Recorder which will include a form of data processing either partial or complete. Further information on this program will be published when test results are available.

It is interesting to see, in block diagram form, what we plan to produce as a complete Automatic Airborne Profile Recorder System.

This is illustrated in Figure 11 which is a block diagram of the system which we envisage as the end result of the development program outlined in this paper. The components specified are available and we see no reason why selected profile points could not be resolved and printed on the appropriate frames of the spotting photography.

A study of Figure 11 shows that we must make some assumptions on the weighting of the barometric slope corrections and closure errors. We visualize these as mechanical inputs set according to the characteristics of the survey area, e.g., average type of winds, type of terrain, etc. This, of course, is done as a first approximation with present data reduction techniques. There will, of course, be areas where secondary checks will have to be done on the data at the ground installation.

We believe that such an Airborne Profile Recorder System as we have described will be a tremendous step forward in the mapping industry. We look forward to the publication of further reports as our development program proceeds.

*Photography and Imagery— A Clarification of Terms**

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THE increased use of pictorial displays of data in the fields of photogrammetry and photo interpretation has led to some confusion of terms, not so much by photogrammetrists as by users and interpreters of pictorial data. The terms "remote sensing" and "remote sensing of environment" are being used as general terms to describe "the measurement of some property of an object without having the measuring device physically in contact with the object" (Parker, 1962).

Measurements of size and shape by photogrammetric and optical means are common examples of remote sensing and therefore require no elaboration. Other techniques of remote sensing of electromagnetic radiation in and beyond the limits of the visible spectrum require some explanation and differentiation from the techniques used in the visible spectrum.

The following definitions of "photography" and "imagery" are proposed to clarify these two terms in hope that this will lead to more precise understanding and explanation of the processes.

PHOTOGRAPHY

The production of a permanent or ephemeral image of a subject on a medium which is directly exposed to electromagnetic radiation emitted or reflected from the subject, or transmitted through the subject, and is affected by the radiation in direct proportion to the emission, reflection, or transmission characteristics of the subject.

Examples of the process are ordinary photographic film that, after exposure to visible light, retains a latent image which prevents restoration of the emulsion to its original form and the evaporograph, which retains an image for a short time after the image-forming radiation is stopped.

IMAGERY

The pictorial representation of a subject produced by electromagnetic radiation emitted or reflected from a subject, or transmitted through the subject, and detected by a reversible-state physical or chemical transducer whose output is capable of providing an image.

A thermistor in a bolometer changes its resistance in response to incident infrared radiation. The resulting voltage change can be electronically manipulated to produce an image. The thermistor is a reversible-state transducer because the resistance produced

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by the incident radiation returns to the normal level when the radiation is stopped and no vestige of a "latent image" is retained.

Two essential differences between the processes of photography and imagery are the interposition of a transducer between the subject and the pictorial display in the case of imagery, whereas the pictorial display medium is directly exposed to the electromagnetic radiation in the case of photography, and the change in state of the medium may continue after the incident radiation ceases.

Photography

Photographic processes involving monochromatic, color, false-color, infrared-sensitive, or other types of films are remote-sensing processes in which direct recording of radiation-subject relationships are made. The resolution of such photographic media is ultimately dependent upon the "graininess" of the emulsion. Resolution of several hundred lines-per-millimeter is not uncommon and for some work resolution of up to 1,000 lines-per-millimeter is used (Eastman Kodak Co., 1960).

The achievement of the maximum resolution of which a film is capable depends upon the optical system and the development processes used. Maximum resolution can be closely achieved if all elements of the photographic data-gathering system are "tuned" to optimum performance. Craig (1961, p. 406) points out that photographic processes are capable of storing data at a rate of "billions of bits-per-minute", in a digital analogy of graininess.

Thus the ability of a photo interpreter to recognize photographic images of selected features and evaluate or measure their characteristics is dependent first upon the quality of the images and second upon the knowledge and competence of the interpreter.

Imagery

Imagery, as defined above, depends upon *indirect* representation of a subject as a basis for interpretation of features and their characteristics. The product of an imaging remote-sensing system, such as an infrared strip-mapping system, is often a picture on a photographic film that shows shape and tone relations of features scanned by the mapper. The resolution of the photographic film is usually much greater than the spacial resolution of the electronic system which produces the image-forming light. The resolution of a radar or infrared mapper is also a function of the angular field of view.

Scan lines on infrared imagery are much farther apart and are themselves wider than the narrowest lines that can be resolved (at 1 to 1) by direct photography of the subject. Thus, resolution is dependent upon the electronic system rather than on the resolving power of the film. The amount of information that can be stored as imagery in this way is far less than can be stored by direct photography of the subject. The photo interpreter must keep this contrast in mind when viewing "imagery".

Use of terminology

The term "image" is applicable to a subject representation on a photographic film whether it is produced by photography or imagery. It is then proper to speak of the image of a volcanic vent on a panchromatic photograph, or a photograph on infrared film. It is also proper to speak of the image of a volcanic vent on infrared *imagery* obtained by photography of the displayed output of a detector.

In these terms then, there is no such thing as a radar photograph or radar photography because no medium is capable of directly recording microwaves. The radar image on the display can be recorded by *photographic* means to produce radar imagery (but not a radar photograph).

References

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