TRAINING FOR AERIAL PHOTOGRAPHERS AND COMMERCIAL MAPPING

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THE inference is that I am supposed to represent the commercial operators. However, I find that among the commercial operators, as is in any pioneer field, there are still considerable differences in ideas of what we should have in training methods, crews, and so forth.

What I have to say is absolutely my own opinion; I am sure that every commercial operator will take some exceptions. My opinion is based on some twenty-five years of experience after college.

J. ROBERT COLTHARP

I want to give a brief historical background of the formation of our commercial firm. In the beginning of any new field of endeavor, it is seldom possible to start with a group of trained and qualified personnel. You must start from scratch and pick the best that you can; you generally get them from all walks of life and in all types of business. This is true of photogrammetry, probably even more so because of aerial photography. Most of the men have to come from personnel who know how to fly and know how to take a picture, and I will show you later that I think that alone is a rather minor detail.

I think aerial photography has developed into a purely and primarily engineering setup and that the education should be along engineering lines. I wholeheartedly endorse everything that has been said along those lines as an over-all general picture that our education should be based on engineering principles.

It has always been my contention that to be a success in any endeavor, you must have a higher education. That does not necessarily mean that you must go to college to get it, but the person who does not go has to educate himself; a lot of people have done that. I do believe, however, that the college-educated person or the college method of education is probably the most efficient and the quickest way of getting an over-all broad education. Therefore, I think that the integration of photogrammetry in our college education is essential, if we intend to really fulfill our place in the nation and in the world as photogrammetrists. I do not want that to be considered as casting any reflection on some of those who have come into this field from other branches and have made a notable success in our field. But I do think that in the future we should have the young person who chooses to get into this field, and particularly commercial mapping, prepare himself through an engineering education. I am very happy to see and hear the reports of accomplishment. But it is still pretty well confined to the higher educational school since 1940.

Getting down to the actual commercial phases of photogrammetry, I will split it into about four phases: the aerial photographic crew; the photographic laboratory crew; the office of compilation crew; and the ground field parties. I have put the aerial photographic field first because that is the first step. I

will spend more time on that because most of the other three have been covered by my predecessors.

It is very important that we have proper education for a photographic crew. The program stated photographers. I shall include the pilot. I am not going to say whether the pilot or the photographer is the more important, because I know quite a few pilots who really knew their stuff and who had done the photography work as well, say that they could take practically anybody and teach them to be a photographer in the matter of a few hours. That could only happen when the pilot himself knew the entire job. I have taken up pilots who previously never took a photograph and they flew a perfect job right off the reel. It was only because I was telling them what to do and handling the entire navigation. The job can be handled both ways and I am not going to say which is the better. One or both of the two must be good and must have the proper background and education to really do a good job.

The pilots and photographers should have an engineering background whenever possible. We have definitely found that some photographers who came in as pure photographers did not do so well as an air photographer. We have definitely found that some pilots who came in just as pilots did not do so well. Of course, we have had some exceptions. Some that had engineering background still could not make the grade. But the success that we have had with our field crews with an engineering background has been far out in front of those who did not have it. It really is an engineering job.

So far as photographic experience being required of an aerial photographer, under the way we operate you can literally teach him in five minutes. As far as I am concerned, all you need to know about straight photography to go out and do a job is to be able to take a light meter, hold it through the hole in the bottom of the ship, turn over and read the slide rule, and set that slide rule information on the camera. You will then have the photographic part of your job done. The operation of the camera is more similar to a theodolite than to an ordinary transit. It has to be handled in the same manner to get a good job done. The man does not learn that in a few minutes, but through hours and hours of practice; and the more he knows about that and the more he has learned in school about the operation of various types of instruments of that sort, the better off he will be when he comes to us.

I could not, for one minute, think of asking the colleges of the United States to teach their students to be aerial photographic pilots and aerial photographers, for the simple reason that at any one time we need only maybe fifty, probably a hundred at the most, for the needs of this country. Certainly the colleges could not gear themselves to anything like that.

However, believing that the pilots and photographers will be drawn from the group of those with an engineering education, it is very important that we consider the educational possibilities of a pilot and a photographer.

I doubt that we can ask that the colleges train all of our personnel; some few individuals, yes, but that would still confine our personnel to generally a small group of people. We cannot ask the colleges, as a whole, to try to train personnel to be photogrammetrists primarily. I would rather see the instruction integrated in part of the civil engineering curricula as a whole so the students will be able to appreciate the uses of aerial photography if they are going to be users, or they can appreciate the other end if they are going into the other field, the map-making.

The same holds true for the pilot and the photographer. They should definitely know how maps are made from aerial photographs. Also they surely

should know how the multiplex works and all the various other stereoscopic machines.

In a lot of cases I have put my pilots and photographers on ground crews and had them make ground surveys so that they would develop an understanding of what the field crew has to put up with in using the pictures that the pilot and the photographer take. They should definitely have an understanding of the law of errors and the law of probability because in all your work as a pilot you never do it exactly. You are always plus or minus an average. If that average is definitely on the base of what is wanted, then they have the full limit to vary from. However, if they fly plus or minus on some line and just take an altimeter reading and fly plus or minus 5 per cent, the temperature corrections are going to throw them off. So I think that the pilot and the photographer should definitely have a sense of absolute values so that they will work in a purely engineering manner.

I have talked with many who have been aerial photographers and pilots about fixing up their flight map, their interval, and similar matters. They did not know what I was talking about. They were not engineers. With the boys with engineering training, I could tell them in a few minutes. They understand the matter and do a good job.

As for the photo-laboratory crews, I will not dwell on that because it is purely photography in its broadest form.

The photographic methods being used now are taxing the limits of all our photographic brains. We have made big strides. I do not think it is necessary, at least for the present, to try to include the actual photographic processes into college engineering courses. There are enough photographic schools in the country to take care of that. There are some exceptions where there may be specialists in photogrammetry, but the job is closely allied to other branches of photography.

For the office work of checking aerial negatives for coverage and overlap, inspection work, compiling photo-index maps, and on up to checking photographs for ground control, planning ground control, making the map compilation, all of these definitely need an engineering background, as has already been indicated.

It is the same with the ground field crews. They should know a little more than what is normally taught in school for surveying in mapping. They should be able to read a photograph, know what is to be done with the photograph afterwards, and know how to tie the ground control to the aerial photograph.

To summarize, I think photogrammetry is definitely an engineering activity. In fact, it is being recognized as such. In some States you must have a license to call yourself a photogrammetric engineer. Some photogrammetric contractors are finding that they must prove to the licensing authorities that they are qualified. The District of Columbia was the last political unit within the continental limits of the United States to get an engineering license law. In other words, all of the forty-eight States have an engineering license law. My own State definitely considers photogrammetry as engineering under the Civil Engineer Division of our law and you must call yourself a photogrammetric engineer. You must be licensed in order to carry on your work. We must qualify ourselves as engineers, particularly if we call ourselves photogrammetric engineers and publish the journal PHOTOGRAMMETRIC ENGINEERING.

Chairman McNair: I expect it is time that some of you folks began giving more thought and taking appropriate action, for photogrammetric education. We already have a little start in that some professors are really concerned over what they teach and why they do not teach this or that.

You know that it is all too easy at an educational institution to get a series of completely unrelated courses. It is not at all difficult to set up a course in photogrammetry, in surveying, in structures, in anything you want to name. It is very easy for an instructor to fall into the pit of being so tied up in his own field that he does not see the forest for the trees. Hence, the title, as you will notice, is "Integration of Photogrammetry into Higher Education." *This instruction in photogrammetry has to be integrated into the entire curricula.* That is very important. We do not need a detailed discussion on educational methods.

I am willing to admit—I do not know about my colleagues—that higher education is probably the slowest in adopting progressive methods of instruction and methods of integrating that instruction so as to give a better unified whole.

Without any more comments, I think we should try to answer some of the questions that you in the audience may have.

DISCUSSION

N. A. Christensen (Director of Civil Engineering, Cornell University): This morning you saw Professor McNair's chart showing the supply of engineers that we anticipate during the next four years provided the Army does not take any of them. What the defense operation will require is rather doubtful. Instead of having 51,000 graduates the number may drop in the next four years to perhaps 12,000, possibly even lower. That means that there must be very careful use made of the engineering supply. I desire to direct one question to the three men who represent employers of engineers.

If you were to analyze your own operations and then decide what positions in your own organizations require men with four years of engineering education, how many in your organizations would you have to have of that level of training? Could we have any estimate of the total in the United States of such men needed each year?

This may be a hard question to answer, but it is very important. If we are going to make the best use of personnel, we must know the job ahead of us during the next ten or fifteen years.

Mr. Moravetz: I can only answer in a general way as I do not have the facts and figures with me. I believe that in the USGS alone, however, there are about 900 people in the Survey now who are professional people. As far as the static condition is concerned, if there were no turnover and all those 900 worked for forty years, that would not mean very many additions per year. I mention that because Professor Perez asked me earlier, "How many engineers per year do you need?" My quick answer to him was, "From zero to five hundred." It depends a great deal upon the condition of the economy of our country and the emphasis placed on mapping and like matters. The impetus given to mapping, from that standpoint, is quite important, and the impetus that counts, of course, is that given by the House and Senate Appropriations Committees.

I cannot answer Mr. Christensen's question specifically. It is difficult to answer because of the varying conditions from time to time. An average figure for the Geological Survey itself, as a single agency, perhaps would be around 120 or 130 or so added engineers per year. I know we have representatives here from Coast and Geodetic Survey. I wonder whether Mr. Jones can estimate how many engineers are needed per year in the Coast and Geodetic Survey?

Bennett G. Jones (Coast and Geodetic Survey): I think at the moment it would be perhaps 50 or 60. Of course, it will increase if many are taken out by military service; we expect to lose some.

There is another phase of that question from the floor that was not answered and it is interesting to me.

What percentage of engineers are needed in a mapping organization? I should like to hear from Mr. Coltharp and others. I will hazard a guess that in photogrammetry we should have a minimum of at least 25 per cent, both in field surveys and compilation. If others think that percentage should be much larger, I should like to get their estimates.