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A Survey of Training Aids

Results of a questionnaire circulated among the schools teaching photogrammetry.

ABSTRACT: *The ASP Education committee has recently conducted a pool by use of a questionnaire of about 350 institutions, firms and faculty about the use of and need in training aids. Based on 23 percent reply sample the results are shown in this paper, including a list of commonly used training aids.*

INTRODUCTION

DURING THE PAST years there has been an increase in the complexity and sophistication of equipment and in the applications of photogrammetry both in practice and in education. The papers by Merchant,[1] R. H. Brock,[2] discuss the trends and show the major course offerings. There are still many schools who have minimal courses and who utilize obsolete procedures and equipment. One possible way to assist the school operating without modern equipment or funds to obtain it is through the use of inexpensive training aids in the form of films, slides, stereogram sets and models. It would appear that the less photogrammetry offered that offered at the University of Washington[3] or Purdue, or by full use of Sabbatical and fellowship programs now available, however, the status of training aids is still important.

NEED FOR THE SURVEY

With this increased awareness in photogrammetry came an increasing inquiry to the Education Committee of the American Society of Photogrammetry (ASP) regarding training aids. As Chairman of this committee in 1966, the mandate to take on this work was inherited from some of the recommendations from Professor Baker. This appeared to be a feasible project that may be of value, so, in consultations with Prof. Bruce Stanton, the vice-chairman, a questionnaire* was designed. This questionnaire was distributed to about 350 individuals, Universities, and firms known to or presumed to be interested in training and education by Mr. C. E. Palmer of the National Headquarters of ASP. As of February 1967 there have been 80 returns, or about 23 percent. This is considered to be a satisfactory sample even though only a small proportion of the respondents had any factual data or ideas.

MOTION PICTURE FILMS

As would be expected, the greatest information obtained concerns 16 mm. movies. The motion pictures used by the respondents are shown in Table 1. The results show that most

the more these aids are needed. This is not, however the apparent case. One reason may be the lack of knowledge of availability of these items. It is certainly true that a *picture* cannot supplant good teaching and or a professionally qualified teacher and they do not *solve* a problem needing mathematical or physical laws. They do, however, show the student the modern *state of the art* and allow him to relate his practice and theory to the real world. They are, of course, especially valuable in the hands of the knowledgeable teacher. It is hoped this last facet can be aided by attendance at the institutes such as

* Submitted under the title "A Survey of Training Aids used in Teaching Photogrammetry."

[1] "A Survey of Courses Offered in Photogrammetry", D. C. Merchant, PHOTOGRAMMETRIC ENGINEERING, Nov. 1963.

[2] "Courses Available in Photogrammetry", R. H. Brock, PHOTOGRAMMETRIC ENGINEERING, Mar. 1966, and Addendum, Sept 1966.

[3] "A New Approach to Surveying Education," J. E. Colcord, PHOTOGRAMMETRIC ENGINEERING, Nov 1963.

* For editorial reasons, a copy of the questionnaire is not reproduced here.—*Editor.*

TABLE 1. ASP EDUCATION COMMITTEE TRAINING AIDS QUESTIONNAIRE SUMMARY

Motion Picture Films (16 mm. Sound for use in Undergraduate & Graduate in Geometric Photogrammetry & Image Interpretation) All are available on loan. See Appendix for addresses and comments.

Item No.	*Title*	*B/W*	*Color*	*Run Time Minutes*	*Date*	*Made Available from*	*Suitability Rating Needs*			
							Ex.	*Gd.*	*Fair*	*Modernization*
1	Leveling for Topographic Mapping		×	20	1951	USGS			×	
2	Transit Traverse for Topographic Mapping		×	25	1951	USGS				
3	Triangulation for Topographic Mapping		×	30	1953	USGS				
4	Supplemental Control for Topographic Mapping		×	25	1952	USGS		×		
5	The Preparation of Topographic Manuscripts for Reproduction		×	30	1952	USGS				
6	Negative Scribing for Map Reproduction		×	24	1953	USGS				
7	Tellurometer		×	12	1959	USGS				
8	ABC System		×	12	1964	USGS		×		×
9	Helicopters as Aid in Alaska Surveys		×	12		USGS				
10	Topographic Mapping by Photogrammetric Methods	×		90–120		USGS			×	××××
11	Introduction to Photo-Interpretation		×	22	1960	USGS	××	×××		
12	Aerial Photo Interpretation of Hydrological Resources		×	39	1960	USGS		××		
13	Aerial Photo Interpretation of Forest Resources		×	39		USGS	×	×		×
14	Aerial Photo Interpretation of Geological Resources		×	34		USGS	×	×		
15	Aerial Photo Interpretation of Soil Resources		×	36		USGS	×	×	×	
16	Paving the Way to Progress		×	35		Wild-Heerbrugg Instrument, Inc.				
17	Making Maps the Efficient Way		×	66		Wild-Heerbrugg Instrument, Inc.			××	×
18	Introducing Photogrammetry		×	25		Wild-Heerbrugg Instrument, Inc.	××	×××	×××	
19	Super Wide Angle Photogrammetry		×	30		Wild-Heerbrugg Instrument, Inc.	×			
20	Navy Photography in Intelligence		×			U. S. Navy	×			
21	From Jennies to Satellites	×		30		Itek Corp.			×	
22	Terrain Investigation Techniques		×	15		The Ohio State University		×		
23	Photography in the USAF (SFP 1028)	×		17	1961	USAF Film Libr.	×			
24	Multiplex Mapping, I, II (TS-5, 1949; 1546)	×		45–50			×	×	×	××
25	The Giant Step (SEP 1449)		×	30	1964	USAF Film Libr.		××		
26	Mapping for Defense		×	25		National Film Board (Canada)			×	×
27	Cameras Above, Secrets Below	×		30	1964	ASP (CBS)	××			
28	Fundamentals of Optics	×		20		U.S. Navy	×			
29	McBride Photo-Interpretation	×		30		U.S. Army		×		×
30	The Airborne Magnetometer	×		24	1952	USGS				

Other films mentioned include:
A film on imagery from Geoscience Division of Texas Instruments
Various Canadian Films from Dept. of Mines & Tech. Services, Surveys & Mapping Branch, Ottawa, Ontario, Canada (Note: Problems of duty even for loan)
Many Army and Air Force film sequences on maps, map reading and associated sciences.
Also of special note is a Pre-Programmed Lecture on Photogrammetry & PI in EDEX by Autometric
Oregon State University is thinking in terms of a taped lecture with instruction only in the laboratory period.

films were produced in the 1950's and that several have become obsolete and should be replaced. The most popular films were *Introducing Photogrammetry* by Wild-Heerbrugg and an *Introduction to Photo-Interpretation* by the USGS (AID). The suitability rating shown depends on a small sample of people with various backgrounds and objectives and is not significant. It would appear that the conscientious instructor should preview these films and see how they fit into his program, or, an eminent board of photogrammetric educators in various disciplines should act as a screening board and classify the films

carefully as to suitability for basic courses, elective courses or special graduate courses. Perhaps then, the main value is a concise list of films available to the teacher of photogrammetry in all its ramifications. It would also seem that good, instructive, color footage showing operation, manufacture and theory of a manufactures instrument would be a good investment in future sales—if the film is well done, essentially non-commercial and kept in good repair and up-to-date. For the descriptions of some films and for the addresses where the films are available see Appendix A.

Slides and Stereograms

The replies to the inquiry concerning slides and stereograms was more varied (Table 2). Specific sets of slides show that in geometrical photogrammetry, the slides by manufactures showing their equipment were most used. There appears to be a need in some areas to develop an integrated set for loan or purchase and the Education committee of ASP could do this by copying selected figures from the *Manual of Photogrammetry* and *Manual of Photo-Interpretation*, and soliciting color slides of equipment from all manufacturers. The availability of an up-to-date set of this type, supplemented by locally produced slides should assist in teaching a modern course in photogrammetry.

The available stereograms, show a relatively heavy use of the annotated set of some 274 stereo-pairs selected by the University of Illinois faculty. They are to be commended on their splendid effort. It is noted, however, that these are now strictly black-and-white photo imagery. The latest additions to the Illinois set do include *IR* and Radar imagery but the increasing importance of color, aerial ektachrome infra-red, and other sensors from *UV*, through multispectral band photography, to microwave means that in a short time slides, stereograms and samples of these type imagery must be produced for proper modernization of teaching.

Models and Other Devices

The use of this type teaching aid appears to be almost non existent except for the use of stereo-projections. The use of models and teaching devices is perhaps new to many instructors however, a well designed model

Table 2. ASP Education Committee—Training Aids Questionnaire Summary

Set Title	*Avail. from*	*B/W*	*Color*	*Number*	*Suitability*		
					Ex.	*Gd.*	*Fair*
a. *Slides*—35 mm. unless noted							
AMS Tr. Col (9×9 Viewgraph)	AMS	×		122	×		
Photogrammetric Instruments	Wild-Heerbrugg	×		41	××	×	
Photogrammetric Instruments	Itek	×	×	31		×	
Photogrammetric Equipment	Zeiss (Aerotopograph)	×		—	×	×	
ITC Slide Collection	ITC, Delft		×	20	×		
Basic P.I. (with tape)	USFS, Wash. D.C. Attn: Mr. Rinehardt		×	—	×		
Intermediate P.I. (with tape)	Attn: Mr. Rinehardt		×	—	×		
Photo Interpretation	Dr. Bell, C.E. Dept. Oregon St. Univ. Corvallis, Oregon 97331		×	100		×	
Photo Interpretation	Olin Mintzer, C.E. OSU Columbus, Ohio 43210			50		×	
b. *Stereograms & Film Strips*—Usually B/W							
STE—Urban	Dennis Richter, Geog. Dept.			50			
Geologic	Wisc. State U., Whitewater,			125			
Military	Wisconsin 53190			35			
Vegetation	Wisconsin 53190 Whitewater,			25			
STE Zeiss Instruments	Zeiss (Aerotopograph)			30		×	
STE Illinois PI Set (5×7 & 8×10)	U of Illinois			206		××	××
STE PI (Edition Technique)	Paris, France			—			×
F.S. Basic PI Workbook	USFS, Div. of Timber Management						
(With tape for LaBelle Rapid Action Automatic Slide Magazine & LaBelle 88 projector & matching sound system)							
STE Basic & Intermediate PI (also slides—with tape @3¾ ips)	USFS, Portland, Oregon (Bob Pope)			150	(color)	×	

TABLE 3. ASP EDUCATION COMMITTEE—TRAINING AIDS QUESTIONNAIRE SUMMARY

Models and Other Devices

1. Plastic " clip board" for estimation of angle of dip
2. 3-D Projectors
   a. Jackson's—DeHavilland Aircraft Co.,
      Toronto, Ontario, Canada
      $3\frac{1}{4}$ slides
   b. Stereo-Vivid
   c. T.D.C.
3. Mossners Parallax Test (USFS)
4. 3-D Models
   a. See PHOTOGRAMMETRIC ENGINEERING Sept 65, Mar 65 (Colwell)
   b. Navy Photo-interpretation Center, Suitland, Maryland
      Contact: V. Vakearen or Page Truesdell
   c. Plastic Models of Tilt & Relief Displacement
      Contact: A. J. McNair—Cornell University
5. Charts on basic mathematics of photos
6. Wild B-9 Training Samples

can supplement even the *real thing* at times. The *models* mentioned are listed in Table 3. It is obvious that model deformation as measured in an Wild A-7 autograph is helpful, but perhaps models of the distorted surfaces would help the beginning student. Another type of model is mentioned by Kulhan[4] and this idea certainly has merit in some teaching situations. As a recommendation, the scheduling of a model seminar at some future ASP Meeting, using a panel of *experts* to show how models are used in their teaching situations may be warranted.

One interesting hint of information comes from Autometric who appear to be interested in the field of programmed learning. The production of a *text* with illustrations and computer simulation is intriguing. Similar thinking apparently is taking place at Oregon State University. They are considering taping a similar but less sophisticated approach to be used in their teaching of basic photogrammetry. This is, then, perhaps a glimpse to the future where models and audio-visual techniques will have a place.

CONCLUSION

It is hoped that this small effort will make a contribution to upgrading of teaching of Geometrical Photogrammetry and Image Interpretations. Some pertinent current comments received are shown in Appendix B. These certainly give an idea of the current thinking in the field. Clearly, an up-to-date, color film showing the use, manufacture and basic design elements of a product can be useful. The production of an up-to-date slide set utilizing figures from the Manuals published by ASP supplemented by color slides of equipment from manufacturers and users will also assist in a more informal presentation that is more adaptable to an instructor's changing needs. Good models can also supplement good teaching and a seminar on *what can be done* would be helpful. Finally, new instructional techniques will necessitate a continual modernization and awareness by those of us in the teaching profession. (One logical method of presentation and updating of available training aids may follow the practice used by the Institute of Traffic Engineers in their brochure entitled, "Selected Audio-Visual Aids for Traffic Engineers."[5])

After all, we are in the business of working effectively with images and *a (good) picture is worth a thousand words.*

[4] "Terrain Model Aerial Photo" E. F. Kulhan, PHOTOGRAMMETRIC ENGINEERING, Nov. 1965.

[5] "Audio-Visual Aids for Traffic Engineers," ITE Committee 2C(63) an Inventory of Audio-Visual Aids. 1725 De Sales Street N.W., Washington, D.C. 1965.

APPENDIX A

AGENCY ADDRESSES AND FILM DESCRIPTIONS.

WILD HEERBRUGG INSTRUMENTS, INC., 465 Smith St. Farmingdale, L.I., N.Y. 11735. West Coast Representative. (Films marked *W* available only.) Surveyor's Service Co., 2942 Century Place, Costa Mesa, Calif.

(*W*) *Introducing Photogrammetry.* 16 mm. sound film in color—duration 25 minutes.

The film demonstrates the principles of Photogrammetry and shows some applications to demonstrate the versatility of this modern survey technique. It is of interest both to professional and laymen audiences.

Technical aspects covered include determination of geodetic points, air survey lenses and their design, explanation of the A-8 plotter's design principles using animation, demonstration of relative orientation, determination of scale and leveling of the model in the plotting instrument, plotting of a map with the A-8.

Uses of photogrammetry are shown in Australia, Japan, Paris and other areas around the world for forestry, geology, cadastre, planning and engineering.

(*W*) *Making Maps the Efficient Way.* 16 mm. sound film, 2 reels, showing time 66 minutes.

First reel: Assembly and adjustment of photogrammetric instruments (phototheodolites, Aerial Cameras, Plotting Instruments) at the Wild-Heerbrugg Factory.

Second reel: Use of Photogrammetric equipment as follows:

(a) Large-scale mapping for a technical project flight with the Wild RC-7a Camera in the Swiss Alps and plotting with the A-7 Autograph.
(b) Photogrammetric Land Registry Survey: Marking the boundary corners, graphic plotting and Registering of the boundary corner coordinates with the A-7 and the transformation of the instrument coordinates.
(c) Small Scale Mapping: Survey flight with the Wild RC-5a Film Camera. Plotting with the Wild A-8 Stereo-Plotter. Preparing the printing plates according to the procedure of layer engraving.
(d) Aerotriangulation in the Wild A-7 Autograph.

Introducing Superwide-Angle Photogrammetry 16 mm. Sound Film in Color, approximately 30 minutes.

The film gives a fine comparison between wide angle and superwide angle photogrammetry. It explains how Wild Herrbrugg solved the problems of developing a lens with 120° angle, the numerous parameters that had to be considered and shows clearly how greater economy can be achieved without giving a tribute to accuracy. The large coverage, the reduction of time consuming ground control work, the favorable base to height ratio and the fewer flight strips which must be flown proves that such a lens was destined to have success.

Aids for mapping and interpretation are shown including:

1) Comparison of infrared and panchromatic emulsions under various flight conditions, advantages of color photography.
2) Determination of pass points combining electronic distance measuring and the Theodolite.
3) Point transfer with the Wild PUG-3.
4) The use of navigation aids during flight.
5) Triangulation in the Wild A-9 Autograph.
6) And a brief introduction of large scale mapping with superwide angle photogrammetry.

DEPARTMENT OF THE AIR FORCE. Air Force Film Library Center (MAC), 8900 South Broadway, St. Louis, Missouri 63125.

American Society of Photogrammetry 105 N. Virginia Ave., Falls Church, Virginia 22046.

Film Data:

Cameras Aloft, Secrets Below. Black & White, 25 to 30 minutes.

This was a CBS film prepared for television in 1964. It shows the role of photogrammetry in the Cuban Crisis and depicts photo-interpretation from the layman's viewpoint.

U.S. GEOLOGICAL SURVEY

For areas listed, address inquiries to:

Arizona, California, Hawaii, Idaho, Nevada, Oregon, Utah, Washington. Pacific Region Engineer, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, Calif. 94025.

Alaska, Colorado, Montana, New Mexico, Montana, Texas, Wyoming. Rocky Mountain Region Engineer, U.S. Geological Survey, Federal Center, Bldg. 25, Denver, Colorado 80225.

Arkansas, Illinois, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, Wisconsin. Central Region Engineer, U.S. Geological Survey, Box 133, Rolla, Missouri 65401.

Others. Coordinator, Motion Picture Films, U.S. Geological Survey Room 2647 Interior Bldg., Washington, D.C. 20242.

Leveling For Topographic Mapping. Color-Sound, 16 mm., duration 20 minutes.

Depicts technical procedures used by the Geological Survey for the third-order leveling required as vertical control for topographic map-

ping. Opening with a rudimentary explanation of the principles of leveling based on sea level datum, the film shows the equipment and actual field operations of a Geological Survey leveling party. Prism levels and precise, invarstrip, self-reading rods are used in the surveying operations, not for the purpose of obtaining greater accuracy but primarily for obtaining a specfic accuracy at the least cost.

Transit Transverse for Topographic Mapping. Color-Sound, 16 mm., duration 25 minutes.

Shows the equipment and techniques used by the Geological Survey, in terrain of moderate relief for transit traverse to determine positions of third-order accuracy for the basic horizontal control—the framework upon which the topographic map is constructed.

The film explains the purpose of transit traverse and shows in detail the equipment used. Among the operations shown are the measuring and recording of angles, measurement of distances, methods of locating photogrammetric control points and an astronomic observation for azimuth.

Triangulation for Topographic Mapping. Color-Sound, 16 mm, duration 30 minutes.

Shows the equipment and techniques used by the Geological Survey, in terrain of considerable relief, for triangulation to determine positions of third-order accuracy for the basic horizontal control—the framework upon which the map is constructed. It also shows the measurement of vertical angles to determine supplemental control elevations, a method commonly used in terrain of this character.

Supplemental Control for Topographic Mapping. Color-Sound, 16 mm., duration 25 minutes.

Shows equipment and techniques used by the Geological Survey for determining the elevations of supplemental-control points for photogrammetric mapping of areas with various conditions of terrain and vegetation.

The film shows how aerial photographs are obtained for modern mapping, the office planning and the field operations used in determining elevations. Planetable and stadia surveys, triangulation methods, and two-base altimetry methods are discussed.

Preparation of Topographic Manuscripts for Reproduction. Color-Sound, 16 mm., duration 30 minutes.

Describes in detail the preparation of final copy for reproduction of topographic maps by smooth drafting procedures. Since the steps shown are now somewhat outmoded and are being replaced by scribing procedures, those desiring to view the current processes of final preparation of topographic maps should request the film "Negative Scribing for Map Reproduction." However, the drafting procedures shown here are still being used in connection with the revision of some maps produced during the past 20 years, and therefore those interested in both methods should view both films.

Negative Scribing for Map Reproduction. Color-Sound, 16 mm., duration 24 minutes.

Shows in detail the procedures involved in preparing negatives for map reproduction by hand scribing. Sheet coating, guide copy preparation, and close-ups, of the various scribing operations and instruments are presented.

Tellurometer. Color-Sound, 16 mm., duration 12 minutes.

Shows the equipment used in the Tellurometer System of microwave distance measurements. Explains how equipment is transported to the station from which the measurements are taken and shows the crew setting up and operating the instruments.

ITEK CORPORATION. 10 Maguire Road, Lexington, Mass. 02173. Washington Contact Office: 1735 I Street N. W., Washington, D.C.

From Jennies to Satellites.

The film is a production of an Educational Television Station (WGHB-TV). It should not be considered a training aid but an untechnical, general interest production on the personal history of General George Goddard and his experience in Air Force reconnaissance.

Aerial Photo Interpretation Films

Introduction To Photo Interpretation. 16 mm., Color, duration 22 minutes.

Provides training in the techniques of photo interpretation for the discovery and evaluation of the natural resources of a country or region.

Aerial Photo Interpretation of Hydrological Resources. 16 mm., Color, duration 35 minutes.

Provides training in the techniques of photo interpretation in the discovery and evaluation of the hydrological resources of a country or region.

Aerial Photo Interpretation of Forest Resources. 16 mm., Color, duration 39 minutes.

Illustrates how the techniques of photo interpretation are used to assist in the discovery and evaluation of the forest resources of a zone.

Aerial Photo Interpretation of Geological Resources. 16 mm., Color, duration 34 minutes.

Illustrates how the techniques of photo interpretation are used to assist the geologist in the discovery and evaluation of resources such as minerals, fuels, and constructive materials.

Aerial Photo Interpretation of Soil Resources. 16 mm., Color, duration 36 minutes.

Shows how soil surveys are expedited by the use of photo interpretation. It points out that proven techniques in this field combined with a limited amount of field work, make possible a

general evaluation of the soil resources of a region quickly and economically.

U.S. GEOLOGICAL SURVEY.—The Information Office, Washington, D.C. 20242.

Airborne Magnetometer. 16 mm., Black & White, Sound, duration 24 minutes.

Explains use of the airborne magnetometer which allows scientist, in aircraft, to gain information on mineral bodies in otherwise inaccessible areas.

ABC System. 16 mm., Color, Sound, duration 13 minutes.

Shows how the recently developed AirBorne Control Survey System (ABC) used the helicopter as an aerial electronic target in surveying and mapping operations. Demonstrates basic elements of system including the unique Stability Augmentation System for precision hovering.

APPENDIX B

Selected Comments from Correspondents (Out of approximately 60 specific comments received)

"I would be interested in seeing a summary list of films, slides, and special structural devices that other institutions are using. . . ."

"Due to curriculum changes resulting in a fewer number of electives, we have not offered our elective course in photogrammetry for several years. However, recently there seems to be a demand for this course so we hope to offer it again soon. I am looking forward to renewed activity in this area so we would be interested in the results of your survey."

"We are developing our Engineering Surveying course and we hope that we will have some of the training aids which have been used in teaching photogrammetry at the University level in the near future. Unfortunately, we have no motion picture films, slides or special Instructional devices at the moment at our University. Therefore, we will be very pleased to use any training aids available from the Committee in our undergraduate program."

"We need a collection so transparencies, with appropriate overlays, for use with overhead projector, to develop systematically the visualization of basic photogrammetric principles and carrying on to instrumentation, etc. A measure of animation can thus be obtained without resotring to movies which are expensive and less readily revised, nor the order of presentation altered as situation demands."

"We need air photos, black-and-white as well as color on 35 mm. slides. Carrousel-type projector has made the little slide the best possible training aid for nearly any class. Film strips are too restrictive on the lecturer. Good solid models of some sort should be available to illustrate. Geometry of single air photo, overlapping pair, the tilted photo, the earth ellipsoid, orientation of stereo pair etc. Training aids should be used with discretion in University level instruction. Photogrammetry and Photo Interpretation by their very nature lend themselves to the use of training aids. . . . "

"I have used very little in the way of films, slides, or models in my photogrammetry course. However, I probably would if they were readily available and I believe your committee is undertaking a very worthwhile project. I shall be interested in the results. . . ."

"I believe there is a need of a film or film strip which can be used at Junior High or High School level for Public Relations. Possibly there should be a consolidation by ASP of slides and film strips available and then publicized to all Universities and colleges as to their availability."

"We do not use any visual aids of any type in any of our courses. . . ."

"I am able to teach our course in Photogrammetry which meets six hours per week for one quarter without using slides or films. We visit the Highway Department Photo section to observe Kelsh A-7 plotters, and the operation of a mapping section. . . . By actually doing this work the student learns more than by viewing a film."

"Preparation of airphoto stereo pairs to be used with 35 mm. stereo slide projector which

uses polarized method (projector available commercially) and polarized glasses worn by audience, such *stereo slides* would be extremely valuable for classroom discussion of photo interpretation."

"We need more modern testing material for examining and training stereo vision. All major instrument companies as well as major governmental and private surveying, photogrammetry, and mapping agencies should provide the pertinent University Departments with demonstration material such as films, slides, stereograms, etc."

"The University of Illinois Series is excellent. . . . We intend to make use of this series of Stereograms when we can obtain them. Other items of teaching equipment have had greater priorities."

Discussion of 'Down to Earth'

Dear Editor:

President Heinz Gruner has presented in his paper, "Down to Earth," PHOTOGRAMMETRIC ENGINEERING, October 1967, the case for practical photogrammetry, and quite rightly says, "Traditionally the surveying professional observes an honored code of ethics and sound practice inimical to exaggerations and speculations." I am in hearty agreement with his approach to preserving the integrity of the mapping profession and to aiding the photogrammetrist whose work is routine (in the sense that he provides a standard product to his customers) in making the most efficient and best use of his skills and equipment.

But I am also in great disagreement with his tenet that the articles in PHOTOGRAMMETRIC ENGINEERING are becoming oriented to "very specialized fields remote from earthly usefulness and remote from the needs of the majority of our members," and that such orientation is undesirable. The scientists and engineers in these "very specialized fields," are not motivated by a "search for excitement and revelation" but are motivated by a desire to find solutions to the problems of coping with our environment. Photographic, photogrammetric, and remote sensing techniques can aid in these solutions.

Let me cite an example. Aerial photographs are routinely taken under rigid specifications for use in standard topographic mapping. The basic metric quality of the photographs is well utilized by the photogrammetrist when he plots the metric and cartographic data on a controlled map projection. The finished topographic map is his product, and a good one. But the task of the map *user* has just begun and, because the map contains only a small percentage of the information in the original photograph, the user needs both the map and the photograph to accomplish his task. Thus, the geologist uses the map as a metric base to plot the interpretive data that he extracts from the photograph on geologic structure, outcrops of bedrock, extent of alluvial deposits, and so on. The forester may use the same photograph and the same map to guide a timber cruise. Thus, the photograph has a multitude of uses beyond its originally intended photogrammetric use (a fact often overlooked in determining the cost/benefits of aerial photography).

As important as photogrammetric quality is, we cannot overlook the interpretive aspects of aerial photography and the need for continually assessing the quality of our environment, a task for which aerial photography and space photography are admirably suited.

The resource scientist who is earnestly searching for better ways to assess the environment has seen that space photography, such as the Gemini photographs, is useful for such evaluations, quite apart from its shortcomings as metric photography. From both a theoretical and an engineering standpoint, it has been demonstrated that small-scale metric photographs can be obtained from space and at a cheaper cost per unit area than aerial photography. In addition, useful photography and imagery suitable for interpretive purposes, but lacking in complete geometric fidelity, can also be obtained from space.

It is well to beware of exaggerations in the claims for space sensing but it is the job of the scientist to speculate and say, "What if . . .?" If it had not been for such speculation in the 1800's, practical photogrammetry would not be the indispensable tool it is today. Today's speculation, fenced in by scientific method and harnessed by the hard facts of engineering, may lead to a new era of practical photo use—both in photogrammetry and in photo (and image) interpretation.