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[Activity Report]

STATUS OF ACTIVITIES IN PHOTOGRAMMETRY
AT ACADEMIC INSTITUTIONS IN THE U.S.A.

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Abstract

Based on the responses of questionnaires and from other information sources a trend of growth is noticed in remote-sensing related activities in the U.S.A. A general idea on the american institutions involved in education and research in photogrammetry and remote-sensing can be drawn from this study. The levels of education, types of academic personnel, equipment available for education and research and associated budgetary provisions are discussed. Some interesting statistical data are presented.

Introduction

The Working Group Chairman, Professor Brandenberger, called upon this author in 1977 to serve as a regional representative for the U.S.A. The primary task was to have a survey of the academic potentials in photogrammetry and remote-sensing in the country. It was also considered that an inventory (including analysis) of photogrammetric education and research facilities could be taken. This would contribute to the world wide inventory being prepared under the auspices of the United Nations Organization by Dr. Brandenberger and his associates.

A set of questions was prepared for the purpose. The questionnaire was sent to forty institutions in the U.S.A. known to have post-graduate education and research in the areas of photogrammetry and remote-sensing. The institutions were picked up from an up-to-date study by Nealey (1977). The mailing was completed in April 1978. Only seventeen responses were received by September 1978. The current report was first intended to be based on these responses. However, the information being very limited, this reporter sought other sources and has attempted to present herein a broad status

report on the United States' education and research activities in photogrammetry and remote-sensing.

Report

Amongst the 17 respondents, 4 are departments of Geography, 2 are of Geology, 7 are departments/schools of Civil Engineering, 2 are schools of Forestry, 1 department of Geodetic Science and 1 department of Geological Engineering. These 17 institutions in total have an average of 140 graduates per year (during the previous five years). This includes recipients of B.Sc., M.Sc. and Doctoral degrees.

The 17 respondents have 38 faculty members and 21 full-time equivalent teaching assistants involved in teaching while 40 people are involved in research (apart from the involved faculty members). A total annual budget of around \$400,000.- is devoted to photogrammetry and around \$500,000.- to remote-sensing. The teaching and research facilities are as varied as can be imagined. They offer a total of 510 quarter credit hours equivalent (some having semester system of offering) of courses in photogrammetry and remote-sensing.

For teaching and research, these 17 respondents have equipment whose total estimated value is \$ 1.99 million. This comprises 260 pocket stereoscopes, 75 mirror stereoscopes, 5 zoom-transferscopes, 27 optical type stereo plotters, 36 mechanical type stereo plotters, 2 analytical plotters, 2 mono-comparators, 7 stereo-comparators, 25 parallax bars, 1 additive color viewer, 1 digital processing unit, 5 densitometers, 2 film processing units, 5 35-mm cameras, 10 70-mm cameras, 18 photogrammetric cameras, 5 photo-theodolites, 15 light-tables, 5 viewers, 6 projectors, 5 scanners, 1 colorimeter, 1 radiometer and 1 thermal scanner. Six of the respondents have their own darkroom facilities within the academic unit (i.e., a department or school).

The questionnaire was aimed at post-graduate level education and research, which seems somewhat satisfactory in the U.S.A. as compared with other countries. On the other hand, the fact remains that the "image" of Surveying and Mapping does not always attract excellent students to it for their careers. Consequently, enrollment is generally low. Low enrollment makes it difficult to keep regular programs. This generates a "vicious circle". The employers, in the absence of a steady supply of educated surveyors, take the best available from other disciplines (mostly their surplus) and have them trained on-the-job. This in turn reduces available vacancies in the area of mapping and discourages students from choosing surveying as a career. Yet, many of the "outsiders" take to mapping as a stop-gap employment much to the frustration of the profession.

The atmosphere of photogrammetric education in the U.S.A. seems somewhat paradoxical. Several institutions, in the 1960's, emphasized graduate programs while neglecting those at undergraduate and lower levels. This placed considerable stress on the informal (on-the-job) trainings to fill the ranks of necessary working photogrammetrists. There is, however, an apparent attempt in several schools to break away from this approach. There has been a proliferation of two-year associate degree programs in several colleges in the U.S.A. in the area of Surveying where Photogrammetry is being introduced. Such developments, although encouraging, are not planned at the national or state levels and are generally unevenly distributed and suffer from the lack of interface between the disciplines associated with photogrammetry.

In terms of the level of education and proficiency, one can group the

photogrammetrists into three categories: (1) Graduates, with college (i.e., post high-school) education of five or more years; (2) Professionals, with post high-school education of four years; and (3) Technicians, with post high-school education of 2-3 years or less. These three correspond to Graduate (M.Sc. or Ph.D.), Bachelor (B.Sc.) and Associate (or none) degrees, respectively in the U.S. system. Brandenberger (1972) reported to the ISP that from available information on a world wide basis, there exists between these categories an average ratio of 1:2.9:5.4. For individual countries, the reported ratios show considerable fluctuations varying between limits 1:3:20. The indicated demand in North America (U.S.A. and Canada only) obtained from a study (Golab, 1974) with responses from 394 employers was known to be 180, 1230 and 2130, respectively in those three categories. This gives a ratio of 1:7:12.

The above clearly indicates a strong demand (need) in the U.S.A. on the undergraduate/technician programs. It has also been found from our studies that there is an emphasis on "qualitative" remote-sensing among disciplines like Forestry, Geology, Geography, etc. This is apparently in response to the public concern on natural resources and environment related problems. In this regard, a recent study by Dahlberg (1979) is of interest to concerned people in conventional photogrammetry in view of national perspectives.

The study of Dahlberg contains data only from 29 states (Arizona, Arkansas, California, Colorado, Idaho, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, New York, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Texas, Utah, Washington, Wisconsin and Wyoming). However, these cover practically all the institutes which pursue photogrammetry and remote-sensing in the post-graduate levels. This study indicates that around one third of all colleges and universities in the U.S.A. offer some courses in the mapping sciences. The courses in mapping sciences are categorized by Dahlberg as follows: Land Surveying - 46.5%; Cartography - 28.2%; Remote-sensing - 15.2%; Photogrammetry - 6.5%; Geodesy - 3.1% and Geographic Information - 0.6%. In the case of Land Surveying, the public two-year schools 'dominate' in offering 61% of all courses. This would indicate the "higher" levels considered for Photogrammetry and Remote-sensing.

Two interesting reports under the auspices of the American Congress on Surveying and Mapping, by Fennell (1971) and by Weeden (1978), indicate a growth in the number of U.S. colleges and universities reporting course offerings in Photogrammetry and Remote-sensing alone from 112 (63.3%) in 1971 to 155 (71.8%) in 1978. This growth may also be viewed in the light of the national trend as illustrated in Table 1.

Broad ideas on the status of top level research in photogrammetry in the U.S. academe can be visualized if one considers that around 3 to 5 doctoral degrees in photogrammetry are offered on the average in the whole country every year. This situation has remained about the same during the last ten years. The status, however, must be viewed against the national background and the national trend as illustrated in Table 2, which is based on a study by Kruger (1979).

In this light, one may even trace backwards. Works of the doctoral level are generally motivated by the requirements in college level teaching and national research requirements vis a vis economic incentives. In this regard, one can not say that situation in the U.S.A. has improved since the middle of the 1960's. This will be apparent from the data presented in Table 3. The "vicious circle" referred to earlier is manifested in this, higher level, as well.

TABLE 1

Demand for Higher Education in the U.S.A.

[Source: *A Fact Book on Higher Education*, American Council on Education, 1977
Washington, D.C.; Second Issue]

Year	Population Age 18-21 (Thousands)	Enrollment in College (Thousands)	Percent, Enrollment to Population	Percent, Enrollment to High-school Grads
1955	8,491	2,418	28	50
1960	9,724	3,227	33	50
1965	12,371	4,829	39	54
1970	14,781	6,889	47	61
1975	16,549	8,468	51	61
1980	17,050 (estimated)			

TABLE 2

Doctorates Awarded and College & University Funds for Research

[Source: Anne O. Kruger, 1979]

Year	Doctorates	Funds for Research (Millions of 1972 Dollars)
1957-8	8,938	941
1961-2	11,622	1,754
1967-8	23,089	2,556
1971-2	33,363	2,606
1975-6	34,064	3,018

TABLE 3

Average Salary for University Professors in
the U.S.A. [Source: Anne O. Kruger, 1979]

Year	Average Academic Salary (US Dollars per annum)	Average Real Salary (at Constant 1967 Prices)
1957	6,320	7,298
1961	8,032	8,865
1966-7	<u>10,449</u>	<u>10,449</u>
1968-9	11,825	10,769
1971-2	13,662	10,903 (peak)
1974-5	15,814	9,812
1976-7	17,601	9,697
1977-8	18,534	9,175

Based on facts and figures, Brandenberger (1966) estimated that for North America, out of the total personnel involved in Surveying and Mapping, about 5 per cent is needed on the doctoral level (for university teaching and research), 15 per cent on the Master's level (for managing and handling works of advanced degrees of difficulty), 25 to 30 per cent on the Bachelor's level (for handling conventional mapping jobs), 25 to 30 per cent on the technician's level (for routine type work requiring skilled technical labor) and the rest 25 to 30 per cent on the level of auxiliary personnel. It can be concluded from our study that such a goal has not been achieved and that we are entering the 1980's with plenty of confusion in the area of education and research in photogrammetry and remote-sensing.

A clear professional policy on education and research for the U.S.A. is lacking. The statistics based on which such policies could be developed are still to be collected. The only consolation is that we are not alone. Our colleagues every where need to be aware of the situation so that we can collectively improve our lot.

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