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James B. Yule: Pioneer of Aerial Photography and Photogrammetry, 1917-1947

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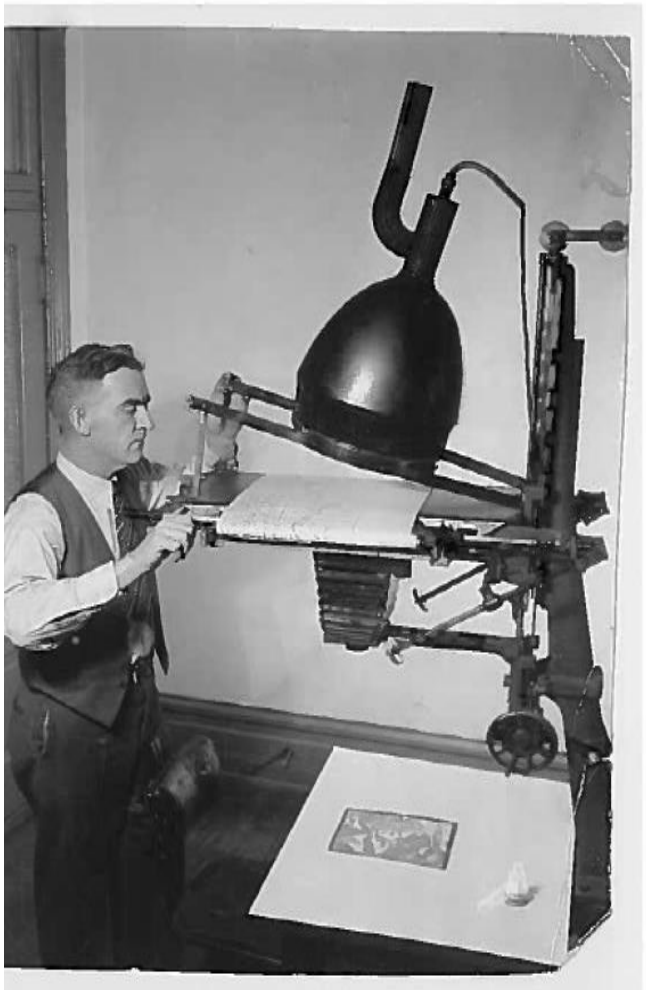

JAMES B. YULE

PIONEER OF AERIAL PHOTOGRAPHY & PHOTOGRAMMETRY

1917-1947

ABSTRACT

James B. “Jim” Yule pioneered the revolutionary use of aerial photography early in the twentieth century to make maps of the newly established national forests, and thereby led the way to the production of maps of an accuracy, detail and caliber never seen before.

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JAMES B. "JIM" YULE

James B. "Jim" Yule pioneered the revolutionary use of aerial photography early in the twentieth century to make maps of the newly established national forests, and thereby led the way to the production of maps of an accuracy, detail and caliber never seen before. Yule joined the United States Forest Service (USFS) in 1911, in Missoula, Montana, headquarters for Region One, and there he made his career. In 1917 he was named Chief of Maps and Surveys for Region One, a position he held until his retirement in 1947. His personnel record shows he was:

> in charge of all surveys and maps made by Region 1, USFS, Missoula Montana. Cooperation with other governmental map-making agencies. Work consists of planning, supervision, inspection, instruction, training, reports. Direct supervision of 20 topographical engineers, draftsmen and engineering aides. (Yule #2)

The impact of his vision and pioneering work in aerial photography and mapping on the development, protection and management of the national forests was monumental. In 2019, 62 years after Yule's death, a former Chief of the U.S. Forest Service wrote, "I believe that the aerial photography pioneered by Yule was as significant at that point in time as satellite imagery is today." (Bosworth)

During the 16 years from 1917-1933 Yule worked steadily to examine, test, refine and operationalize his original vision of aerial photography and photogrammetry. He believed that maps made from aerial photographs, as opposed to those made by traditional "boots on the ground" surveying methods, would produce maps that were vastly superior in multiple ways: greater precision, exactitude and accuracy; access to quantities of valuable topographic details never before available; far greater speed in map production and at significantly lower costs. A

small but possibly related detail in Yule's career was reported in the *Choteau Acantha* when Yule retired in 1947. "During World War I he was assigned to the Forest Products Laboratory, Madison, Wisconsin on *aircraft production research* [italics added]." It is likely that his work with aircraft during the war influenced his thinking about using them in new ways in his work.

Sometime in the early 1920's, working alone, without support from any of his bosses, and without access to a research library, Yule identified his hypothesis: aerial photographs were a viable means of producing superior maps for the Forest Service. To begin testing his hypothesis, he bought a box camera from a photography shop in Missoula, and hired the pioneering Johnson Flying Service at Hale Field in Missoula to fly him over the Missoula Valley to take his first aerial photographs. To make the initiative successful, however, he had to convince Bob Johnson to cut a hole in the fuselage of his plane to accommodate the camera lens. Johnson eventually agreed. Years later when asked what stood out in his mind the most from that historic first flight he replied, "Never take aerial photographs of the ground when there are clouds in the sky." (Yule, PhD) He and Johnson continued to fly and take photographs of more, and more wide-ranging. sections of the Lolo National Forest. Since this work had never been done before, and he had no mentors nor texts to guide him, Yule relied on auto-instruction, analytical thinking, logical reasoning, his education in engineering, imagination and a unique ability to synthesize disparate entities into a meaningful whole. He was also undoubtedly guided by the question he always posed later to his children when they encountered problems: What do you already know/have that can help you solve this problem?

Yule was a voracious reader. He used written materials to learn what he could about others' work relating to aerial photographs from ". . . balloons, kites, rockets . . . pigeons . . . and

airplanes." His review of the current literature available to him reveals a paucity of written material on the subject. Only one article addresses the subject of making maps from aerial photographs. Rear Admiral Richard E. Byrd had photographed "2000 miles of horizon on Antartic *[sic]* expedition" and "For more than 2 years . . . the work of preparing maps from the photographs has been carried on." No source nor date for this quotation were provided. (Yule #1)

Little appears to have been written about Yule's pioneering work during the 1920's. Archives at The University of Montana-Missoula contain five undated photographs of Yule working in the field sometime during this period. (Unknown MSS-418-4) These pictures show him using a stereoscopic headset to view aerial photos and line maps to identify survey markers on the ground.

He recalled in personal correspondence to Evan Kelley, Regional (One) Forester, about "Our meeting at Ogden in about 1921, when you were writing the Minor Road & Trail Manual and I was on detail reorganizing Region 4 section of Surveys and Maps." The fact that he was assigned to reorganize the Ogden, Utah, office of his counterpart in Region Four suggests several assumptions: a) He was recognized as an able manager; b) His work on aerial photography and photogrammetry had progressed to the point where he began reaching out to his counterparts in other regions to educate them and encourage them to buy into his vision of how to produce superior maps more quickly and more inexpensively than ever before. (Yule #4)

That Yule's work had no support from his superior may be obliquely verified by the fact that his Regional Forester was writing a Minor Roads and Trail Manual while Yule was exploring and developing aerial mapping of his world! Yule places 1932 as the year when his Regional Forester,

first showed interest in his work. In personal correspondence to Evan Kelley he recalled, "A Saturday P.M. meeting in the spring of 1932, *when you first showed interest in our aerial photographic program* [italics added] at a demonstration planned for your information." (Yule #4)

In 1933 Yule published his paper "Our National Forests: Aerial Photography" which was the first time he laid out for national attention and review the history of aerial photography and its benefits not only for administration of the nation's forests, but also for fire detection and suppression, transportation planning, planting, water studies, erosion practices, range management, timber surveys, mining and agriculture.

> Space does not permit detailed description of aerial photography to all our local industries. But generally, the engineer who is building roads, dams, transmission lines, topographic maps and other activities of a construction nature is as far behind the times if he isn't utilizing aerial photography methods as a Chinaman who is still plowing with a crooked stick.

He described in some detail how aerial photographs are taken, how maps are made from these pictures and the current status of photogrammetry. He wrote:

> At the present time an area of 1000 square miles is being photographed on the northern one-half of the Shoshone Forest by Region 2 at Denver. Marshall Wright, of the Forest Service, an experienced aerial cartographer is in charge. J.E. King of Denver has the flying contract.. . During the 1932 field season the Forest Service of Region One, with headquarters at Missoula, Montana, photographed 3360 square miles, during the winter of 1932-33 compiled 3280 square miles of this area into map form and delivered to the field organization finished maps at the beginning of the field season.

It is apparent that Yule's vision of aerial photography and photogrammetry was well established in at least two Forest Service regions by 1933, and was proving itself to be as useful, efficient and practical as Yule had predicted---a singular achievement given the lack of institutional interest or support.

In March of 1936, three years after the publication of Yule's paper about his work and its promise, a meeting identified only as an All Services Surveys and Mapping Conference was convened at the University of Montana. Although no archival evidence is available concerning the participants, focus, content, methodology or outcomes of this meeting, two things are of interest: a) Its focus and purpose were of sufficient academic interest to warrant hospitality at the University of Montana in Missoula; b) Yule's Regional Forester, Evan Kelley, ". . . gave the address of welcome to men from other regions." (Yule #4) It appears that Kelley had a change of perspective in the previous three years. What is clear, however, is that by this time Yule's work was well known, valued and quite possibly being implemented in other regions of the Forest Service.

During the week of May 6-12, 1936, the historic First Maps and Surveys Conference of the United States Forest Service occurred in Region One, Missoula, Montana. The official photographs of that meeting appear to be taken outside the Forestry Building at the University of Montana. Participants include a beaming Jim Yule sitting in the center of the front row, three others of his team, and Yule's immediate boss, Head of Engineering. Other participants are his counterparts from various USFS regions and, presumably, representatives from other government map-making agencies. Most importantly, three of the men---Wright, Loutz and Grunner---are from the highest levels of the Forest Service headquarters in Washington DC. (Unknown) Little is known about the focus and content of their meetings, but the outcome was significant: the United States Forest Service and the United States Coastal and Geodetic Survey officially adopted Yule's method of making maps from aerial photographs as the basis for all future cartography.

(Unknown) History was changed! It was changed not just for the Forest Service but for all who made, and all who used, maps throughout the United States, and farther.

On November 30, 1936, Yule presented an illustrated lecture entitled "Utilization of Aerial Photographs in Mapping and Studying Land Features" in Helena, Montana, to the Montana Society of Engineers. The advertising circular for the meeting promises "an unusually interesting program" and identifies Yule as "Chief of the Aerial Photography Division of the United States Forest Service, District 1, Missoula, Montana." Notice of this lecture is the first archival evidence of Yule's interaction with non-governmental organizations which would find his work useful and "unusually interesting." (Montana Society of Engineers)

Four years later, June 24-29, 1940, the Surveys and Maps Conference convened in Denver, Colorado. Participants came from seven of the nine Forest Service regions as well as three engineers from the Forest Service Washington DC office. The purpose of the conference was

". . . to discuss and coordinate the uses of aerial photographs by the various Forest Service regions in the administration of the National Forests." A report of this meeting entitled "Forest Service Uses of Aerial Photographs" was published in *U.S, Air Services* in August of the same year. Its author, Helen B. Smith, is identified as Assistant Chief, Section of Surveys and Maps, Division of Engineering, Forest Service, U.S. Department of Agriculture. After a description of the aerial map-making process she writes:

> These maps, based on aerial photographs, are found to be the most accurate ever made of these mountainous areas and are of inestimable value not only to the Forest Service, but to other Federal agencies and private map users. They serve as the most reliable and accurate base on which to show data collected by all branches of the Forest Service, especially since these data have been shown on pictures identical to those used in the preparation of the map. Actually, it is to obtain these planimetric bases on which to show forest data that these maps are prepared, thereby making it possible effectively and

> efficiently to administer the National Forests. . . . It was agreed by all that in the near future the old, slow, expensive and tedious methods of surveying on the ground would be abandoned.

On December 7, 1941 Pearl Harbor, Hawaii, was bombed. To secure and defend the west coast of the United States mainland, the Department of War demanded precise, exact maps of the California coastline. Highly accurate, detailed maps of the Pacific coastline topography were essentially non-existent. In January 1942 Yule and some of his team were sent to California to work for the San Francisco office of the Department of War in the War Mapping Project (WMP). As *The Choteau Acantha* reported, "In the forepart of World War II he [Yule] was placed in charge of all phases of the aerial photography forest service war mapping project in California."

Apparently the WMP was completed rather quickly. In October 1942, Yule was reassigned to the Emergency Rubber Project (ERP), also known as the Guayule Rubber Project. Japan had effectively cut off United States access to traditional sources of rubber in the South Pacific; accordingly, attention was turned to the potential of the Mexican milkweed plant, the guayule, to produce rubber. Large acreages of California land had been planted in guayule. Yule was given the assignment of finding suitable factory sites, and supervising factory construction to produce the needed rubber. (Unknown) By 1944 useable rubber was indeed produced by the ERP but apparently not in sufficient quantities to merit its expansion. Samples of this guayule rubber are still in existence today in private collections. Several samples are in the archives of the National Museum of Forest Service History in Missoula, Montana, where the Director reports that it is still pliable and supple.

Yule returned to Missoula, Montana, in September 1944. During the 1940 meeting in Denver participants had agreed that "These maps based on aerial photographs. . . are of inestimable value not only to the Forest Service, *but to other Federal agencies and private map makers* [italics added]." Following up on this observation, in 1946 Yule wrote a proposal to an unidentified committee entitled "Evoluation [sic] of General Land Office (G.L.O.) Surveys in Montana as Applied to Mapping by the Forest Service." As one committee member, C.D. Jackson, wrote in response to Yule's proposal of close cooperation between the G.L.O. and the Forest Service:

> "It should be obvious to even a layman in the field of mapping that Mr. Yule has originated and carried out a unique and practical method of combining the work of two government agencies so as to save the taxpayer money and still give him a better product. . . .Unlike some of the other suggestions submitted to the Committee, this one was put into actual practice years ago and Region 1 has over 1200 sq. miles of excellent topographic maps in use today as a testimonial. Furthermore, thanks to Mr. Yule's foresight, many thousands of miles more can be mapped from the G.L.O. notes on hand, right now, with little or no further expense to the Forest Service. . . Mr. Yule's report should be studied carefully by every Region. I believe it is by far the most constructive and inspiring suggestion so far called to the Committee's attention, not only in regard to its future possibilities but as a concrete example of real pioneer initiative and ingenuity." (Yule #2)

Another committee member, Flach, wrote:

> "The present and potential savings are enormous and deserve most serious consideration and such support as the Forest Service can give. Mr. Yule is to be congratulated for presenting this worthwhile suggestion." (Yule #2)

Upon Yule's retirement in September 1947, the Chief of the USFS, Lyle Watts, sent a commendation which praised his

> . . . directing a splendid forest mapping program in Region One. Many excellent mapping methods and standards were pioneered by you. You have met many challenges in the course of your work and have shown industry, resourcefulness and the fortitude so essential to success. (Watts)

Similarly, the Secretary of the Department of Agriculture, Clinton P. Anderson, wrote:

> . . . you have not only contributed a great deal to the better methods and standards of map making but have also accomplished an outstanding volume of production in the making of national forest maps. You have also shown fine accomplishments, I am told, while in charge of the Section of Surveys and Maps under the Regional Engineer in Region One. (Anderson)

From his earliest days in the Forest Service until his retirement, and after, Jim Yule was recognized for his "infinite patience and great resourcefulness" in a career "which has been of inestimable value to the Forest Service in its program of formulating better methods of mapping the national forests." (US Department of Agriculture Forest Service, p. 48)

Many years later, Dale Bosworth, Chief Emeritus, USFS wrote:

> " As an employee of the United States Forest Service for 41 years, and working at every level of our organization, I know firsthand the significance of Jim's contribution to natural resource management. For decades, Jim spearheaded the use of aerial photography to produce more accurate maps. This was critical to the success of the Forest Service, and to that of other federal, state and private land managers. When I went to work for the agency in the 1960's, every field-going employee carried maps and aerial photos wherever they went in the course of their duties. The agency and the public grew to depend heavily on those maps because aerial photography made them so much more accurate. We can thank the forward-thinking of James B. Yule for these critical tools in land managers' tool chest." (Bosworth)

On June 4, 2019 the National Museum of Forest Service History honored Yule's pioneering thinking, leadership and history-changing work by naming its initial structure, an amphitheater, the James B. Yule Pavilion. (Briggeman)

> As President of the National Museum of Forest Service History and former Deputy Chief for the Forest Service, I am very familiar with Mr. Yule's significant contribution to the field of cartography through the early use of photos taken from the air. His innovative and creative approaches in using aerial photography revolutionized mapmaking early in the twentieth century and became the foundation for greater precision, greater efficiency, and lower costs. His work and forward look to the future had a far-reaching impact on many disciplines, professions, and organizations. He was a true leader and made a huge difference across not only the forests of Montana but all across the country.

Even though he was only able to complete three years at The University of Montana, his career accomplishments and work are widely recognized as unparalleled and truly significant for the City of Missoula, the State of Montana, The U.S. Forest Service, and many other entities who were able to benefit from his contributions, thinking and willingness to step forward with progressive ideas in the early part of the last century. Our Museum has recently recognized the significance of his life's work by establishing a pavilion and amphitheater on our campus named in his honor.

He was a true pioneer . . .. (Thompson)

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