediately adjacent to the film plane. The Reseau plate has 25 cross-shaped index marks vacuum evaporated onto the glass surface. With the aid of these index marks, measurement results can be corrected for film shrinkage and for the slight lens distortion.

The selector dial provides a choice between single-frame or sequence operation. The camera can be operated by a release cord or by a release on the camera.

There are two different film magazines for different lengths of perforated type II 70 mm film. The MK 70/70 film magazine provides 70 exposures and the 70/200 model holds 190 black & white and 160 color exposures. The MK 70/200 film magazine must be darkroom loaded since the cassette is replaced by a film spool.

The 60 mm f/5.6 Biogon and 100 mm f/3.5 Planar lenses are available for the MK 70. The latter lens, which is part of the Hasselblad standard lens series, has been optically redesigned for use with the Reseau plate. The 60 mm f/5.6 Biogon lens features outstanding correction for distortion (nominally $< 5 \mu\text{m}$ across the field) and MTF values (modulation transfer function) of 8.0 within 15% of the field and 0.6 with the remainder at a spatial frequency of 20 lp/mm.

These values apply when the lens is focused on infinity. This lens can be focused down to 35 1/2 in. and has a diaphragm range from f/5.6 to f/45.

The 100 mm f/3.5 Planar, like the 60 mm f/5.6 Biogon, also features extremely good correction for distortion, i.e. $< 10 \mu\text{m}$ across the entire field, and an MTF curve at a spatial frequency of 20 lp/mm which is 0.7 within 15% of the field and 0.55 with the remainder with the lens wide open. The 100

mm Planar cannot be focused and is permanently set at infinity. The diaphragm range is from f/3.5 to f/22.

Both lenses have Synchro-Compur shutters with speeds from 1—1/500 sec. and B. The synchronization contact is permanently set at X. All controls feature robust grips to facilitate use even in poor conditions.

HASSELBLAD MULTI-CAMERA BRACKET

Hasselblad has now introduced a specially designed multi-camera bracket for multispectral aerial photography and holding four Hasselblad 500EL/M or MK 70 cameras.

This multi-camera bracket is made of welded aluminum for rigidity and lightness. The cameras are mounted in the frame with the aid of an ordinary quick-coupling device for each camera. The cameras are synchronized for simultaneous triggering via a modified command unit. This unit has four numbered, red pilot lamps, each corresponding to one of the four cameras. These pilot lamps flash during each exposure and turn off immediately thereafter. In the case of faulty operation, i.e. a camera defect during exposure, the pilot light of the camera in question remains lit.

Exposures are either made via the release button of the command unit or by remote control (release cord, or intervalometer).

The interchangeable magazines can be loaded with four different film types in various combinations, for example black & white, color reversal or negative and infrared.

Thus, the combinations made possible by the use of different cameras, lenses, magazines, films and filters provide the opportunity of obtaining a rich abundance of material for photo interpretation of the areas photographed.

The Hasselblad multi-camera bracket is not a standard Hasselblad accessory but will be available on special order, since many airplanes have their own special attachment devices for camera equipment.

H A S S E L B L A D[®]



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