many different types of difficulties were encountered, such as acquiring photographic sensitized material, especially film, and replacing the present antiquated aerial cameras. There is a strong need for cameras equipped with statoscopes, horizon or other type cameras that are useful in aerial triangulation, and those that can be used with our stereoplotting instruments. Almost all of our equipment has been German, which has given and is giving excellent results.

From February 1949 to December 1949, 16 sheets of the fire control maps (sheets which can be used for the *Mapa Nacional*) were prepared, which brings to about 790,000 hectares (3,050 square miles) the total area mapped by the *Servicio Geografico del Ejercito* since 1941 at the scale of 1:20,000 using photogrammetric methods.

A DISCUSSION OF DR. SARALEGUI'S PAPER*

O. S. Reading, U. S. Coast and Geodetic Survey

"O wad some power the giftie gie us
To see oursel's as others see us!
It wad frae monie a blunder free us
And foolish notion."

ROBERT BURNS

DIRECTOR SARALEGUI has done the members of the American Society a great service by his frank paper published in March 1950 PHOTOGRAMMETRIC ENGINEERING. Such friendly critical comments will cause many of us to re-examine carefully the premises on which our photogrammetric efforts are based. Perhaps a few of us will redirect our efforts to better advantage because of his letter.

I suppose it is both a strength and a weakness of every human mind that it tends to seek that which builds up its previously held ideas and to overlook that which tends to contravert them. A strength in that this assures the maximum reinforcement of efforts to carry out the ideas; a weakness in that one sometimes overlooks important information that can be more economically used near the start than by revising procedures later; or that would enable one to accomplish much more with the time and money available to him.

After much travel and many discussions, it seems to me that there is little difference in intelligence between the leaders in photogrammetry in the different countries. The rather marked differences in instruments and procedures used are rather due to:

(1) The different needs or problems met and comprehended.
(2) The different assumptions made as to what is most important among the needs and methods, some of which must be compromised.
(3) The "building blocks" of skills, materials and machines available.
(4) National security, national pride, tariffs and trade restrictions.

If the differences were due to differences in basic intelligence, little could be done about it. There would be little use for technical societies, meetings and publications, national or international. But fortunately much can be done about correcting assumptions, exchanging techniques and skills, and in calling attention to successful answers already worked out to meet common problems and needs.

The first step in such profitable exchanges is a frank critique of the differ-

* PHOTOGRAMMETRIC ENGINEERING, Vol. 16, No. 1, March 1950, pp. 128–131.

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ences between other ideas and solutions and one's own. Then, remembering that the other fellow is just as intelligent or perhaps more intelligent than we are, let us ask what assumptions does he make to start with? What needs is he trying to meet? What does he think most important? How many different solutions has he actually tried? Which of his methods, materials, skills, can I adopt and use to advantage in meeting my own problems?—Now if one has great mental energy and ambition he can find the answers to these questions himself, particularly if he feels sure that valuable answers exist.

But a simpler process, requiring much less study and effort, is to write an evaluation of another's efforts in the light of one's own assumptions and to have one's paper discussed by one's fellow specialists. They will readily fill in the gaps in one's assumptions and point out differences in evaluation experiences. This saves much arduous study and results in very valuable exchanges if all is done with good will and with the understanding that the other fellow has approximately equal intelligence but has had different experiences.

By way of such a return of the favor of Dr. Saralegui, it seems to me that he should have remained in the United States long enough to have learned to fully appreciate two of our most used words, "Bottleneck" and "Deadline." If one has much work to accomplish, he must so organize his equipment that all men available are used to best advantage with a smooth flow of work through all steps of the process. There must be a minimum of "bottlenecks" restricting production anywhere in the total procedure.

Often information, to be of much value, must be available in time to meet other exigencies—must meet a certain "deadline." As the decision to make the expenditure for the information is apt to be postponed until the need is very pressing, such "deadlines" often occur. Dr. Saralegui must have noticed that in the United States almost everyone has a cheap wrist watch and drives a moderately priced automobile. We do not wait until we can afford Longines or Cadillacs. Similarly, many American organizations are making large use of aerial photography and photogrammetry. They have avoided "bottlenecks" and met "deadlines." Others who have similar large, low cost needs are welcome to their ideas.

Doubtless others who discuss Dr. Saralegui's letter will point out that the resolution obtainable from high speed emulsions and cameras in vibrating, swaying aircraft is less than one-fourth that of the fine grain emulsions used in the laboratory for multiplex diapositives. Hence the small size aerial photographs he suggests for multiplex projectors would not be satisfactory.

Since the most elaborate and accurate plotting machines draw only one line of a map at a time, there must be as many machines as maps to be produced at one time. The main advantage of the elaborate precise machines is gained through the reduction of the numbers of photographs to be controlled and the cost of the more detailed ground control surveys. There are limits to this saving through the use of small scale, large areas photographs due to the limited resolution of the high speed aerial photographic emulsions. Expensive equipment, high skill, and practically perfect weather are necessary to secure high altitude aerial photographs of satisfactory quality for precision mapping. If small scale photographs are used for mapping, a second set of larger scale photographs is often needed for other purposes.

The cameras and instruments used are important but not necessarily the limiting factors which determine the benefits gained and the amount of use that is made of photography and photogrammetry. Each project carried out is necessarily a compromise of many factors.

Fortunately, by the time of the VII International Congress of Photogrammetry in 1952 there will be much more comparative data available regarding the different instruments and processes. At the U. S. Engineer Research and Development Laboratories in Ft. Belvoir, in the U. S. Geological Survey, the U. S. Coast and Geodetic Survey, and several commercial agencies, apparatus of several different makes and countries of origin is now working side by side on the same or similar projects. The results obtained will give the International Technical Commissions much to discuss that will be of interest to photogrammetrists everywhere. We hope that Dr. Saralegui will take part in the study and discussion of these results.

SPECIFICATIONS FOR AERIAL PHOTOGRAPHY AND MAPPING BY PHOTOGRAMMETRIC METHODS FOR HIGHWAY ENGINEERING PURPOSES*

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Introduction

THE Boy Scouts of America, have a motto, "Be Prepared." It is a good motto for everyone. We should all be prepared.

Dr. Kellogg has given an excellent talk this morning, pointing out the need for preparedness in the development of the agricultural resources of the world. The highway engineer's problem, of course, is parallel to that in agriculture. We must have transportation to be prepared, and the highways are the means for providing transportation to help make Dr. Kellogg's program become a reality. But we cannot build highways until they are properly located; and we cannot properly locate highways unless we have the essential information in sufficient amount at the time needed, Photogrammetry, of course, is a means of getting the information to the degree required. Then the highway engineers are prepared.

But the highway engineers must know what information they will need and, in order to get that information, they must be able to define it in the form of specifications. Today, that is our problem. We are trying to become better prepared to go ahead in that particular endeavor.

Specifications for aerial photography and mapping by photogrammetric methods for highway engineering purposes are not yet standardized. There is no consensus of what they should contain. Opinions range from one extreme to another. Some specifications now in use merely call for an aerial photograph or a map; others may include every detail that can be thought of about the photograph or the map, and how they shall be obtained.

It is the intent in this brief paper to provide an outline of specifications for consideration, and to indicate certain items that should be discussed for inclusion in the specifications. In this way, specifications written in the future can be improved. We also may be able to standardize their provisions as far as practicable. The experience of many aerial photographers, photogrammetrists and the highway-engineer-users of the aerial photographs and maps can be combined

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