EDOUARD GASTON DANIEL DEVILLE

"Father" of Canadian Photogrammetric Mapping

Dr. E. G. D. Deville

Historical commentary by G. S. Andrews for the dedication of the Historic Site Monument commemorating Edouard Gaston Daniel Deville [*Thomson* 1967, 1969] at the entrance to Yoho National Park, near Field, B.C., September 30, 1975.

I was most happy to accept the distinct compliment of Mr. Turnbull's invitation to speak on this occasion for two compulsive but quite different reasons. The magnificent setting for this ceremony, here at the entrance to Yoho National Park, so close to the Great Divide in Kicking Horse Pass, is for me, strongly nostalgic. More than half a century ago, in the summer of 1919, on vacation from high school in Calgary, at the tender age of 15, I worked as "bull-cook" at Takakaw Camp, only a few miles away in the heart of the Yoho valley. I spent a second summer in 1921, an undergraduate from UBC, working for Brewsters as a "horse-wrangler" at Field, Hector and Glacier House. At that time it is unlikely I had ever heard of Deville, but no doubt the exciting environment of those two summers oriented my professional career in a direction to be inspired by men like Deville, and this relates to the second reason for my enthusiasm here today.

My first awareness of Deville testifies to his illustrious and widespread fame. In 1933-34, during the "hungry thirties", on an interlude of "indefinite leave without pay", I was busy with postgraduate studies in photogrammetry at the Technische Hochschule, Tharandt bei Dresden, Germany, under the celebrated Professor Dr. Reinhard Hugershoff. It was from him, in that faraway and alien setting that I first learned that a famous Canadian, Dr. E. G. Deville, had, at the turn of the century, originated some of the most ingenious ideas for mapping with stereophotographs that were to have worldwide application in the decades following.

To outline, all too briefly, the historical background for this ceremony, I begin by quoting from Mr. Turnbull's invitation:

> Edouard Gaston Deville contributed to the development of the science of photogrammetry and as Surveyor General of Canada introduced this technique to the mapping of the Rocky Mountains.

Photogrammetry has to do with the derivation of quantitative and qualitative information about features imaged and recognized in photographs. "Quantitative" concerns measurement: how big; how long; how wide; how high; how deep; how far; in what direction? . . . etc. "Qualitative" refers to identification: *what* is it, a goat or a pig; a meadow or a swamp; a high-rise or an outhouse; a stream, a trail, a road, or a railway; a forest of spruce, of pine or whatever species? . . . and so on. It is based on perspective geometry, known long before photography evolved in the mid 19th century, to scholars such as Pythagoras, 6th century B.C., and Albrecht Dürer, 1471-1528 A.D., better known as the artist of Nürnberg. Lacking photography, they had to sketch the objects of study as best they could, in true perspective, — painstaking, time-consuming work, in scant detail and only approximately accurate. With discoveries in optics, thanks to Galileo, 1564-1642, and others, and in photochemistry, chiefly by Niepce and Daguerre early in the 19th century, photography soon became practicable with cameras and materials crude by today's

standards, but capable of exciting applications including photogrammetry.

A pioneer in using photography for military mapping was Captain Aimé Laussedat of the French army. His method, "métro-photographie" was recognized in 1859 by the prestigious French Academy of Science. Today his name enjoys worldwide acclaim as "the father of photogrammetry". Simply, the method is to photograph the terrain from several camera stations of known position, with cameras having low-distortion lenses, carefully leveled, with the optical axis truly horizontal, and oriented in known directions. With the photographs thus obtained, in the office, it is possible to plot directional rays to significant features that appear in photos from two or more stations, such that the intersections of these rays locate the features on the map in true positions relative to the camera stations. It is also possible, with simple photomeasurements to derive relative elevations. Thus the primary ingredients of topographic mapping are obtained: position and elevation. The photos show far more detail than may be needed in the first instance, but which may be mapped later if found to be desired. The method is especially applicable to accidented terrain, such as mountains, which would be quite hopeless to survey in comparable detail and accuracy by orthodox methods such as plane-tabling. Field work is minimal. Detail plotting is done in the comfort and convenience of the office.

Edouard Gaston Daniel Deville, born in 1849 in France, graduated from the Naval College at Brest in 1868, and then served far afield in the South Pacific as a hydrographic officer in the French navy. It is likely that his training in hydrographic surveys at Brest included exposure, at least, to Laussedat's new but recognized method of "métro-photographie". Later, when Deville initiated what he called "photographic surveying" in Canada, he enjoyed Laussedat's personal support and advice [*Klawe* 1970].

References available to me as yet have not explained Deville's motive for emigrating to Canada in 1874, at the age of 25, well trained with six years' stimulating professional experience. His talents found a ready market in surveying. After four years in Quebec, during which he married Mlle Josephine Ouimet, daughter of the premier, he joined the federal Survey Branch of the Department of the Interior, Ottawa [*Anon* 1924]. Likely he was attracted by the wide scope offered for propagation of the classic DLS system of township surveys over the Canadian West, initiated in 1872, to cope with settlement following acquisition by Canada of the vast "HBC" lands in the northwest in 1870. As inspector of surveys, Deville had much to do with bringing the DLS survey program to a high state of efficiency and vigor. In 1885 his abilities were recognized by promotion to surveyor general of Dominion Lands. This was the year that construction of the CPR across the continent to the Pacific was completed. The coincidence posed a challenge to Deville in his new position of responsibility and authority: mapping the rugged mountain country along the route of the railway in the west, so different from laying out townships on the prairies. Deville had the answer, photographic survey. Losing no time, the next field season, 1886, he initiated the new method in the Rocky Mountains along the CPR under field supervision of one of his senior surveyors, J. J. MacArthur, DLS, to whom he had given special instructions and equipment for the work.

Deville's photographic surveys expanded vigorously in following years under (now) famous Canadian surveyors schooled by himself, but who have also joined him beyond the Great Divide. Too numerous for mention here, their names and accomplishments are on record for those interested [*Thomson* 1967, 1969; *Field* 1953]. These men inspired and coached some of us who survive today and who, in our turn have handed the torch to younger and capable hands in the eternal quest to transform the "unknown" into the "known" of our ever expanding environment, by photogrammetry and allied sciences. In spite of the pressures of his high office, Deville found time and energy to design and have produced survey cameras especially for Canadian conditions, and to produce a classic textbook on the subject [*Deville* 1895]. In 1902 he publicized original ideas for plotting maps from stereoscopic photographs [*Deville* 1902]. When death terminated his brilliant career on September 21, 1924, he had been endowed with many honors and was able to anticipate the application of his photogrammetric principles to the new and promising field of aerial photography.

Deville's photosurvey methods were adopted internationally as early as 1893-4-5 for topographic mapping of the fantastically rugged country along the Alaska Panhandle and the 141st Meridian, as a prerequisite for the Alaska-Canada Boundary Tribunal Award of 1903, under the direction of the (then) Canadian commissioner, Dr. W. F. King, DLS, DTS [*International Boundary Commission* 1952]. In the same decade, Tom Kains, surveyor general of British Columbia (1891-98) initiated Deville's methods in the Kootenays of southeastern B.C.

Another epic photosurvey, in close proximity to our situation here today was for the demarcation of the Alberta-British Columbia boundary along the very axis of the Rocky Mountains from the 49th Parallel in the south to its intersection with the 120th Meridian in the north. The Convention of 1818 defined the 49th Parallel of North Latitude as the boundary between the United States and British North America from the Lake of the Woods west to "the Stony Mountains" (the "Rockies"). In 1846 this boundary was extended westward to "the middle of the channel which separates the continent from Vancouver's Island". By Imperial Act of 1863, British Columbia was "bounded . . . to the East . . . by the Rocky Mountains and the 120th Meridian . . .". When the province of Alberta was created in 1905, it was bounded on the west by British Columbia. In 1912, when the matter of surveying and marking this boundary was brought to a head by George H. Dawson, surveyor general of British Columbia, and Edouard Deville, owing to mining activity and other considerations, it was necessary to clarify the rather vague definition of the boundary as being (in part) the Rocky Mountains. When the International Boundary along the 49th Parallel was first surveyed eastward from the western shore of Point Roberts, 1857-61, the British Commissioner, Captain John S. Hawkins, RE, was authorized to carry the work as far east as a point on the "eastern base" of the Stony or Rocky Mountains, as defined in the Convention of 1818. However, the American commissioner, Archibald Campbell, had authority to proceed only as far as the eastern boundary of (then) Washington Territory, on "the summit" of the Rocky Mountains, and this was where the terminal monument, No 161, "a cairn of stones" was erected [*Andrews* 1975]. It was renumbered 272 later, and of course became the southern terminus of the Alberta-British Columbia boundary. Deville's interpretation of "the Rocky Mountains" for the purposes of this boundary was officially adopted by Order-in-Council February 18, 1913, and accepted by all concerned as "the line dividing the waters flowing into the Pacific Ocean from those flowing elsewhere". In this neat turn of phraseology, "elsewhere" took care of waters flowing to the Arctic via the Athabasca river, to Hudson's Bay via the Saskatchewan river, and the possibility of waters flowing to the Gulf of Mexico via the Missouri and Mississippi rivers.

Thus, to survey and mark this natural boundary, the water divide along the tumultuous axis of the Rocky Mountains, meandering for some 700 miles, both vertically and horizontally according to the orogenic and erosional whimsy of nature's handiwork, it was necessary to make a detailed topographic map along it to locate and prove exactly where the waters divided, as specified. The only and obvious way to do this was by Deville's method of photosurvey, now proven by some 25 years' application in the mountains of western Canada. The task was in distinct contrast to the survey of the 49th Parallel, a geometric line following the gentle curve of the said parallel, deviating neither to the left nor to the right, regardless of what topographic features lay in its path.

The work began in Kicking Horse Pass, only a few miles from here, in 1913 and continued till termination well northward on the 120th Meridian in 1924. A. W. Cautley, DLS, ALS, commissioner for both Alberta and the Dominion, assumed supervision of detail survey and monumentation in the main passes through the main range of the Rocky Mountains, and A. O. Wheeler, DLS, BCLS, commissioner for British Columbia specialized on the phototopographic survey of long and complex segments of alpine terrain between the said passes. Wheeler, schooled by Deville, already enjoyed an eminent reputation in this work, especially in the Selkirk Mountains [*Wheeler* 1905]. His chief assistant in this work was Alan J. Campbell, DLS, BCLS, who later became chief of the Phototopographic

Division of the provincial Surveys and Mapping Branch in Victoria. The sole surviving member of the field crew under Messrs. Wheeler and Campbell is Alan S. Thomson of Victoria, now in his 89th year. Mr. Thomson's superb hand as a cartographic draughtsman is happily perpetuated in the map sheets of the official atlases of this boundary [*Alberta-British Columbia Boundary Commission Atlases*, 1917, 1923, 1925, 1955] and that for the British Columbia — Yukon Boundary along the 60th Parallel [*British Columbia-Northwest Territories-Yukon Commission Atlas* 1963]. Mr. Thomson's meticulous diaries of the field surveys have been recently presented to the Provincial Archives of British Columbia.

It may interest many here today to be reminded that some 160 miles, as the crow flies, to our northwest, in Robson Pass is an earlier monument commemorating both the boundary survey of 1913-24 and Edouard Deville. The special monument on the summit of Robson Pass was dedicated July 31, 1924. High ranking and appropriate representatives of the two provincial and federal governments, the CN and CP railways were present. The monument was unveiled by Mrs. A. J. Campbell "as a tribute to the excellent work done by her husband in the survey of the boundary . . . " The following quote from A. O. Wheeler in the official report of the boundary commissioners, and written after Deville's death a few months prior, is relevant [*Alberta-British Columbia Boundary Commission Report* 1925]:

> The monument erected did more than memorialize the boundary survey. On the Alberta side an inscription plate recorded the name of the late Dr. Edouard Deville, ISO, LL.D, DTS, FRCS, who for more than forty years had been Surveyor General of Canada, and under whose direction the work of the boundary survey had been carried on since its inception in 1913. A man and a scientist to whom Canada owes most largely her magnificent system of land surveys, and also the introduction of the method of photo-topography, a method so well suited to her mountain areas and so successfully carried on in mapping them. It is fitting his name should be on record at a place where their grandeur reaches a climax.

Deville lived to witness the incipience of aerial photogrammetry, spawned by the development of practical aviation in World War I. Veterans who had used air photographs for military mapping and intelligence were keen to exploit their promising possibilities, especially for mapping Canada's enormous and as yet uncharted wilderness. Terrestrial photomapping had proven so effective in accidented mountain terrain, and especially for measuring differences of elevation. It was least effective for detail in flatter ground, normally obscured from view at the camera stations. Air photos overcame this difficulty by revealing all surface detail except that hidden beneath dense vegetative cover. "Vertical" air photos, taken with the camera aimed vertically downward are like pieces of an actual map, in remarkable detail, at a scale governed by the flying height above ground and the focal length of the camera lens. True, they are burdened with subtle scale distortions due to differences of ground elevation and tilt of the camera, mostly due to air turbulence in flight, (the rectification of these distortions being a primary task of aerial photogrammetry). In their early use, air photos were weakest for determining differences of elevation. Thus, the ground photos and the air photos were complimentary; where one was weak the other was strong and vice versa.

After some initial skepticism, Deville accepted membership on the Canada Air Board (1920-23) at the invitation of its secretary, J. A. Wilson. He then initiated experiments in the use of air photos for mapping, and delegated appropriate members of his staff to study and test various ideas. One of these, the outcome of Deville's earlier application of perspective geometry, became known as the "Canadian Gridded Oblique (Air Photo) Method". It had considerable application for medium-scale planimetric mapping of low relief areas, particularly the lake-strewn Precambrian Shield. He also proposed a multicamera installation in photo aircraft for obtaining horizon-to-horizon cover similar to the later

tri-camera or trimetrogon method widely used during and after World War II [*Field* 1953].

Among Deville's disciples in terrestrial photomapping, a number became enthusiastic proponents of air-photo applications, where their experience with applied perspective geometry was of primary value. Beside the main body in the federal service at Ottawa was a small but able nucleus in the oasis of the provincial "Phototopographic Division" in Victoria, stimulated by the challenge of the tumultuous terrain here in British Columbia. They devised practical methods of combining the separate advantages of aerial and terrestrial photogrammetry. Photocontrol points from the ground views identified also in the air views were used to control planimetry and contouring from the latter. The method required very simple, mostly homemade equipment, an important consideration when budgets were drastically trimmed in the 1930s [*McCaw* 1928; *Stewart* 1930; *Campbell* 1935].

It could be said that aerial photogrammetry was born in World War I, had its (somewhat clumsy) adolescence in the two decades following, and achieved vigorous maturity during and after World War II. It has had universal application for mapping and many other specialized uses, and more recently has assumed staggering sophistication and specialization. Thanks to the foundation in photomapping so well and widely laid by Deville, Canada has maintained a position of international distinction in the broad field of photogrammetry, and among the provinces, owing to the challenge of alpine grandeur, possibly, British Columbia has achieved a position of primary eminence [*Andrews* 1948].

To conclude this tribute to Edouard Gaston Daniel Deville, the following lines from an old notebook seem appropriate:

"Were a star quenched on high
For ages would its light,
Still travelling downward from the sky
Shine on our mortal sight.

So when a great man dies,
For years beyond our ken
The light he leaves behind him lies
Upon the paths of men."

(Author unknown)

References

Alberta-British Columbia Boundary Commission Atlases, Parts I, 1917; II, 1923; III, 1925, IV, 1955.

Alberta-British Columbia Boundary Commission Report, Part III, Ottawa, 1925.

Andrews, G. S. Air survey and photogrammetry in British Columbia, *Photogrammetric Engineering*, Vol. XIV, No. 1, Washington, D.C. March 1948;

A traverse of East Kootenay Survey History, *British Columbia Historical News*, Vol. 8, No. 2, 1975.

Anon. Passing of Our Patron (obit), *Journal of the Dominion Land Surveyors' Association*, Vol. 1, No. 10, October 1924.

British Columbia-Northwest Territories-Yukon Boundary Commission Atlas, Ottawa, 1963.

Campbell, A. J. Phototopographical control for aerial photographs, proceedings of the annual general meeting, Corporation of British Columbia Land Surveyors, Victoria, B.C., 1935.

Deville, E. *Photographic Surveying*, Ottawa, 1985;

On the use of the wheatstone steroscope in photographic surveying, *Transactions of the Royal Society of Canada*, Ottawa, 1902.

Field, R. H. History of photogrammetry in Canada, *The Canadian Surveyor*, January 1953.

International Boundary Commission Report, *Tongas Passage-Mt. St. Elias*, Ottawa, 1952.

Klawe, Janusz J. The mapping of the Canadian Rockies, 5th International Conference on Cartography, Stresa, 1970.

McCaw, R. D. Phototopographical surveying, proceedings of the annual general meeting, Corporation of British Columbia Land Surveyors, Victoria, B.C., 1928.

Stewart, N. C. Mapping from aerial photographs, proceedings of the annual general meeting, Corporation of British Columbia Land Surveyors, Victoria, B.C., 1930.

Thomson, Don W. *Men and Meridians*, Queen's Printer, Ottawa, Vol. 2, 1967; Vol. 3, 1969.

Wheeler, A. O. *The Selkirk Mountains*, King's Printer, Ottawa, 1905.