CAMERAS ON THE MOON

The equipment Apollo 11 will carry to the moon—and the precautions against contamination that will be taken when the astronauts return

As the US programme of space exploration has progressed, so has the use of photography increased with it. But what equipment and films are used? How do the astronauts go about their photography in space? What happens when the films are brought back? Will there be any differences when Apollo 11 brings back film from the lunar surface?

The photographic equipment carried aboard the Apollo 10 flight in May consisted of two modified Hasselblad 70-mm still cameras, two Maurer 16-mm cine or data acquisition cameras, and a special TV camera.

The Hasselblad cameras are electrically driven by special batteries and the film magazine, which was originally designed for 12 exposures, now holds 180 black and white exposures on thin-base film. However, as the actual number of exposures—or the length of the roll of film—that the magazine can hold depends on the thickness of the emulsion coatings, the magazine can hold only 150-160 exposures of thin-base colour film, which has more coatings of photographic emulsion.

The cameras are either handheld by the astronauts or else mounted on the spacecraft and operated automatically by an intervalometer. Most photographs are taken at 1/250 sec at f/11. The use of the same settings does not always provide the best exposed photographs, but it can provide more helpful information for photometric purposes—that is, for purposes of measuring the brightness of subjects photographed from space.

Should the astronauts want to alter the settings, they use a Minolta light meter with a narrow (one degree) field of view to determine exposure. However, NASA technicians have—after much research—established "nominal" settings. These are ideal camera settings for photographs of either the moon or earth. The astronauts can radio back to ground control for the nominal camera settings at any instant and obtain precise recommendations.

Houston's Manned Spacecraft Centre has tried to keep the number of different films it uses to a minimum in order to make the astronauts' task easier. Normal requirements call for films made on thin Estar polyester film base. There are three reasons for this:

- ☐ The strength of Estar polyester film base allows a thinner base to be used (0.0025in instead of the 0.0052in thickness of normal triacetate base). Hence, 40ft of film can be contained in a magazine that holds only 20ft of film made with base of normal thickness.
- ☐ The dimensional stability is an important advantage.
- ☐ Under the low atmospheric pressure (pure oxygen) in the spacecraft cabin (about one-third of normal atmospheric pressure at sea level on earth) triacetate film base would give off solvents that would be unpleasant for the astronauts. Practically no solvents, however, are left in the Estar base to evaporate under such low-pressure conditions.

NASA officials also decided to rely heavily on colour film because of its ability to provide substantially more information than black-and-white. At the outset, officials had to choose between negative and reversal films. They decided on reversal films because of the better grain and resolution characteristics and because, if laboratory personnel were to know how to make prints from negative colour film exposed to subjects of unknown colour, a sensitometric colour scale would have to be included within the frame of each exposure.

For black-and-white photography, the astronauts use mainly Kodak Panatomic X aerial film 3400 (Estar thin base), a fine-grain, high-resolution film, exposed at the equivalent of about ASA 80. In very low light, the spacemen have used Kodak 2485 high speed recording film (Estar-AH base). Said to be the most sensitive black-and-white film available it is generally exposed and processed at ASA speeds between 6,000 and 10,000.

Two infra-red-sensitive films also were used on Apollo 9: Kodak Infra-red aerographic film SO-246—a black-and-white film—and Kodak Ektachrome Infra-red aerial film (Estar thin base) SO-180.

Processing precautions

None of the films has been made exclusively for NASA. Kodak had introduced them before NASA indicated a need for them, and a wide variety of professional and industrial customers depend on them.

Houston's highly sophisticated film-processing laboratory is designed to provide the most reliable processing possible. Because even the slightest interruption during processing would damage the film, there are two auxiliary sources of electric power, each rated at between 500 and 1,000 amps.

For the processing, a sensitometric strip is attached to the end of each roll, and a new sensitometric strip is processed separately before the next roll of film so that any adjustment needed in the processing solutions can be made.

While the space film is in the processor, technicians know precisely where in the processor it is located at every instant. In fact, one technician announces each new position over a loud-speaker while others stand beside the processor, poised to take instant corrective action should any problem arise.

Biological contamination

Following the recommendations of a group of prominent scientists, NASA has set up special precautions in connection with lunar flights that include contact with the moon. Although the likelihood of chemical or biological contamination is remote, the astronauts and everything else in the spacecraft are to be kept in quarantine until it can be determined that they carry nothing with them that would harm life on earth.

When the spacecraft is recovered after splashdown, cameras and film will be removed directly into a mobile quarantine unit aboard the recovery ship. They will be divided, placed in sealed plastic containers and passed through a decontamination lock, containing a solution of 1,500 to 2,000 ppm of sodium hypochlorite.

At Houston, the films will be completely exposed to a fumigant-sterilant gas, ethylene oxide, for 16 hours in an autoclave chamber. To ensure that the entire film is exposed to the fumigant, the film will be interleaved with a plastic material.

The film will remain in the decontamination tank for 24 hours before it is checked by biologists and then, if cleared, be released for processing. Only then will man see the evidence of conquering the moon.