

## Getting Aerial Photographs 'On-the-Ground' in Forest Management

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THIS is a report on a personal research study now in progress. It concerns the use of aerial photographs on the National Forests in Texas, and will culminate in the preparation of lesson plans designed to improve the confidence of the field forester in using aerial photographs in his routine forest management tasks in order to expand photo use in these endeavors. Primary emphasis in this paper is placed on a discussion of these lesson plans—how they are intended to get aerial photos in the field man's hands in the woods and then in the office, to make his work easier and more accurate. The entire research study was not entered into as a criticism of present use of aerial photographs on the seven ranger districts comprising the Texas National Forests. Rather, it was undertaken as a personal challenge to improve the utility of aerial photographs in forest management tasks, over and above their current use.

The Forest Service realizes that aerial photo use on the ranger districts in the Southern Region should be expanded, and is taking steps in this direction. Special cartographic sessions on photo use in access road location and in property corner assessment, have been offered by the Southern Region to field engineers in recent years. In 1961 a week-long training session in aerial photo use was conducted for timber management officers at the forest supervisors' offices in the Southern Region. Current plans call for a photo-use training session for Texas National Forest personnel.

### CURRENT TRAINING STATUS OF TEXAS NATIONAL FOREST PERSONNEL

Through personal contact with all district rangers, and with most assistant rangers and foresters on the Texas National Forests during the summer of 1960, it was admitted that a course or two in photogrammetry and photo interpretation in college was not enough to provide the incentive for a field forester to obtain maximum use of the aerial photographs on file in his office, although they by

no means remain idle. With this as an incentive, the current study was continued, culminating in the training manual being discussed here. Though there has been a considerable turnover in personnel since 1960, the above conclusion is probably still valid.

*Available lesson plans and manuals.* Books and pamphlet material devoted to the forestry uses of aerial photographs are primarily given to map making, timber estimating and stand mapping aspects, as well as describing the photographic appearance of timber under different film, filter and seasonal combinations. Too little space is devoted to examples of everyday field and office use of aerial photographs as the forester covers his district. Foresters are resourceful individuals if they once have gained confidence in a tool or instrument, or management method. Unfortunately, the forester must have his confidence in aerial photos as a forest management tool renewed to fit the practical forest management situation at hand. For the Texas National Forests two useful pamphlets are on file in the district rangers' offices—a 1947 Southern Region photo interpretation manual and Avery's *Forester's Guide to Aerial Photo Interpretation*. These are of limited size, and of course were not designed to present Texas examples.

The Forest Service is currently providing field personnel with photo training kits, containing photographs for examples from the Rocky Mountain Area,<sup>1</sup> which are useful as a beginning point in training southern foresters. As yet, time limitations within the Forest Service Southern Region have precluded the use of local adaptations of these training kits. The training lesson plans discussed in this report should help bridge this gap. A similar training manual in limited

<sup>1</sup> Moessner, Karl E. "Training Handbook, Basic Techniques in Forest Photo Interpretation and Training Kit, Basic Techniques in Forest Photo Interpretation." U. S. Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah. 1960.

edition preliminary form has been prepared by the Pacific Northwest Forest and Range Experiment Station for use by their personnel in that region.

#### REQUISITES OF A TRAINING MANUAL FOR LOCAL USE

A training manual for local use is a special thing, so it must be personalized. It must have local examples. Examples supplied by personnel who will use the manual are especially encouraged. The inclusion of photographs that the individual recognizes from his own district personally relates him to the training manual. Several good examples to illustrate each problem should be made available—preferably on overlays so photos may be reused. Contact prints are more desirable than stereograms—the extra cost should be justified. Ground photos assist the translation from horizontal to vertical perspective. Historical examples brought up to date appear to have merit here too—it is important to recognize past efforts and emphasize the time-saving features of up-dating against performing a completely new job. Practical examples should always be stressed—extremely special uses might properly be excluded. The language should be simple and technical terms should be avoided.

A photo training manual for local use should be designed to get photos in the field man's hands (both in the office and on the ground), have him gain confidence in their use, whet his appetite to learn more about them, have him use them in his regular work, let him devise new uses for them, and finally encourage him to leave a permanent record of his work for his successors. These five principal objectives of a photo training manual for local use will be considered in turn.

A. *Get photos in the man's hands.* First and foremost, in order for aerial photos to achieve their maximum potential, their existence must be known and appreciated. Although contact prints can be filed away, the photo training manual can be large enough that it cannot be easily slipped away under other papers—use contact prints, enlargements and maps and shove them in some out-sized presentation binder. With the manual in view the field man will see it and be reminded of its purpose.

The first lessons in the manual should be elementary, showing what a man having limited training with aerial photos can accomplish. Single print use should be stressed at first. A long, cumbersome introductory section is undesirable. In the case of the manual under consideration, the first lesson points out

a major use of photos—the historical comparison, followed by exercises in adding pertinent historical detail to current photos. This points out that photos become out-dated but never obsolete, that old photos should always be kept in the files, and that the coverage dates should be posted on the outside of the file cabinet for all to see. Next, is a brief review of stereoscopy, including nomenclature, followed by a demonstration of the field of view of common stereoscopes, since some choice is usually afforded. The next exercise—and a most necessary one for the field man—deals with translating perspective and scale from the horizontal eye to the vertical camera, and takes the form of a make-believe field trip, having distinctive field locations along the route marked on the photos, together with ground photos of these points as additional locational aids. This perspective problem eventually concerns every field man as he tries to find his exact position in the field by pointing it out on the photograph. Being able to make this location repeatedly is a personally rewarding experience in aerial photo use. Field exercises designed to orient the photograph and to follow a given bearing in the field to a specific location, using the photo for reference, complete the introductory portion of the training manual. These introductory exercises will provide the field man with non-stereoscopic as well as stereoscopic routine uses of aerial photographs.

B. *Have the man gain confidence in photo use.* The second step in the training manual for photo use in forest management is to expand the field man's confidence in photos through example and problem of their time saving capabilities. Exercises of this type are: delineating streams and defining watersheds, using photo data to supplement maps, locating new roads on old photographs, placing corners and property lines on current coverage, and using the back of the photograph as a source document. These activities are of a general nature, useful in the everyday work of forest management, and can be done at the field man's leisure. With practice in stream delineation the job of searching for suitable recreation sites—especially lake sites—is easier. A rainy day affords the forester a chance to bring property lines on the district up to date on the latest coverage, to put a new road showing on the photos onto the office map, or to annotate on the back of a photograph some observations he made while in the field earlier in the week. In this latter respect, areas where road erosion is severe, where a recent blowdown occurred, where undesirable

hardwoods are overtopping thick pine reproduction, the pinpointing of an out-of-the-way property corner are examples of information observed in the field which can be annotated on the photographs for future reference.

C. *Whet the man's appetite for photo use.* Once the field man starts to use aerial photos in routine jobs he is ready for a photo training manual section containing lessons which show how photos can help perform the more important management tasks. In the manual under discussion, several topics are included in this section. First, is a general exercise in using aerial photographs to aid in preparing a timber sale offering, followed by specific exercises in sawtimber and then in pulpwood sales problems. Next, is a treatment of the effect of drastic cutting or other changes which out-date parts of the photo image, necessitating delineation of such changes so mental adjustment in photo image can be made. Another problem in this section concerns recognition of differences in timber size and density, a central problem in forest inventory. Also included is an exercise in delineating existing roads on photographs and the use of photos in road location planning.

D. *Let the man devise new uses for aerial photos.* A training manual is of limited value for encouraging the field man to devise new uses for photos, but well chosen exercises should open the field man's eyes to novel uses for photos. In this section, the manual includes an exercise devoted to subtleties in photo interpretation and use, in which such items as photographic evidence of past cutting, how to recognize the best timber, and other helpful shortcuts to field work are discussed. Here too is an exercise concerned with tree-crown size and crown count designed to encourage the field man's associating photographic images on areas with which he is familiar and extrapolating this knowledge to new areas where field inspection has not yet been made. This practice leads to the photographic inspection in lieu of field inspection of many areas, a more sophisticated use which experience with photos develops in the field man.

E. *Encourage the man to leave a permanent record.* If the author was asked to choose a frontispiece for a photo-use training manual, it would most certainly be an annotated aerial photograph. A blank photograph is of limited value since it must be interpreted by each user each time it is used. The lasting effect of a photo training manual can be traced through the information its continued use leaves for the future. To assure maximum

continued use through the choice of meaningful examples, and stress posting a record of results and observations, should be the overriding aim throughout a photo-use training manual. This cannot be accomplished in any one exercise, but must be demonstrated whenever possible throughout the manual.

*Detailed lesson plan descriptions.* Discussion up to this point has been generalized. As an indication of the type of lesson plan included in the manual, the following case examples are cited. One exercise concerns up-dating changes on aerial photographs. In the introductory statements it is pointed out that aerial photos become out-dated swiftly, especially on areas receiving drastic treatment, such as heavy cutting, fire or insect attack. It is mentioned that by delineating these areas on the photo, or on an overlay, the pictorial view can be changed in the forester's 'mind's eye' to the new condition. Three photo examples are furnished: an area where cull hardwood treatment converted the stand condition from pine-hardwood to pure pine, an area where a highway construction gravel pit replaced a timber stand, and an area scheduled for clearcutting. Three problems are presented: one for the field forester to find several places on his district which have recently received drastic treatment, a pulpwood plantation due for thinning which has two previously thinned plots for visual comparison, a problem in counting cull hardwoods by comparing photos taken before and after treatment.

A second case example worthy of mention is an exercise in locating new roads on old photographs. It is helpful to the field man to be able to locate his woods position on the photos, especially while he travels along a road. The Texas National Forests are in an expansion period in the permanent access road net. As a result, with photo coverage scheduled for 5-year intervals, many roads have been constructed which do not appear on the most recent coverage. It is a simple matter, once controlling points along the road can be spotted on a photo, to delineate the road in white ink, just as it would appear on a photo taken that day. An example is presented in which the before and after aerial photographs are available. A road segment was mapped and placed on a photo taken before construction began; this photo was then compared stereoscopically with a later photo on which the road appeared. The fit was quite close. In the problem included with the lesson plan, another road segment is shown, the terminals spotted, and field survey

notes of the location furnished. The field man is called upon to plot the road on an outdated photo, and then to compare its location with the actual location given on the most recent photo. The close comparison sure to result will improve his confidence in aerial photographs as a forest management tool.

#### CLOSURE

This discussion has dealt with an ever-present problem in a forestry organization. This problem is encouraging the field man to use time-saving equipment and procedures. Aerial photographs fit into this category. Al-

though they are not a direct function of forest management, they are a tool of such management and must be publicized as such. A local aerial photo training manual can provide this publicity in a personal manner through use of local aerial photographs.

Although the case discussed in this paper dealt with aerial photographs in a forest management setting, the points covered could be used to advantage in other disciplines. The need for a local photo training manual no doubt exists within many organizations, and when prepared, should provide a valuable reference for all field men in the organization.

## *Geodesy's Newest Dimension\**

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*ABSTRACT: Many methods and projects of three-dimensional geodesy have a common denominator—the photographing of a light source against a star background. Tested methods are Rocket-Flash Triangulation and Long Line Azimuth determination. The geodetic satellite ANNA is an example of a system whose observation program is just beginning. A proposed program which is now under study is Project SCORPIO, a satellite system primarily designed to calibrate range instrumentation equipment but which will also provide geodetic and geophysical data. LARGOS, a laser-activated reflecting geodetic optical satellite, also in the design stage, will be a passive type satellite. Undergoing feasibility studies is a geodetic equatorial synchronous satellite, which could provide valuable information on gravitational harmonics.*

#### INTRODUCTION

THE new dimension of geodesy is *space*. One of the basic keys to the utilization of this new dimension is photogrammetry. The principles of this science are employed with precision stellar cameras and a light source in space for the purposes of performing geodetic stereo-triangulation.

The various methods and uses of photographing a light source against a star background for geodetic purposes can best be appreciated if we look at our past performances and failures, our present systems, and our hopes and plans for the future.

The methods discussed here are techniques which have been fostered by Air Force Cambridge Research Laboratories as a part of our geodetic research activities. Rocket-Flash

Triangulation and photogrammetric azimuth determination are examples of tested projects; ANNA, the geodetic satellite which on Oct. 31 was successfully injected into orbit; Projects SCORPIO and LARGOS are future programs under development; geodetic uses of synchronous satellites are still being studied.

#### ROCKET-FLASH TRIANGULATION

In 1946, Vaisala conceived the idea of rocket-flash triangulation (RFT); thus, geodesy moved into the new dimension of space.

Early experiments with this method used small balloon-borne or aircraft-borne photo-flash cartridges as light sources which could be photographed by several cameras simultaneously. These images, measured against

\* This paper was presented at the 1962 St. Louis ACSM-ASP Convention.